Kaipara te Oranganui

KAIPARA DISTRICT

Two Oceans Two Harbours



# Engineering Standards 2026

The Kaipara District Council (KDC) 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 KDC 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 KDC and the community have 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.

KDC has chosen to adopt, as its ES, the majority of the Whangārei District Council's Engineering Standards (WDC ES) and the transport chapter of CoLAB's Regional Infrastructure Technical Specifications (RITS). The WDC ES has the benefit of being a widely used standard in Northland. Consistency with the Kaipara District's northern neighbour has benefits for users of the standards. The RITS transport chapter is considered to more appropriate than the transport chapter of the WDC ES, for the building of roading and associated infrastructure within the Kaipara District. This approach reflects Council's desire to facilitate growth and achieve the vision of "Kaipara – the place to be".

The Council does not wish to restrict innovation in how infrastructure is provided. Accordingly, the Council may, at is sole discretion, approve alternative designs provided it is satisfied that the alternative designs will achieve an equivalent function, and performance incorporating optimised whole of life outcomes, against the recommended standards specified in the engineering standards.

KDC seeks long term solutions to the provision of appropriate infrastructure. KDC welcomes collaboration with developers to address impacts on down-stream catchments and to future proof the Council's asset network taking into account strategic asset development plans.

Tools to facilitate growth may include the use of development agreements, financial contributions, and consent conditions providing for staging of infrastructure."

## KDC "Hybrid" Engineering Standards

The KDC ES are made up of the following:

1. KDC has adopted Whangārei District Council's Engineering Standard (2022) (WDC ES) Chapters 1-2 and 4-8 including relevant drawings and appendices as part of the KDC ES, with KDC related amendments being incorporated.
2. KDC has adopted the Regional Infrastructure Technical Specifications (RITS) Chapter 3 Transport (Version 1) and relevant drawings, forms and checklists as part of the KDC ES, with KDC related amendments being incorporated.

### WDC ES Chapters adopted by KDC

| WDC Engineering Standards 2022 |
|---|
| 1. General |
| 2. Site Development |
| 4. Stormwater and Drainage |
| 5. Wastewater |
| 6. Water Supply and Reticulation |
| 7. Public Spaces |
| 8. Electrical Telecommunications and Gas |
| Appendices -Checklists and supporting information |
| Drawing Sheets |

### RITS Transport Chapter adopted by KDC

| Regional-Infrastructure-Technical-Specification-V1.0 |
|---|
| 3. Transport |
| Appendices -Checklists and supporting information |
| Drawing Sheets |

## Kaipara District Plan

Where there is any conflict or ambiguity between engineering or infrastructure standards specified in rules contained in the Kaipara District Plan and the engineering or infrastructure standards specified in the ES, the standards specified in the District Plan rule will take precedence.

The KDC ES can be accessed via KDC's website site and can be downloaded as a complete document or by chapter.

## RITS Transport Chapter adopted by KDC as part of the ES

Kaipara District Council acknowledges the Waikato Local Authority Shared Services and Co-Lab for the use of the Regional Infrastructure Technical Specifications, version 1(RITS).

This chapter sets out the requirements for the design and construction of transportation infrastructure (including accessways) associated with land development, subdivision and transportation improvements/upgrades within the Kaipara District.

KDC has adopted the RITS as its engineering standards for transportation infrastructure.

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

## Document Control

| Version | Comments | Author | Date Finalised | Approved by | Date Approved | Date Effective |
|---|---|---|---|---|---|---|
| 01 | For Council approval | Lloyd Barton | 18/08/2026 | Council (Elected Members) | 26/08/2026 | 26/08/2026 |
| 02 | Minor edits for publishing | Lloyd Barton | 08/09/2026 | Chief Executive | 09/09/2026 | 09.09/2026 |
| | | | | | | |

Where any amendments are made to the versions of the WDC ES and the RITS Transport Chapter that have been adopted by KDC as parts of the KDC ES, the KDC ES will not change automatically to reflect this. These changes would need to be considered by KDC and would only be incorporated into the KDC ES if it was determined by KDC that it was appropriate to amend the KDC ES.

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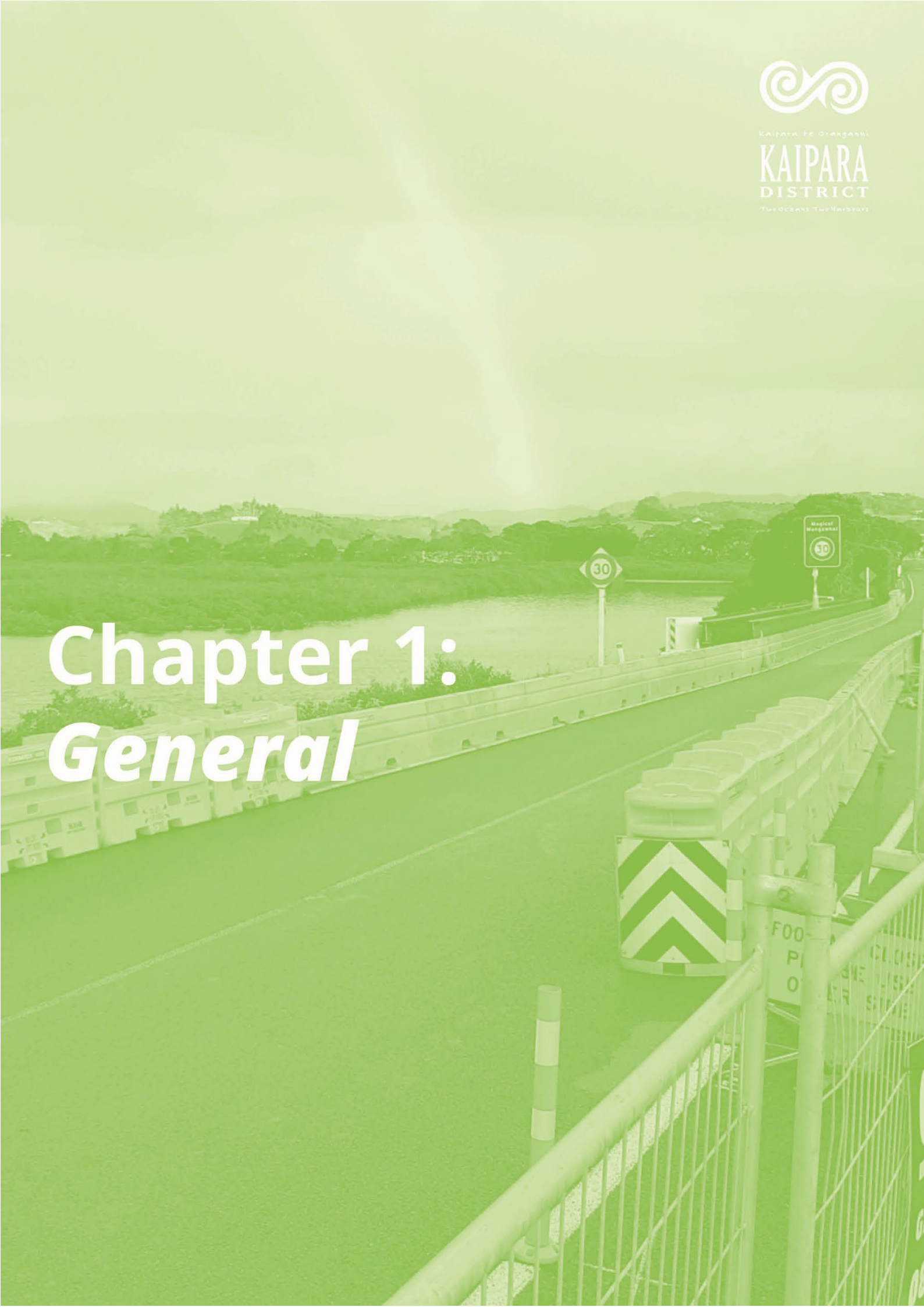
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# Chapter 1: *General*

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# 1.1. Introduction

## 1.1.1. The Engineering Standards

The Kaipara District Council (KDC) 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 KDC 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 KDC 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 KDC's recommended technical specification.

If you identify any issues with this document, or any areas where improvements can be made, please contact Council at council@kaipara.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 KDC's capital and/or operational works contracts or professional services agreements
b. Development works regardless of whether the infrastructure will be vested in KDC or remain in private ownership, or
c. Any other form of infrastructure development that will connect to the KDC'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 KDC 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)
e. Traffic signals

These works shall be undertaken on a Specific Design basis involving the KDC'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 Roading Powers Act 1989

Health and Safety at Work Act 2015

Local Government Acts 2002 and 1974

New Zealand Building Code

NRC Regional Plan

Operative District Plan 2013, KDC

Public Works Act 1981

Resource Management Act 1991

### 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

NZS 4404:2010 Land development and subdivision infrastructure

### 1.1.4.3. KDC Documents

WDC Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018

KDC Application to Connect to Services WDC Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

RAMM Template KDC's data collection form (*To be provided by KDC on request*)

WDC Specification for Registered and Licensed Contractors for Waste & Drainage

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

### 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

New Zealand Asset Metadata Standards August 2017

NZ 3 Waters Asset Data Standard

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 Roading 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. KDC Operative District Plan and Proposed District Plan

w. KDC Stormwater and Land Drainage Bylaw

x. KDC Wastewater Drainage Bylaw

### 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 | Annual Exceedance Probability (refer to definitions below) |
| ARI | Average Recurrence Interval |
| BMF | Blue metal fines |
| CAR | Corridor Access Request |
| CC | Climate Change |
| CDP | Catchment Drainage Plan – historical documents title, may still be in use |
| CMEngNZ | Charted Member of Engineering NZ |
| CMP | Stormwater Catchment Management Plan or historical Catchment Drainage Plans |
| CN | Curve Number |

| | |
|---|---|
| CPEng | Charted Professional Engineer |
| DN | Nominal Diameter |
| EDA | Engineering Design Approval |
| ES | Engineering Standards (this document) |
| 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 |
| KDC | Kaipara District Council |
| 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 - NZ 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.

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| Access (Low Volume) | Refer to Access (Road) below and Table 3-2. |
| Access (Road) | Roads not classified as arterial or collector, whose major function is to provide access to properties rather than provide routes for other traffic. See Table 3-2. Includes ROWs, vehicle crossings over a road, access lots and any private land area for the purpose of access. |
| Accessway | Provides access to a specific destination |
| Alternative Design | Alternative design is considered a design proposal deviating from the ES. |
| Annual Exceedance Probability | 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 | KDC approval in writing. |
| Arterial Road | Major roads with high traffic volumes or a significant component of through traffic. These include major roads into and through the district, and roads serving significant areas of development. Existing arterial roads are shown on District Plan Maps. |
| Attenuation | Temporary storing stormwater for a period with a controlled release to lessen the intensity/severity/effects of run-off 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 Annual Exceedance Probability 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 **Sheet 2.** |

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| Collector Road | Roads that collect traffic from specific areas or link important roads or major traffic generators. Existing collector roads are shown on District Plan Maps. |
| Commercial and Industrial Area | As defined in the District Plan (KDC 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 KDC. |
| Consent Holder | See Developer. |
| Contractor | The company engaged to undertake the physical works. |
| Curve Number | An empirical parameter used in hydrology for predicting direct run-off 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 KDC, 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. KDC will normally require a bond to cover any necessary works.<br>See Section 1.7.3.1 Defects Liability Period. |

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| Design/Technical Review | A review of a specific part of an overall design or report by a suitably qualified and experienced professional. Refer to document ENZ Practice Note 02: Peer Review -Version 2, April 2018. The review can be done internally with KDC or externally. External reviews must be accompanied by a PS2- Design Review and associated documentation.<br>Also see Peer Review. |
| Detention (hydraulic) | Temporarily detained water which enters a dry pond or tank, before being released slowly. |
| Developer | In relation to resource consents, is the applicant, owner, Trust, Company, person(s), or organisation or legal entity who have been granted consent to undertake the activities applied for. |
| Developer's Representative | See Section 1.4.1 Developer's Representative |
| District Plan | The operative and proposed plans for the district and any combination of them applicable to resource consent applications. |
| Drain | A pipe or channel that conveys sewage or stormwater flow. Drainage has a corresponding meaning. |
| Earthworks | Any modification to the shape of the land surface, removal of soil, excavation, infilling or re- contouring, including construction of any road, track, landing, overland flow paths, open drains and streams. |
| Engineering Design Approval | Any works that impact on KDC owned assets and/or proposed assets to be vested to KDC will require an EDA. Equivalent to EPA Engineering Plan Approval. |
| Engineering Design Approval | Any works that impact on KDC owned assets and/or proposed assets to be vested to KDC will require an EDA. Equivalent to EPA Engineering Plan Approval. |

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| EDA Certificate of Completion | Any completion of works requires the developer to apply for an EDA Certificate of Completion from KDC. |
| 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 | Is defined in B1 Acceptable Solutions and Verification Methods, and in NZS 4229:2013: as 'any rock or soil capable of withstanding an ultimate bearing capacity of 300kPa (i.e. an allowable bearing pressure of 100kPa using a factor of safety of 3), but excludes:<br>• 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<br>• Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2 and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS 4402 Test 2.6, and<br>• Any ground which could foreseeably experience movement of 25mm or greater for any one or a combination of land instability, ground creep, subsidence, seasonal shrinking and swelling, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots'. |
| Gradient | The slope of a surface or object off horizontal generally described either as a percentage or as a ratio i.e. 1:4 is equivalent to 25% or 250mm/m. |
| Greenfield Development | Development on land that has not previously been developed. |

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| 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 Public Works Act 1981. |
| | For private roads, private ways or easements (rights-of-way), the width of the strip of land over which the public, shared owners or landowners with dominant tenement are legally entitled to pass without the specific approval of any one landowner. |
| Licensed Contractor (Water Supply) | As defined in WDC Specification for Registered and Licensed Contractors for Water Supply. |
| Licensed Contractor (Wastewater & Stormwater) | As defined in WDC Specification for Registered and Licensed Contractors for Waste & Drainage Department. |
| Manhole | A chamber which provides access from the surface to an underground service. |
| Maximum Probable Development | MPD represents a maximum impervious area for an allowable land use by District and Regional Plans. It is used for hydrological/hydraulics modelling scenarios. |

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| Means of Compliance | A method by which the requirements of the standard may be complied with. |
| Modified Rational Method | A method to calculate 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.<br>The underlying assumption is that the peak intensity is maintained for a long enough duration to reach peak flow at the outlet of the catchment. |
| Network Utility Operator | Has the same meaning as given to it by Section 166 of the Resource Management Act 1991. |
| Outlet | The discharge point of a catchment associated with a fluid conveyance system for both a gravity or pumped fluid system. |
| Overland Flow Path | A path taken by stormwater run-off as a surface flow concentrates. An OLFP may act as either primary or secondary stormwater conveyance system. |
| Owner | Includes an owner of land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale. It also includes the Crown, the Public Trustee, and any person, local authority, board or other body or authority, however designated, constituted or appointed, having power to dispose of the land or interest therein by way of sale. |
| Pavement | The layer(s) of a road or access structure above the subgrade, incorporating sub-base and/or basecourse crushed granular material whether chemically stabilised or not, or rigid material (such as concrete), but excluding any seal coat. See **Sheet 2** and **Sheet 3.** |

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| Peak Flow (Q) | The maximum rate of surface flow at a point in a catchment for a given period of run-off and rainfall.<br>It could be determined using various hydrological modelling software or by Modified Rational Method. |
| Peer Review | An overall review of a design or report by a suitably qualified and experienced professional. Refer to ENZ Practice Note 02: Peer Review - Version 2, April 2018.<br>Also see Design/Technical Review. |
| Primary Stormwater System | The stormwater system comprising of pipes, watercourses, and other elements of built and natural drainage, that convey the flow of stormwater within the catchment for more frequent storm events and provide a primary protection from flooding to surrounding properties. Which may be owned by KDC or controlled by easements, Local Government Act and the KDC Stormwater and Land Drainage Bylaw. |
| Principal Watermains | All water reticulation 100 mm inside diameter or greater, including associated valves. |
| Private Road | Any roadway, place or arcade laid out within KDC on private land intended for the use of the public. |
| Private Way/Private Accessway | A road or passage over private land that is not open or intended to be open to general public use. Also see District Plan definitions. |
| Private Stormwater | Any part of the stormwater system that is privately owned and includes on drainage from a private land to a receiving environment or up to the point of service connection with the public stormwater network, and includes pipes, gutters, downpipes, catchpits, swales, subsoil drains, stormwater treatment devices, rainwater tanks and any stormwater management device or redundant stormwater system. |

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| Public Stormwater | Public stormwater network includes: Any stormwater pipe, channel, watercourse, land drainage or treatment facility, vested in or under the control of KDC.<br>Any stormwater drain, drain, land drainage work or treatment facility declared by KDC to be a public drain under Section 462 of the Local Government Act 1974.<br>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. |
| Receiving Environment | A water body, river, stream, lake or sea where a catchment run-off discharges. |
| Registered Contractor (Water Supply) | As defined in WDC Specification for Registered and Licensed Contractors for Water Supply. |
| Registered Contractor (Water Supply) | As defined in WDC Specification for Registered and Licensed Contractors for Water Supply. |
| Registered Contractor (Wastewater & Stormwater) | As defined in WDC Specification for Registered and licensed Contractors for Waste & Drainage |
| Regulatory Review | As defined in ENZ Practice Note 02: Peer Review -Version 2, April 2018. |
| Retention (hydrology) | A volume of stormwater reaming in a wetland, pond or tank after detained water was released, the retained water may infiltrate ground, evaporates and be used by living organisms. |
| Rider Main | Water reticulation less than 100 mm inside diameter, including associated valves, that serves more than one property |
| Right of Way (ROW) | A ROW is a private access. |
| Rising Main | Pressure reticulation between a pumping station and a non-pressurised junction or termination, including another pumping station, manhole, reservoir or treatment system. |

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| Road or Street | Road means, subject to Sections 43(1), 51(1), 54(1) & 55(1b) of the Government Roading Powers Act 1989, any road as defined in Section 315(1) of the Local Government Act 1974, and roading has a corresponding meaning. |
| Run-off Coefficient (C) | Used to estimate the amount of rainfall run-off that will occur off any given surface. See Table 4-3. |
| Rural Area | As defined in the District Plan. |
| Safety in Design | Refers to the Health and Safety by Design concept of managing health and safety risks throughout the lifecycle of structures, plant, substance or other products as presented by WorkSafe NZ guidelines and framework (WorkSafe NZ Health and Safety by Design: An Introduction, August 2018). |
| Secondary Stormwater System | The path taken by stormwater run-off 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.<br>The secondary system is vital for flood protection of surrounding properties. |
| Service Lane | Has the meaning given in Section 315 of the Local Government Act 1974. |
| Specific Design | A design that requires analysis, and/or calculation, as required by a method referenced in the ES, or outside of the scope of methods used in the ES.<br>Specific Designs shall be prepared by a SQEP in accordance with sound and accepted engineering practice and principles and shall meet the objectives set out in the ES and/or the District Plan. The design shall comply with New Zealand Standard specifications and/or other nationally recognised procedures and systems.<br>All specific designs must be accompanied by a PS1 Design and a PS4 Construction Review.<br>KDC may require a PS2 Design Review to be provided. |

| | |
|---|---|
| Standard Design Vehicle | See **Sheet 26** for details. |
| Stable Ground | Land that in the opinion of a suitably qualified and experienced Geo-Professional is in a state which is unlikely to settle, slip, erode or otherwise move, allowing for a suitable factor of safety to the detriment of superimposed buildings, services, roads or property. |
| Stormwater | Rainwater that turns into run-off and flows via primary and secondary stormwater systems into a receiving environment. |
| Stormwater Treatment Pond | A permanent pond, wetland or dry detention basin, designed to control peak stormwater flows and provide water quality treatment (see also Attenuation). |
| Sub-base | The material between the subgrade and basecourse aggregate. |
| Subgrade | The top 1 m layer of the road formation below the pavement. It includes any stabilisation, granular or non-granular material of a lower standard than quarry run aggregate. |
| Suitably Qualified and Experienced Person | KDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design approval and a consent from KDC shall be undertaken, supervised and certified by a SQEP who is working within their level of competency.<br>Generally, the required level of competency and qualifications corresponds with the scale and type of the project and the overall risk (Refer to Section 1.5.1.3 Risk Based Assessment Framework). |
| Surcharge | A pipe running in excess of its gravity flow condition, above full and under a degree of pressure. |
| Survey Plan | As described in Section 2 of the Resource Management Act 1991. |
| Swale | A planted or 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 Roads and Streets 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 District Plan. |
| Vehicle Crossing | A trafficable pavement created over a public road corridor in order to connect KDC'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

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

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

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

Should the appointed SQEP change during the various phases of the work, KDC 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 $500,000. See Section 1.4.3 Insurance
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 KDC correspondence relating to the conditions of consent shall be with the nominated SQEP. The Council does not expect to be provided with copies of commercially sensitive information, where this is not relevant to the assessment of an application. To the extent that designs provided to the Council contain intellectual property, once provided to the Council the information forms part of the public record and could be requested by members of the public. Accordingly, it is important that the owner of that intellectual property takes steps to ensure that its rights are protected under New Zealand Law.

### 1.4.2. Cost of the Work and KDC Contributions

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

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

In certain circumstances KDC 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 KDC 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 KDC.

### 1.4.3. Insurance

Where work is carried out on a public road or reserve, on a KDC 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**: KDC may, at its sole discretion, reduce the required value of the Public Liability Insurance to less than $2,000,000 where this is considered appropriate, based on the level of risk to third parties.*

   ***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 $500,000.
   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 KDC 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 KDC's approved Inspection and Testing Plan (ITP) as per Section 1.6.3 Inspection and Testing Plan (ITP).

## 1.5. General

### 1.5.1.1. Design Statement

All designs submitted to KDC 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

KDC supports and encourages innovation and designs which add value. KDC may approve alternative designs provided it is satisfied that the alternative designs will achieve an equivalent function, and performance incorporating optimised whole of life outcomes, against the recommended standards specified in the engineering standards. The Alternative Design provided shall be described in the Design Statement and include all relevant supporting information to enable review and assessment by KDC.

Where a designer identifies a product that is not currently approved (refer to KDCs Approved Materials Lists), an application shall be made to KDC 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 KDC'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 KDC 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 KDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design and a consent from KDC, 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 KDC 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 and/or 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 Charted Professional Engineer (CPEng) accredited with the Charted 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 KDC 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 KDC 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 KDCs and SQEP involvement in various aspects of development.

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

**Engineering Standards**

↓

**Performance Standards and Design Requirements**

| Assets to Vest in KDC | Assets to be Retained in Private Ownership with Impact on Public Assets | Assets to be Retained in Private Ownership |
|---|---|---|
| Includes roads, public reticulation, reserves | Includes stormwater management, vehicle crossings | Includes private roads/ ROWs, private sewerage disposal schemes, private parking areas |
| • Conditions of consent identifying assets to vest.<br>• Approval of EDA with relevant Producer Statement (PS1 Design).<br>• Inspection and Test Plan in accordance with Section 1.6.3.<br>• Inspections and testing in accordance with Inspection and Test Plan.<br>• Final inspection undertaken in accordance with KDC QA/QC Manual 2010.<br>• Relevant Producer Statement (PS4 Construction Review), documentation and as-built information provided.<br>• Maintenance bond secured (where necessary).<br>• Asset vests to KDC | • Conditions of consent identifying assets to be retained in private ownership with any ongoing maintenance requirements.<br>• Approval of EDA with relevant Producer Statement (PS1 Design).<br>• Schedule of required inspections by KDC included in plan approval.<br>• Inspections undertaken in accordance with Schedule.<br>• Final inspection undertaken by KDC with Developer.<br>• 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 ongoing maintenance requirements.<br>• Approval of EDA with relevant Producer Statement (PS1 Design).<br>• KDC notified of inspections/testing for optional observation.<br>• Relevant Producer Statement documentation (PS4 Construction Review) and as-built information provided.<br>• 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 KDC for clarification.*

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

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

| Complexity of Site Suitability | | |
|---|---|---|
| | *Low risk or not identified in a hazard zone* | *Medium/High Risk or identified within a hazard zone or unmapped in terms on land instability* ***(note 'risk' is in the context of all hazards)*** |
| 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.<br>(See page 16 and 17 of Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2012 for further guidance) | |

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

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

| Complexity of the Development | | | | |
|---|---|---|---|---|
| | *Low complexity AND small subdivision (Typically 0-2 Dwellings)* | *Low complexity AND small to medium developments (Typically 3-8 Dwellings)* | *Low complexity AND medium to large developments (Typically 9-29 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)* |
| All Design & Access Statements as per Section 3.2.2.2 Design and Access Statements for vested roads. | Tier 1 | Tier 1 | Tier 2 | Tier 4 |

| Complexity of the Development | | | | |
|---|---|---|---|---|
| | *Low complexity AND small subdivision (Typically 0-2 Dwellings)* | *Low complexity AND small to medium developments (Typically 3-8 Dwellings)* | *Low complexity AND medium to large developments (Typically 9-29 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)* |
| Integrated Transportation Assessment as required under the District Plan Rules - Section TRA-15 | Tier 1 | | | |
| Roadway Design for Private Accessways:<br>• Geometric Design<br>• Horizontal & Vertical Alignment<br>• Cut/Fill Batters<br>• Footpaths<br>• Accessible Crossings<br>• Cycle Facilities<br>• Crossfall & Superelevation | Tier 1 | Tier 1 | Tier 2 | Tier 4 |

| Complexity of the Development | | | | |
|---|---|---|---|---|
| | *Low complexity AND small subdivision (Typically 0-2 Dwellings)* | *Low complexity AND small to medium developments (Typically 3-8 Dwellings)* | *Low complexity AND medium to large developments (Typically 9-29 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)* |
| Roadway Design for Roads to Vest based on District Plan Table TRA 13 - Transport Network Hierarchy:<br>• Geometric Design<br>• Horizontal & Vertical Alignment<br>• Cut/Fill Batters<br>• Footpaths<br>• Accessible Crossings<br>• Cycle Facilities<br>• Crossfall & Superelevation | Tier 2<br>(Only if low volume and access roads) | Tier 3<br>(Only if secondary collector) | Tier 4<br>(For primary collector, arterial, regional & national roads) | Tier 4<br>(For primary collector, arterial, regional & national roads) |
| Intersection Design - Based on District Plan Table TRA 13 - Transport Network Hierarchy.<br>For the intersection of two different classifications of roadway, qualification requirements will be based on the higher of the two roadway classifications. | Tier 2<br>(Only if low volume and access roads) | Tier 3<br>(Only if secondary collector) | Tier 4<br>(For primary collector, arterial, regional & national roads) | Tier 4<br>(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 | | | | |
|---|---|---|---|---|
| | *Low complexity AND small subdivisions (Typically 0-2 Dwellings)* | *Low complexity AND small to medium developments (Typically 3-8 Dwellings)* | *Low complexity AND medium to large developments (Typically 9-29 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)* |
| 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 | | | |
|---|---|---|---|
| | *Low complexity AND small subdivisions (Typically 0-2 Dwellings)* | *Low complexity AND medium to large developments (Typically 3-10 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically >10 Dwellings)* |
| Stormwater Management Plan | Tier 2* | Tier 3* | Tier 4 |
| Stormwater Mitigation Analysis | Tier 2* | Tier 3* | Tier 4 |
| Stormwater Management Device Design:<br>• Rainwater Re-use and/or Attenuation Tanks<br>• Vegetated Swales<br>• Bioretention Devices (including raingardens)<br>• Pervious Paving (including porous or permeable paving)<br>• Infiltration devices | Tier 3* | | |

| Complexity of the Development | | | |
|---|---|---|---|
| | *Low complexity AND small subdivisions (Typically 0-2 Dwellings)* | *Low complexity AND medium to large developments (Typically 3-10 Dwellings)* | *Medium to high complexity AND/OR large developments (Typically >10 Dwellings)* |
| 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 Table 1-1 | | |
| Hydraulic calculations and gravity stormwater reticulation design requiring pipework including culverts. | Tier 2* | Tier 3* | Tier 3* |

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

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

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

| Complexity of the Development | | | | |
|---|---|---|---|---|
| | *0-6 Dwellings AND if extension is of the existing water or wastewater network.* | *7-10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 63 mm watermains. Pump stations are excluded.* | *>10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 125 mm watermain. Pump stations are excluded.* | *40+ Dwellings or where design problems are complex and require broad spectrum or specialized engineering principles (includes work such as structural design, pump stations, process work or larger diameter pipework (225 mm and over)).* |
| 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 Appendix B ES-SEW1 or similar) | Tier 2 | Tier 3* | Tier 3* | Tier 4 |
| Community wastewater treatment systems | Tier 4 | | | |

| Complexity of the Development | | | | |
|---|---|---|---|---|
| | *0-6 Dwellings AND if extension is of the existing water or wastewater network.* | *7-10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 63 mm watermains. Pump stations are excluded.* | *>10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 125 mm watermain. Pump stations are excluded.* | *40+ Dwellings or where design problems are complex and require broad spectrum or specialized engineering principles (includes work such as structural design, pump stations, process work or larger diameter pipework (225 mm and over)).* |
| Siphons and retaining structures | Tier 4 | | | |
| Low Pressure Sewer Systems | Tier 4<br>(Pressure sewer design must be reviewed by the proprietary product supplier) | | | |
| Water Booster pump stations Reservoirs | Tier 4 | | | |
| Reservoirs | Tier 4 | | | |
| 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 KDC undertakes review of information submitted to the KDC. 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.

KDC at its own discretion may arrange for external regulatory reviews as part of the approval process where KDC 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 KDC, 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 KDC 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 KDC 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 onsite 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 onsite

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 areas 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-lodgement meeting with KDC 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 KDC 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 KDC management teams on all infrastructure design and landscaping proposals at an early stage of the development is encouraged.*

#### 1.5.3.1. 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 KDC'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 KDC assets are to be clearly identified (e.g. abandonment, removal, upgrading and relocation).

### 1.5.3.2. Investigation, Design and Certification

#### *1.5.3.2.1. 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.

#### *1.5.3.2.2. 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.*

#### *1.5.3.2.3. Design Life*

The design life of assets shall be 100 years unless otherwise stated in the ES. Alternative Design Life values can be submitted for components of the system at the discretion of the Asset Management/Infrastructure Manager or delegate.

#### *1.5.3.2.4. 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 KDC.

#### *1.5.3.2.5. 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 KDC 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.*

#### *1.5.3.2.6. 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 KDC 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 KDC or a third-party property to undertake works. A right of access must be obtained from the affected party in writing before works commence.

#### *1.5.3.2.7. Request for Further Information*

Prior to approval of EDA being issued, KDC 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.

#### *1.5.3.2.8. 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 KDC.

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 KDC approves the variation.

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

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

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

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

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

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

| Type | Plan View | Long Sections | Other |
|---|---|---|---|
| Utility Services | The depth and location of existing and proposed electricity and telecommunications, (including gas services where applicable). | | |

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

| Type | Prior to Construction Commencing | During Construction | After Construction |
|---|---|---|---|
| Geotechnical Information | • Geotechnical Design Report | • Site Supervision | • Geotechnical Completion Report<br>• Site Contamination Validation Report<br>• Statement of Professional Opinion<br>• Final contour plan identifying areas of fill |
| Transportation | • Road pavement design calculations including results of preliminary soil testing.<br>• Approval for sub-soil drainage discharge (if appropriate)<br>• Signal Plans including design, traffic modelling and peer review<br>• Pre-Construction Road Safety Audit (RSA) or RSA Exemption | • Site Supervision | • Producer Statement<br>• As-built information<br>• Post Construction RSA |

| Type | Prior to Construction Commencing | During Construction | After Construction |
|---|---|---|---|
| Stormwater | • Detailed catchment run-off calculations including each sub-catchment input factors used in the calculations<br>• Detailed pipeline flow capacity analysis.<br>• For stormwater treatment and detention devices, detailed analysis demonstrating the design performance in respect of stormwater quantity and quality as appropriate<br>• Proposed operations and maintenance manuals for stormwater treatment and detention devices<br>• Proposed landscaping plan for stormwater treatment and detention devices, landscape plans to include any services and access requirements for future maintenance | • Site Supervision | • CCTV Inspection and Report<br>• Final operations and maintenance manuals for stormwater treatment and detention devices<br>• As-Built Plans |
| Wastewater | • Wastewater flow estimates supported by the estimates of population equivalents for each catchment together with catchment boundaries and catchment areas<br>• Pipe flow calculations showing pipe capacity and flow velocity for average dry weather flow, peak daily flow and peak wet weather flow<br>• Pump station calculations justifying the selection of wet well size, pump selection and rising main hydraulics | • Site Supervision | • CCTV Inspection and Report<br>• As-Built Plans |

| Type | Prior to Construction Commencing | During Construction | After Construction |
|---|---|---|---|
| Water | • Fire flow calculation | • Site Supervision | • As-Built Plans |
| Landscaping | • Statement of design intent and design objectives<br>• Planting schedule<br>• Existing tree and vegetation plan<br>• Maintenance schedule for weeding and replacement planting during Defects Liability Period | • Site Supervision | • As-Built Plans |

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

The Developer's Representative shall give KDC 24 hours' notice of the intention to commence construction work, and advise KDC 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 KDC 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 KDC 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
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
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 KDC prior to the commencement of work on site.

### 1.6.4 Pre-start Meeting

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

KDC 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 KDC 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 KDC assets or public land shall strictly comply with the KDCs health and safety policies and procedures.

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

a. Comply with KDC's Appendix A - Health and Safety Requirements for Procurement Documents
b. Ensure they can meet the minimum requirements outlined in the current KDC Contractor Health and Safety Handbook
c. Comply with Appendix I, where applicable, of KDC'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 work will be carried out within a road.

No work on KDC assets or on any public land shall proceed before the above has been complied with and approved by KDC. KDC may refuse to allow a contractor to carry out work on KDC assets or on public land where in the opinion of KDC, 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 KDC 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 KDC land to undertake works. Separate approval is required from KDC 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 KDC.

### 1.6.5.3. Registered Contractors and Licensed Contractors

For some infrastructure services, KDC maintains a list of contractors that are permitted to construct or work on KDC assets, or assets that will be vested to the KDC. 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. Alternatively, contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate.

### 1.6.5.4. Site Inspections

Where assets are to vest, the Developer's Representative shall notify KDC 24 hours prior to requiring site inspections. KDC 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**: KDC may inspect any incomplete KDC 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 KDC assets, may be inspected/tested by a

SQEP. KDC is still to be informed 24 hours in advance of when such inspections/tests taking place so that a KDC officer may observe if so desired.

All works that impact on KDC assets, may require KDC representative to be present when inspections/testing take place. KDC 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 KDC, 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 KDC upon completion of the work shall be undertaken in accordance the KDC 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
n. Other testing as directed by KDC.

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

If the work does not meet the standard when inspected by KDC, 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 KDC 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 KDC 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 KDC 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). Alternatively, contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate.

A KDC 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 KDC.

### 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 KDC 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
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 KDC that they have made the proper reinstate. The KDC 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, KDC 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 KDC 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, KDC 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 KDC 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 KDC

   ***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 KDC on application for 224(c) or works acceptance

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

Auditing requirements for types of works are covered in the various sections. KDC 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 KDC to enable any audit to be carried out if required:

a. Commencement of work
b. Prepared earthworks and subsoil drainage prior to filling Completed earthworks and prepared subgrade
c. Commencement of stormwater, wastewater (including pump stations) and/or water reticulation
d. Finished basecourse
e. 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, KDC 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, KDC 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. Refer to KDC Corridor Access Request website or enquire directly to KDC.

"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.*

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 KDC 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 KDC in accordance with the National Code of Practice for Utility Operators' Access to Transport Corridors - Updated Version 2, July 2019.

#### 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 KDC 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 KDC 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 KDC 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 KDC. 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
j. Any bonds in terms of Section 1.7.3.2 Bonds 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 KDC and private 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 KDC 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, KDC 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-Builts

d. As-Built Plans shall include non-physical details such as the extent of overland flow paths
e. All 'Asset Information Schedule Requirements' as per Appendix H Asset Attributes and the example in Appendix G Example As-Built Drawings. KDC Asset Schedule Template for developers is available on request and should be used for larger developments at the Development Engineers discretion
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 KDC'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 KDC approved road names, and parcels with legal descriptions and house numbers (where available)
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 ±10mm
b. Locations (x,y co-ordinates) accurate to ±100mm.

#### 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 KDC. RAMM data requirements are as set out in KDC RAMM data forms (Refer to KDC RAMM Template).

##### *1.7.2.3.1. Resource Consents*

The KDC assess RAMM data capture for KDC maintained road(s) and parking assets.

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

a. All pavement details, including aggregate types, depths and sources of aggregate
b. Typical sections and plan views
c. Top surface and sealing data
d. Dates that each pavement layer, surfacing etc. are constructed
e. Details of all road signs
f. Footpath construction details
g. Streetlighting details
h Crossings, features and minor structures
i. Details of subsurface drainage, geotextile layers, and all other buried features
j. Information on all structures, including bridges, retaining structures etc.

   ***Note**: that culverts with a watercourse area greater than 3.4m$^2$ are regarded as bridges in terms of the Waka Kotahi Bridge Manual.*

k. For roads, accessways and access lots serving 5 or more lots or household units, which are intended to be named but not maintained by KDC, 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
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. KDC Asset Schedule Template for developers will be provided on request.

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 20m centres and the perimeter, sufficient that the area can be drawn in GIS
f. Public (KDC owned) or private
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 KDC 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 KDC.

***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 KDC 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 KDC 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 KDC notice or within such other reasonable time agreed by the KDC.

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

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

a. The bond shall be an agreed cash deposit, or at the KDCs discretion where sound reasons for not providing a cash bond are demonstrated, a bank bond from a New Zealand based Trading Bank
b. KDC will pay no interest on bond monies
c. Defects Liability/Maintenance bond: Council will apply its discretion to set an appropriate bond amount that reflects the value of the work and the risk to Council assets.
d. The Developer is responsible for providing all necessary documentation, and shall pay all processing fees, legal costs and disbursements relating to the bond
e. KDC may require the bond to be registered against the title(s) of the property
f. The bond for outstanding or defect/maintenance work is refundable upon confirmation of final inspection and acceptance by KDC following completion of the works, and payment of all associated fees
g. Bond payments and refunds shall include GST, where applicable, in the bond value approved by KDC

h. Council will apply its discretion to set an appropriate bond amount that reflects the value of the work and the risk to Council assets.

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

#### 1.7.3.3. Uncompleted Works Bond

KDC does not generally accept Uncomplete Works Bonds.

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 KDC.

#### 1.7.3.5. Vesting and Easements

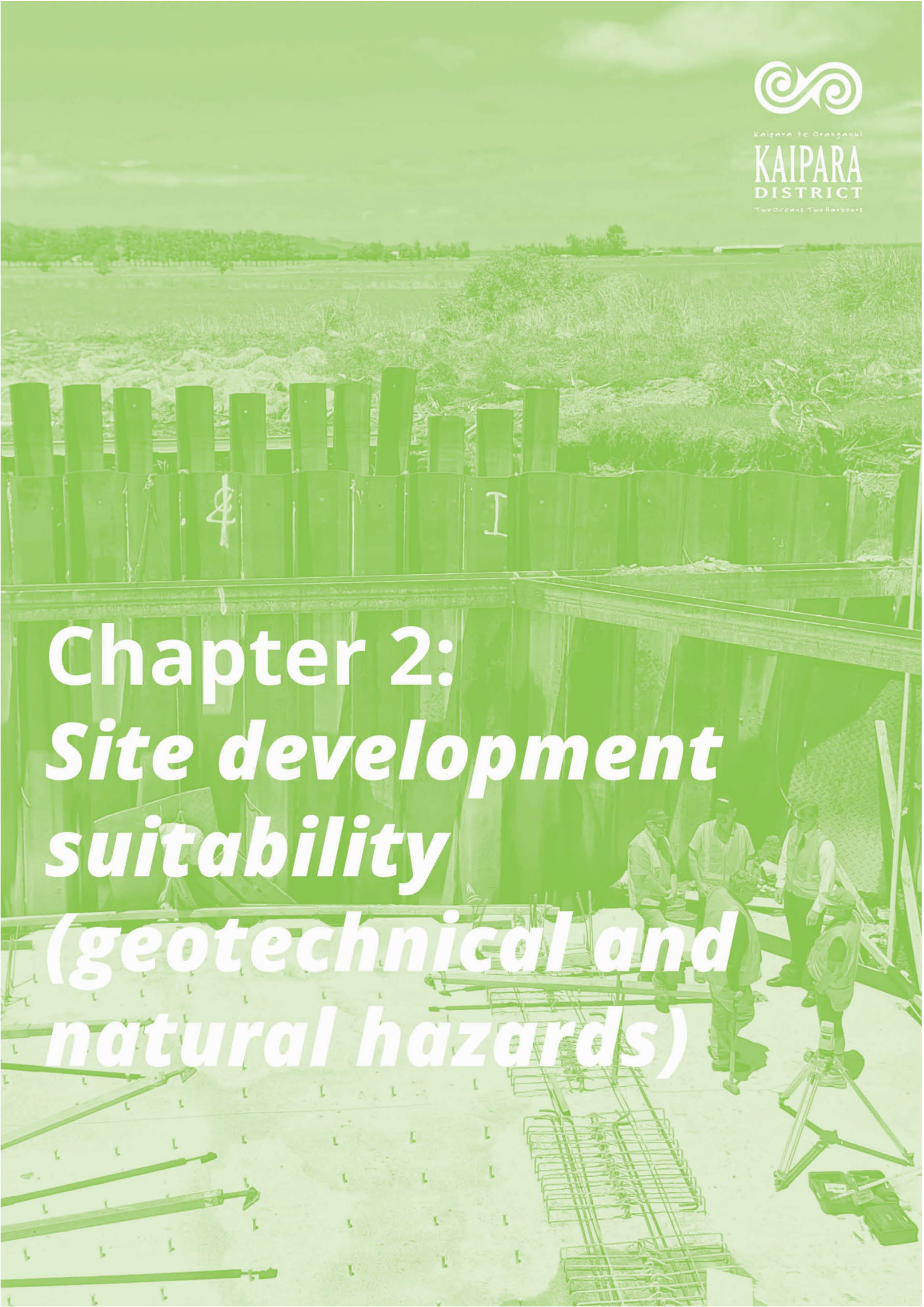
The Developer's Representative shall ensure that all KDC requirements are satisfied prior to requesting the transfer of constructed assets to KDC ownership. (As required in accordance with WDC QA/QC Manual 2010). See Section 1.4.4 Quality Assurance and Quality Control.

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

Easements in favour of KDC are required for all public reticulation located in private property regardless of sizing. Easements may be required for access to maintenance structures.

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

Kaipara te Oranganui
KAIPARA DISTRICT
Two Oceans Two Harbours



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

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## 2.1. Introduction

The KDC 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 Kaipara District are referenced in this chapter.

### 2.1.1. Scope

This section sets out the KDC'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 KDC 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 KDC's duties in relation to Section 106 of the Resource Management Act 1991 and Section 71 of the Building Act 2004 have been discharged
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 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 document is sourced.*

#### 2.1.3.1. Statutory

Building Act 2004

NRC Regional Plans

Operative District Plan and Proposed 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. KDC Documents

WDC Acid Sulphate Soil Planning Policy Basic Guide 2015

Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018

Stormwater Catchment Management Plans *(to be provided by KDC 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 KDC any NRC consents that may be required under those rules.

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

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

### 2.2.2. KDC 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 KDC 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
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 KDC 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. KDC Consents

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

Any KDC 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 KDC 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 documents:

a. KDC Stormwater Catchment Management Plans
b. NRC Regional Policy Statement for Northland
c. NRC Coastal Flood Hazard Assessment for Northland Region 2019-2020
d. NRC Coastal Erosion Hazard Assessment for Selected Sites 2019-2020
e. WDC Acid Sulphate Soil Planning Policy Basic Guide
f. WDC Policy #0129 - Land Development Stabilisation 2018
g. WDC Land Development Stabilisation – Technical Design Requirements 2018
h. Rockfall: Design considerations for passive protection structures 2016, and
i. Other relevant KDC documents available on the Natural Hazards page of the KDC website.

#### 2.2.2.3. Historic Investigations

KDC 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 KDC'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 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
g. Acid sulphate soils.

Where the proposed development site is outside of an area covered by the available 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.

#### 2.2.2.5. Erosion, Sediment and Dust Control

The Developer shall be responsible for compliance with any NRC and KDC 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
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
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
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 KDC 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 KDC 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)
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 wastewater.

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 KDC.

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
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 wastewater into or over the area) on the whole slope, and
i. 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 KDC.

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 wastewater into or over the area) on the whole slope

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

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 Kaipara District.

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

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

a. Expansive soils
b. Compressible soils
c. Volcanic soils
d. Soils subject to liquefaction
e. Acidic soils

f. Soils prone to dispersion
g. Previous fill material.

#### 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
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.*

### 2.2.4.3. 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.

### 2.2.4.4 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)
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

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.
   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
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 KDC 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 KDC 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 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 KDC 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 work

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, A range of suitable moisture contents of the material,
b. A maximum air voids of the material, and
c. A maximum and minimum shear strength of the material.

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

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

#### *2.4.1.2.3. End Product Specification*

Where the desired compaction criteria of the placed and compacted fill are specified in the Geotechnical Design Report, the earthworks 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
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. 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.

### 2.6.2. Contaminated Site Validation Report

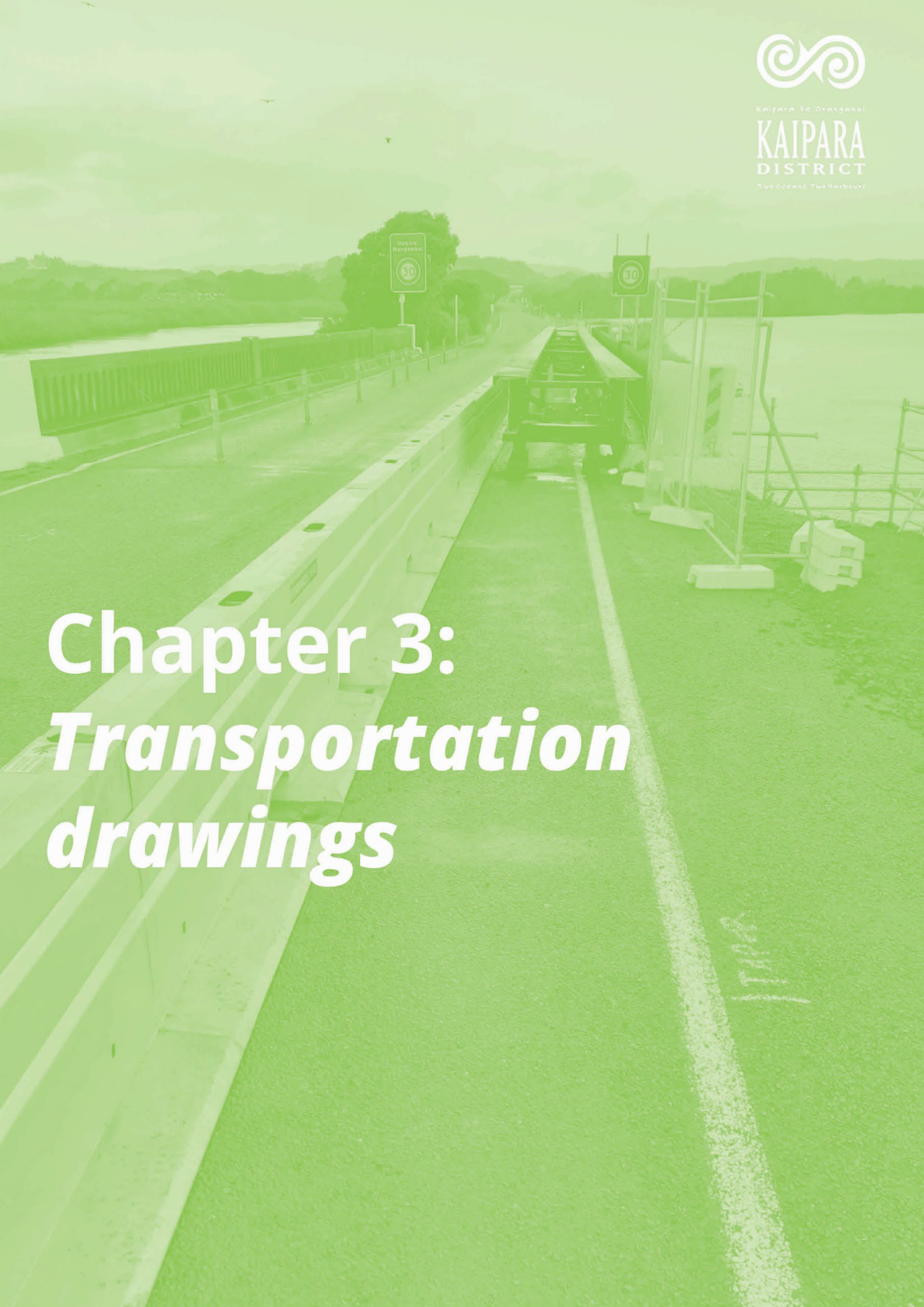
When earthworks have been undertaken on potentially contaminated sites or a site known to be contaminated, a Contaminated Site Validation Report shall be prepared and submitted to the KDC.

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.

### 2.6.3. Resource Consents

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



Kaipara te Oranganui
KAIPARA
DISTRICT
Two Oceans Two Harbours

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## 3.1 Scope

This Section sets out the requirements for the design and construction of transportation corridors within the city/district that are, or will be, managed by or vested to Council. It is also to be used for maintenance of existing infrastructure, including asset renewal, unless the standards are not compatible with the existing assets.

## 3.2 General

### 3.2.1. Objective

The objective is to provide a hierarchical network of transportation corridors that respond to land use and landform, provide safe and convenient transport for all road user modes, provide access to adjacent property, travel choices, are well connected, safe to use and provide corridors for utility services. They must be consistent in their design standards to provide uniform guidance to users and be designed and built to provide the least whole of life cost to the community, consistent with the desired level of service.

***Table 3-1: Reference Documents***

Details of documents referenced in this Section are as follows:

| STANDARD/LEGISLATION | TITLE |
|---|---|
| AS 1141.32.2008 | Methods for sampling and testing aggregates - Weak particles (including clay lumps, soft and friable particles) in coarse aggregates |
| AS 2144:2014 | Traffic Signal Lanterns |
| AS 2353:1999 | Pedestrian Push-button Assemblies |
| AS 289.5-1993 | Parking Facilities – On-street parking |
| AS/NZS 1158 Set | Lighting for Roads and Public Spaces Set |
| AS/NZS 2276.1:2004 | Cables for traffic signal installations - Multicore power cables |
| AS/NZS 2276.2:1998 | Cables for traffic signal installations - Feeder Cable for Vehicle Detectors |
| AS/NZS 2276.3:2002 | Cables for traffic signal installations - Loop Cables for Vehicle Detectors |
| AS/NZS 2312:1:2014 | Guide to the Protection of Structural Steel Against Atmospheric Corrosion by the Use of Protective Coatings with 2004 Amendments - Part 1: Paint coatings |

| STANDARD/LEGISLATION | TITLE |
|---|---|
| AS/NZS 2312.2:014 | Guide to the Protection of Structural Steel Against Atmospheric Corrosion by the Use of Protective Coatings with 2004 Amendments - Part 2: Hot dip galvanising |
| AS/NZS 3000: 2007 | Electrical Installations (known as Australian/New Zealand Wiring Rules) |
| AS/NZS 3845.1:2015 | Road safety barrier systems and devices |
| AS/NZS 4819:2011 | Rural and urban addressing |
| ASTM C309:2011 | Specification for liquid membrane–forming compounds for curing concrete |
| BS 381C | Colour chart for paints |
| S 812–114:1989 | Testing aggregates. Method for determination of the polished-stone value |
| NZS 3104:2003 | Specification for Concrete Production |
| NZS 3109:1997 | Concrete construction |
| NZS 3116:2002 | Concrete segmental and flagstone paving |
| NZS 3910:2013 | Conditions of Contract for Building and Civil Engineering Construction |
| NZS 4121:2001 | Design for Access and Mobility – Buildings and Associated Facilities |
| NZS 4402.4.1.1:1986 | Test 4.1.1 NZ Standard Compaction Test |
| NZS 4402.4.1.3:1986 | 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 |
| NZS/AS 1657:1992 | Fixed platforms, walkways, stairways and ladders – design, construction and installation |

### *NZ Transport Agency (NZTA) Standards, Specifications and Guidelines*

#### *NZ Transport Agency (NZTA) Guides*

| | |
|---|---|
| NZTA | Pedestrian Planning and Design Guide (2009) |
| NZTA | One Network Framework Detailed Design (2022)<br>One Network Framework Classification Guidance (2022)<br>One Network Framework (2022) |

| | |
|---|---|
| NZTA | Cycling Network Guidance – planning and design |
| NZTA | Making Roads Motorcycle Friendly |
| NZTA | Speed Management Guide<br>Speed Management Toolbox and Appendices |

***NZ Transport Agency (NZTA) Traffic Notes***

| |
|---|
| NZTA Traffic Note 48 Light Vehicle Sizes and Dimensions: street survey results and parking space requirements |

***NZ Transport Agency (NZTA) Manuals***

| | |
|---|---|
| NZTA RTS 14 | Guidelines for Facilities for Blind and Vision Impaired pedestrians (2015) |
| NZTA RTS 18 | NZ On Road Tracking Curves for Heavy Vehicles (2007) |

***NZ Transport Agency (NZTA) Specifications***

| | |
|---|---|
| NZTA B/2 | Construction of Unbound Granular Pavement Layers |
| NZTA B/5 | In-Situ Stabilisation of Modified Pavement Layers |
| NZTA C/20 | Erection and Maintenance of Traffic Signs Chevrons Markers and Sight Rails |
| NZTA F/1 | Earthworks Construction |
| NZTA F/2 | Pipe Subsoil Drain Construction |
| NZTA F/5 | Corrugated Plastic Pipe Subsoil Drain Construction |
| NZTA M/1 | Roading Bitumens |
| NZTA M/4 | Basecourse Aggregate |
| NZTA M/6 | Sealing Chip |
| NZTA M/7 | Line Marking Paint |
| MZTA M/7 | Notes to Line marking Paint Specification (M/7) |
| NZTA M/10 | Asphaltic Concrete |
| NZTA M/12 | Raised Pavement Markers specification |
| NZTA M/14 | Edge Marker Posts |
| NZTA M/17 | W-Section Bridge Guardrail Specification |
| NZTA M/20 | Long Life Line Marking Materials Specification |
| NZTA M/20 | Notes to Long Life Line Marking Materials Specification (M/20) |

| | |
|---|---|
| NZTA M/23 | Bridge Approaches and Specification for Road Safety Barrier Systems<br>Appendix A - List of Compliant Road Safety Hardware for Accepted Products (with interim acceptances) |
| NZTA M/24 | Audio Tactile Profiled Road Markings Specification |
| NZTA M/26 | Specification for Lighting Columns<br>Appendix A – Type Approved Passively Safe Lighting Columns |
| NZTA M30 | Specification and guidelines for Road Lighting design |
| NZTA P/3 | First Coat Sealing |
| NZTA P/4 | Resealing |
| NZTA P/9 | Asphaltic Concrete Paving Construction |
| NZTA P/11 | Open Grade Porous Asphalt |
| NZTA P/12 | Pavement Marking Specification |
| NZTA P/12 Notes | Notes to Pavement Marking Specification (P/12) |
| NZTA P/14 | Specification for Installation of Raised Pavement Markers |
| NZTA P/15P | Fabrication and Assembly of Standard Guardrails and Handrails for Highway Bridges |
| NZTA P/22 | Reflectorised Pavement Marking Specification |
| NZTA P/43 | Specification for Traffic Signals |
| NZTA T/1 | Benkelman Beam Deflection Measurements |
| NZTA T/8 | Road marking Applicator Testing Specifications |
| NZTA T/12 | Long-life Pavement Marking Material Applicator Testing |

**Austroads Guides**

| | |
|---|---|
| Austroads Guide to Road Design | Part 3: Geometric Design |
| Austroads Guides to Road Design | Part 4: Intersections and Crossings |
| Austroads Guides to Road Design | Part 4A: Unsignalised and Signalised Intersections |
| Austroads Guide to Road Design | Part 4B: Roundabouts |
| Austroads Guides to Road Design | Part 4C: Interchanges |
| Austroads Guide to Road Design | Part 6A: Pedestrian and cyclist paths |

| | |
|---|---|
| Austroads Guide to Pavement Technology | Part 2: Pavement Structural Design |
| Austroads Guide to Traffic Management | Part 10: Traffic Control and Communication Devices |
| Austroads Pavement Design for Light Traffic | |

**Other Documents**

| | |
|---|---|
| Thick Brick Australia | Clay Paving Design |
| Ministry for the Environment (MfE) | Crime Prevention through Environmental Design (CPTED) |
| Health and Safety at Work Act 2015 | |
| Manual for Streets (UK Dept for Transport) 2007 | |
| New Zealand Building Code | |
| NZ Roadmarkers Federation (NZRF) | Manuals Industry 'Best Practice' |
| Road Safety Manufacturers Association (RSMA) | Compliance Standard for Traffic Signs (2010) |
| Electricity Regulations 2010 | |
| Electricity (Safety) Regulations 2010 | |
| NZ Electrical Code of Practice for Electrical Safe Distances (NZECP 34:2001) | |
| The Electricity Act 1992 | |

### 3.2.3. Guidelines

In designing the layout of a Transportation Corridor, the following issues must be considered:

a) Zoning and likely use of the adjacent land
b) Land form and geological and cultural features
c) Connections to existing transport corridors
d) Linkages to other developments and amenities
e) Relationship to the concept for the total area

f) Recognition of the One Network Road Classification hierarchy[1] and the One Network Framework hierarchy
g) The relevant Council's District Plan
h) Public transport requirements
i) Service/utility corridors and the impact the development will have on the capacity of the utilities in the adjacent areas
j) Protection of unique features
k) Pedestrian needs
l) Cyclist needs
m) Needs of mobility or visually impaired persons
n) Stormwater collection, treatment and disposal
o) Access by vehicles needing to service the area e.g. refuse collection, street cleaning
p) Risk, reliability and redundancy
q) Green space and vegetation
r) Whole of life costs for the operation and maintenance of the asset including ease of cleaning, procurement and replacement of infrastructure when vandalised, damaged or at the end of its design life.
s) Mitigation of adverse effects of traffic:
    a. Volume
    b. Speed
    c. Manoeuvrability
    d. Function
    e. Parking
    f. Safety
    g. Noise, air and water pollution

### 3.2.4. Functions of a Transportation Corridor

A Transportation Corridor provides a space for interaction between people for a range of purposes and access to land uses so that movement between places can occur.

Refer to the relevant District Plan for the transportation functional classification.

The three key functions of a Transportation Corridor are movement, place context and utility corridor.

[1] The RITS is based on the HCC ITS, and that document had many roading hierarchy statements similar but slightly different to ONRC. As a result, users need to be aware that this is an area of work that is still to be done late in 2018.

#### 3.2.4.1. Movement

Linking places with transportation infrastructure that provides for a range of transport modes to move people and goods efficiently.

#### 3.2.4.2. Place Context

Creating public spaces for people to interact, exercise and enjoy where appropriate. There are some transportation corridors where such activities would create health and safety issues. The place function would be limited in such situations e.g. arterials and expressways.

#### 3.2.4.3. Utility Corridor

Providing corridors that network utility operators can use to service the city (e.g. telecommunication, fibre, electricity, three waters, and gas networks).

#### 3.2.4.4. Transportation Corridor Hierarchy

Each Council currently has their own transportation corridor hierarchy. These can be found in the relevant District Plan.

#### 3.2.4.5. Network Connectivity

Well-connected urban networks (roads and other links) are achieved with smaller block sizes and regular connections. Network connectivity shall be designed to achieve:

a) Shorter travel distances
b) An increased number of alternative routes for all types of users (noting that this is not the case with arterials and expressways)
c) Increased opportunity for communities to interact, e.g. socialise, play together, etc.
d) Improved access to; public transport, cycling and walking networks, access to destinations such as schools, amenities and employment

Development design shall ensure connectivity to properties and roads that have been developed, or that have the potential to be developed in the future. The design shall ensure the maximum walking distances in the following Table 3-2 from a lot to a collector or arterial road.

***Table 3-2: Maximum Walking Distances from a Lot to a Collector or Arterial Road***

| | |
|---|---|
| Rural road | No maximum distance. The design should maximise future connectivity to a suburban network. |
| Suburban | 400m. A shorter distance shall be considered near centres and major public transport routes |
| Urban | 300m |
| Centre | 200m |

Provision of safe and accessible crossing points across collectors and arterials will also be necessary to ensure that Network connectivity between blocks is maintained.

### 3.2.5. Road Safety Audit

A Safe Systems Audit (Road Safety Audit), or exemption, is required for any improvement or renewal activity that involves vehicular traffic and/or walking and/or cycling where, with respect to the table below:

1. A new activity specified in Column (A) exceeds the Threshold Limit in Column (B); or
2. A change to an existing activity specified in Column (A) exceeds the Threshold Limit in Column (C); or
3. Any subdivision or activity accesses:
   - a State Highway, or
   - any road with an ADT > 5,000 (Urban) or > 3,000 (Rural), or HCV > 300; or
   - any road with an ONF 'Place' classification of P1 to P3 (Urban), or P3 to P4 (Rural); or
4. If the proposal increases ADT on the frontage road by >50%; or
5. If the proposal is a new school at NOR stage, or the proposal intensifies an existing school (e.g. via roll increases and/or additional classrooms).

   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 NZTA's Safe System Auditing Procedures for Transport 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(s) shall be implemented before the 224 certificate is issued or the contract works accepted for practical completion.

| | (A) | (B) | (C) |
|---|---|---|---|
| **1** | Residential Units | 25 residential units | Every additional 25 residential units |
| **2** | Supported residential Care | 20 beds | Every additional 20 beds |
| **3** | Visitor Accommodation | 25 bedrooms | Every additional 25 bedrooms |
| **4** | Drive-Through Facilities | 300m$^2$ | Every additional 300m$^2$ GFA |
| **5** | General Retail | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **6** | Grocery Stores | 750m$^2$ GFA | Every additional 50m$^2$ GFA |
| **7** | Trade Retail | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **8** | Commercial Services | 1,250m$^2$ GFA | Every additional 1,250m$^2$ GFA |
| **9** | Food and Beverage Activity | 500m$^2$ GFA | Every additional 500m$^2$ GFA |
| **10** | Entertainment Facilities | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **11** | Other Commercial Activities | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **12** | Place of Assembly | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **13** | Recreational Facilities | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **14** | Other Community Facilities | 2,500m$^2$ GFA | Every additional 2,500m$^2$ GFA |
| **15** | Storage | 5,000m$^2$ GFA | Every additional 5,000m$^2$ GFA |
| **16** | Other Industrial Activities | 2,500m$^2$ GFA | Every additional 2,500m$^2$ GFA |
| **17** | Rural Centre Service Activities | 1,000m$^2$ GFA | Every additional 1,000m$^2$ GFA |
| **18** | Retirement Village | 20 individual retirement village units or beds | Every additional 20 individual retirement village units or beds |
| **19** | Care Centre | Facilities which accommodate at least 25 persons receiving care | Every additional 25 persons receiving care that are accommodated in the facility |
| **20** | Service or Charging Station | 4 refuelling /charging spaces per site | Every additional 4 refuelling /charging spaces per site |
| **21** | Educational Facilities – Primary Schools, Pre-schools and Childcare Facilities | Facilities/schools which accommodate at least 40 pupils | Every additional 40 pupils accommodated at the facility /school |

| | (A) | (B) | (C) |
|---|---|---|---|
| **22** | Educational facilities – Secondary and Tertiary Schools | Schools which accommodate at least 180 pupils | Every additional 180 pupils are accommodated at the school |

### 3.2.6 Design and Access Statement

A design and access statement shall be submitted with the application for design approval. The statement shall cover all relevant aspects of this Specification and specifically address:

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 NZTA 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 such as street furniture, pedestrian refuge facilities, bus stops and shelters, for visual consistency and also potential increase in usage
j) Any new parking restriction that will be required in order for the proposed design to operate safely, e.g. no stopping.

## 3.3 Engineering Design

### 3.3.1. General

Roads shall be designed with reference to the transportation functional classification table contained in the relevant District Plan and NZS 4404 Section 3.3. However, all references within Section 3.3 (NZS 4404) to Table 3.2 (NZS 4404), shall be taken instead to refer to the table in the relevant district plan.

#### 3.3.1.1. Design Speed Environment

The relationship between carriageway width, forward visibility and the design speed environment for various road types is illustrated in Fig 3.2 of NZS 4404.

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

Design speed environments can be managed by physical and psychological devices such as narrowed movement lanes, reduced forward visibility, parking, slow points, build outs, chicanes, planting and landscaping, and street furniture and art works.

The Austroads Guide to Road Design - Part 3: Geometric Design provides suitable guidance for designing to a design speed. Reference can also be made to the Manual for Streets (UK Department for Transport) and the NZTA Speed Management Guide Toolbox and Appendices.

#### 3.3.1.2. Special Character Zones or Specific TLA Requirements

Where Special Character Zones (residential, heritage, natural, etc) are identified in the relevant district plan, or specific requirements relating to street furniture etc exist, there may be associated local variations to the RITS.

### 3.3.2. Corridor Alignment, Width and Cross Section components

Horizontal alignment of transport corridors shall be based on terrain and the design speed applicable to the road function. Vertical alignment of residential roads should ensure that inclines can be negotiated during all weather conditions and sight distances are adequate for safety. The gradient shall be considered as a planning factor when selecting locations for shopping centres, service centres, or footpaths.

The minimum centreline radius for industrial roads, residential collector and sub collector roads is 80m. The minimum centreline radius for local residential roads is 15m. Reverse curves are to be separated by an adequate length of straight in metres of 0.7 times the posted speed limit.

#### 3.3.2.1 Lane Widening

Where the centreline radius is 80m or greater, extra widening on curves is not required. Where curves are less than 80m radius, extra widening may be applied to the carriageway to ensure that heavy vehicles are able to negotiate the curve wholly within their lane. In such cases, the minimum berm width shall not be reduced.

*Table 3-3: Design Vehicle for Curve Widening*

| ROAD CLASSIFICATION | DESIGN VEHICLE |
|---|---|
| Arterial Collector and Industrial roads* | 19m Semi-trailer |
| Local roads and lanes (excl industrial zones) | 11.5m Rigid |

* As defined in the relevant District Plan

#### 3.3.2.2. Visibility

The road centre line radius and the road width also affect the visibility along the road, particularly on the inside road boundary of the curve.

As such, in addition to carriageway widening, there is a need to also check that horizontal visibility meets the road design speeds both on the inside of the curve and also at vehicle entrances and access way. Achieving this may result in a need to increase the berm width by adjusting property boundaries.

#### 3.3.2.3. Carriageway Crossfall

Minimum crossfall is 1:33 for chip seal surfaces, 1:50 for asphaltic concrete surfaces and 1:25 for unsealed surfaces.

Maximum crossfall is 1:25, with the exception of where vehicles and pedestrians operate in shared zone environments. In shared zone environment, carriageway crossfall shall comply with footpath requirements.

Single crossfall will be considered on carriageways up to 7.0m where normal crossfall is unobtainable.

#### 3.3.2.4. Super Elevation

Maximum super elevation is 1:17.

Super elevation should be used on short radius curves on roads with operating speeds of greater than 40km/h.

#### 3.3.2.5 Gradients

a) Minimum gradient is 1:250
b) Maximum gradient (on arterial, collector and industrial roads) is 1: 12
c) Maximum gradient (on residential roads) is 1:8

Steeper gradients may be acceptable for shorter lengths of road in hilly country or low overall speed environments, subject to approval by Council in accordance with Part 329 (road gradients) of the Local Government Act 1974. However, consideration of these steep grades is to be taken into account in the design of adjacent footpaths.

#### 3.3.2.6 Vertical Curves

Vertical curves shall comply with the requirements of Austroads Guide to Road Design Part 3: Geometric Design, section 8.6 Vertical Curves. For areas where the design speed is ≤ 50 km/h, vertical curves shall have a minimum length of 20m, except where the grade change is ≤ 1:100 where the minimum vertical curve length is 10m for centre lines. Kerb and channel grades should not be flatter than 1: 300 within the vertical curve.

#### 3.3.2.7 Cross-section

Typical road widths are provided in the relevant district plan. Preservation or capitalisation of some natural feature of a landscape or existing specimen tree(s) may dictate an irregular shaped road width.

Certain carriageway and berm geometrics, utility services and stormwater swales, may require that the road width be increased, but usually just locally.

#### 3.3.2.8 Road Reserve

In some circumstances an increased overall road reserve may be necessary for utilities provision or increased amenity, stormwater treatment and drainage, landscape or urban design element. In other circumstances, reserve widths may be reduced if development is only on one side of the road or the road is only one way.

All rural road reserve boundaries shall be fenced.

#### 3.3.2.9 Movement Lanes

One movement lane in each direction is typical, but the requirements vary according to the nature and function of the road.  Refer to the relevant district plan.

#### 3.3.2.10 Parking, Passing and Loading

Allowance for parking, passing and loading activities shall be provided in accordance with the relevant district plan and section 3.3.6 of NZS 4404.

#### 3.3.2.11 Cycle Facilities

Cycle facilities shall be provided in accordance with the requirements set out in the relevant district plan and/or cycle/biking plan and shall be marked in accordance with the Traffic Control Devices Manual and the drawings contained in this document.

#### 3.3.2.12 Shoulder Widths

Shoulder widths on rural roads need to be assessed for each project, based on the speed environment of the area, terrain and activities. For high speed environments where high non-motorised use is expected, shoulder widths may need to be increased to optimise overall road safety. Refer to the relevant Council's District Plan.

### 3.3.3 Formation Width

Formation width shall be sufficient to contain the functions described in 3.3.2.8 above. Where topography dictates, the formation width should extend beyond the carriageway edge by 500mm, with batters providing a smooth and safe transition to the adjacent building lot grades. Refer to Drawing D3.1.1.

### 3.3.4 Structures

Where structures retaining private lots are required, these shall be fully located on the lot, not within the road reserve.

### 3.3.5 Visibility

The driver sight distance requirements relate to the road classification function and vehicle speeds. Refer to NZTA RTS 6.

Visibility splays and envelopes may require the road boundary to be set back (refer to Drawing D3.1.5). Trees shall not be planted in the visibility splay; only road lighting columns and road signs shall be considered. More detail on requirements for planting within visibility splays is given in the landscape section.

Horizontal and vertical sight distances along a road shall be designed in accordance with Austroads Guide to Road Design Part 3: Geometric Design, considering the wet surface coefficient. The stopping sight distance measured round a curve shall be along a line 1.5m into the lane width from the inside kerb.

The developer shall submit with the engineering plans the criteria used in determining the visibility distances.

### 3.3.6 Berms

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, stormwater treatment and control and grass areas. (Refer Drawing D3.1.3)

Berms shall be of adequate width to:

a) Achieve safe clearances between the carriageway edge and any obstacle (minimum 600mm for urban and 1,500mm for rural areas).
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 room for efficient road edge and edge drain maintenance
e) Allow adequate space for the effective operation and maintenance of any form of stormwater management device
f) Allow sufficient width to allow for adequate growth of the plants/ trees and ease of their maintenance.
g) Allow for use of a lawnmower for general maintenance - narrow grass strips less than 650mm wide should be avoided
h) Allow for the safe kerbside collection of rubbish and recycling (minimum 2,500mm x 1,000mm space for presentation and collection of rubbish and recycling)

The minimum width of berm shall be in accordance with the relevant District Plan except for private ways (Refer Drawing D3.1.6) and shared environments.

Berm crossfall shall typically be 1:25, however localised grass berm cross falls may range between 1:50 and 1:10 but must be able to be easily mown by the adjacent property owner. Engineering drawings should identify any variances from the typical crossfalls. The berm crossfall (maximum 1:10) and the footpath cannot be negatively impacted by the vehicle crossing which has a maximum grade of 1:6. (Refer Drawing D3.1.4)

On rural roads berm crossfall to be a maximum of 1:4 starting at the edge of the carriageway shoulder or surface water channel.

### 3.3.7 Survey Marks

Survey marks shall be installed in a separate, purpose built concrete slab, clear of vehicle and pedestrian facilities.

### 3.3.8 Cut / Fill Batters

To be read in conjunction with Chapter 2.

#### 3.3.8.1 Urban Roads

Cut and fill batters for roads shall generally be constructed outside the Transportation Corridor (refer clause 3.2.6 for berms).

a) With a maximum grade of 1:5 starting at the road boundary. Where circumstances dictate a steeper grade is necessary, and it is longer than 10 metres, a geotechnical assessment of the slope shall be provided together with specific access design (Refer to Chapter 2).

b) Any retaining wall designed to support the road, or footpath shall be constructed within the transportation corridor and will likely require a building consent

c) Where Council consider the stability of any planned embankment is in doubt, a stability analysis of the slope under saturated conditions may be required

#### 3.3.8.2 Rural Roads

a) Rural batters for cuttings and embankments shall usually be constructed inside the Transportation Corridor

b) Batters less than 750mm high shall be cut at 1:4 and shall be topsoiled and grassed. (Refer to Public Spaces Chapter 7, Clauses 7.3.4 and 7.3.6)

c) Batters 750mm high and above shall be cut at 1:2 and shall be protected from face erosion by hydro-seeding or similar (refer to Landscape Section)

d) Batters 4.5m high and above shall be assessed by a Geotechnical Professional. In undertaking this check and determining the appropriate erosion protection the Geotechnical Professional shall take into account:

   (i) The type of soils present in the cutting

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

### 3.3.9 Intersections

#### 3.3.9.1 Intersection and Alignment Design

All intersections shall be designed in accordance with Austroads Guides to Road Design parts 4 and 4A.

Generally, in urban areas, 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 local roads. The angle of intersection should be 90°, although a minimum angle of 70° can be used when justified by other constraints. Multileg intersections may require control by roundabouts. Intersections on curves, particularly on the inside of curves, other than large radius curves, are to be avoided.

All road intersections in residential areas should have a kerb radius at intersections of 4m to 6m. An alternative and reduced kerb radius may be considered to enhance pedestrian facility in low speed environments and shall be subject to the approval of Council.

All intersections in industrial areas should have a minimum kerb radius of 13.5m with corner splays of 6m, or subject to specific design.

Intersections in all other 50 km/h or lower speed environments shall have the lot corners splayed by a minimum of 4m along both boundaries, although these may be dispensed with in low design speed environments provided that there is adequate provision for pedestrians and utility services.

Corner boundary splays shall be subject to specific design in higher speed environments, to ensure safe visibility at intersections.

#### 3.3.9.2 Arterial Road Intersections

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

a) Design Speed
b) Design Vehicle
c) Distance from limit lines to viewpoint (LV)
d) Approach Sight Distance (ASD)
e) Safe Intersection Sight Distance (SISD)
f) All radii

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

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

#### 3.3.9.3 Intersections with State Highways

In the case of roads intersecting or joining State Highways, consultation must be undertaken with the NZTA with regard to appropriate standards prior to commencing design.

### 3.3.9.4 Grades at Intersections

Gradients within 30m of intersections shall be:

a) For Local Roads - less than 1:33 where practicable and not greater than 1:10

b) For Collector and Arterial Roads - less than 1:50

A plateau with minimum grades, of at least 10m is to be provided at any intersection where a vehicle may be expected to stop and give way to other vehicles e.g. at a Give Way control.

### 3.3.9.5 Channelisation at Intersections

All side roads that have direct access to a collector or arterial road (existing or proposed as defined by the relevant District Plan and/or Structure Plan) shall be channelised using either kerb extensions and / or a central throat island at the intersection with the collector or arterial road. Such treatments are to be designed and constructed in accordance with this specification. Side roads expected to carry less than 120 v.p.d (12 dwellings) and have a carriageway width of 8m or less do not require channelisation.

### 3.3.9.6 Priority Controls

All priority intersections must fulfil the requirements of the Land Transport Rule: Traffic Control Devices 2004, associated NZTA Traffic Control Devices Manuals, and the NZTA Pedestrian Planning and Design Guide.

### 3.3.9.7 Intersection Spacing

Minimum permitted spacing between adjacent intersections on different categories of road are set out in Table 3-4 below. All distances are measured along the centreline of the major road between the centrelines of the intersecting roads.

***Table 3-4: Minimum Intersection Spacing***

| | Local roads | Collector or arterial roads | Industrial roads |
|---|---|---|---|
| Same Side | 60m | 90m | 200m |
| Opposite Side | 30m | 45m | 100m |

In all cases a right/left stagger is preferred. If cross roads are unavoidable a roundabout is required for all but low volume local roads.

### 3.3.9.8 Road Rail Intersections

Road rail level crossings shall be designed in accordance with the NZTA Traffic Control Devices Manual; Part 9 Level Crossings.

### 3.3.10 Roundabouts

Roundabouts may be required at intersections where Stop or Give Way controls do not provide adequate capacity or Level of Service, or to provide traffic calming. Roundabouts are not permitted where their prime purpose is to provide a landscaping opportunity.

Roundabouts 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. The minimum design criteria outlined in Table 3-5 shall be applied. Refer Drawing D3.10.1

***Table 3-5: Minimum Roundabout Design Criteria***

| Road type | Central island diameter | Circulating width | Lv distance* |
|---|---|---|---|
| Local (Access) road | 16m including a 2m concrete collar | Single lane – 7.0m | 5.0m |
| Collector (Primary and Secondary) road | 20m including a 2m concrete collar | Single Lane – 7.0m<br>Dual lane – 10.5m | 9.0m |
| Arterial (Primary and Secondary) or Industrial road | 24m including a 2m concrete collar | Single Lane – 7.0m<br>Dual lane – 10.5m | 9.0m |

*(*LV distance is defined as the minimum distance from limit lines to point of view)*

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

Minimum criterion may be reduced if:

a) Physical constraints such as a building/structure prevent practical implementation of minimum design criterion

b) Roundabout can be shown to form a traffic control device as part of a Local Area Traffic Management scheme

Any roundabout below the desirable design criteria requires approval by Council.

Supporting evidence to show that the design will meet capacity, safety and turning movements of intended vehicles, including motorcycles (refer NZTA Guide 'Making Roads Motorcycle Friendly' shall be supplied.

Traffic modelling shall be provided to show that the design can mitigate the effects of traffic generation due to the development. Where applicable, consideration shall be given for future network growth and development. This could include intersection modelling using software such as SIDRA.

The engineering plans shall show, the visibility splays for each approach of each roundabout, landscaping details, signage, road marking, and state the:

a) Design Speed – both approach and circulating
b) Design Vehicle and Turning Path
c) LV Distance
d) Central Island Diameter
e) Circulating Width
f) Level of Service
g) Provisions for pedestrians and cyclists to ensure their safety when negotiating the roundabout

A copy of the Safety Audit and evidence of compliance with recommendations must be included.

### 3.3.11 No-exit roads, Cul-de-sacs, Service Lanes and Private ways

#### 3.3.11.1 No Exit Roads

'No-exit' roads should not be provided where through roads and connected networks can be designed. Where no-exit roads cannot be avoided, they should ensure connectivity for pedestrians and cyclists and have no-exit signage.

Public no-exit roads and lanes shall provide for road turning at the end of the road for an appropriate vehicle as described in NZTA standard RTS 18. No Exit roads shorter than 60m may provide reduced turning facilities but must cater for 11m rigid trucks (e.g. rubbish collection). The design of turning facilities for light vehicles in urban areas shall be in accordance with AS 2890.5. See Figures 3.3 and 3.4 for acceptable solutions.

Turning heads will be required at the end of all rural no exit roads in accordance with Austroads Rural Road Design.

An on-road turning area may provide for parking or landscaping/hard standing in the centre of the turning area. The minimum kerb gradient around turning heads shall be 1:200. Appropriate drainage shall be provided.

#### 3.3.11.2 Cul-de-sac Design

The design of cul-de-sac turning areas shall be in accordance with Drawing D3.1.7 or NZS4404 except in commercial and industrial areas where the minimum radius shall be 15m to accommodate the turning movements of service vehicles.

The maximum long or cross section slope in turning heads is 1:17, with the desirable matching normal camber.

All urban roads shall have kerb and channel (unless roadside swale treatment is more appropriate than kerb and channel to support Water Sensitive Urban Design objectives and contamination reduction) with associated stormwater collection and disposal systems provided on all cul-de-sac heads to the tangent point.

Staged road construction will require temporary cul-de-sacs to be built.

For rural roads, Council may require kerb and channel with associated stormwater collection and disposal systems to be provided on cul-de-sac heads where conventional shoulder/berm surface runoff is unable to be achieved to Council's satisfaction.

#### 3.3.11.3 Service Lanes

The minimum carriageway width permitted is 3.5m. Service Lanes are to have concrete edging both sides and stormwater is to be collected and disposed of. Specific geometric and pavement design is required, as covered in clause 3.3.12 and the relevant council's formation requirements as set out in their district plan. Carriageway surfacing is to be asphalt conforming to the specifications in clauses 3.3.13.2 and 3.4.9.8.

#### 3.3.11.4 Private ways

***General***

Kerb and channel for Urban Residential and Industrial private ways is to be in accordance with Drawings D3.3.1, D3.3.2 and D3.3.3.

Stormwater shall not discharge across the vehicle crossing from the private way to the road.

Vehicle crossings to private ways shall be designed and constructed in accordance with Clause 3.3.19 and Drawing D3.1.6 (Urban Residential).

Surfacing requirements shall be in accordance with clauses 3.2.13.2, 3.4.9.8 and 3.4.10.

***Urban Residential Private ways***

Urban residential private ways are to be in accordance with the relevant District Plan (see Appendix 3A: Transportation Corridor Hierarchy Tables).

The minimum permitted inside radius of curves shall be 9.0 m. The gradient shall not exceed 1:6. Where the gradient exceeds 1:6, any reasonable safety provisions required by Council shall be provided. A passing bay shall be provided at every 75m of private ways.

***Industrial Private ways***

a) The minimum carriageway width for an industrial private way serving a single lot is 4m. For an industrial private way serving two or more lots the minimum carriageway width is 6.4m. Berm widths each side are to be 1.8m minimum. The minimum permitted inside radius of curves is 12m.

***Rural Residential Private ways***

a) For rural residential private ways serving ≤ 4 lots and ≤ 250m in length, the total minimum permitted sealed carriageway width is 3.5m, with the total width of the private way a minimum of 7.0m.
b) For rural residential private ways serving ≥ 5 lots or ≥ 250m length, the total minimum permitted sealed carriageway width is 4.0m, with the total width of the private way a minimum of 7.5m. The crossfall shall be 1:25. A passing bay should be considered.

### 3.3.12 Road Pavement

Pavements shall be provided to all roads such that vehicle loads may be carried without distress, in all weathers, for at least the design life with only normal routine maintenance and periodic re-surfacing. Pavements shall generally be flexible granular pavements with thin surfacing layers, however where this is not sufficient or a more innovative solution can be implemented, it may be approved by Council.

Stabilisation additives are not permitted in new pavement construction, unless specifically agreed to by Council.

#### 3.3.12.1 Pavement Design

A pavement design may be carried out by one of the following methods:

***Sealed Pavement - Specific Design***

This method shall be used for all industrial and high volume (over 3000 vpd) residential roads. It may be used for roads of lower classification.

Pavement design shall use the methodology of Austroads Guide to Pavement Technology, Part 2 and the NZ Supplement to the Austroads Pavement Design Guide. Designs for local roads may also use Austroads Pavement Design for Light Traffic.

Use of alternative materials such as recycled aggregates or the treatment of lower grade material is encouraged. The use of stabilisation agents may be considered by Council for subgrade and sub-base improvement, but not basecourse stabilisation.

Factors to be included in the design are:

a) Design Period - 25 years
b) Trips generated per household per day - 10
c) Annual HCV growth factor - 3 % minimum unless otherwise outlined by Council
d) Load factor the Presumptive ESA/HCV of 1.44 shall be used for design purposes unless otherwise outlined by Council
e) % HCV 1.5% local residential road/3.5% collector and higher classification/10% industrial and 9% rural roads

The design report shall provide the following information as a minimum.

- Results of soils investigations
- Design assumptions and figures
- Material specifications
- Engineering Drawings
- QA measures for construction

***Sealed Pavement - Default Design***

This method may be used for local residential roads only. Using this design does not exempt the construction from any tests nor compliance with any targets and does not provide any guarantee that the resulting pavement will comply with all testing requirements. Pavements shall comply with the depth and aggregate specified in the following table.

*Table 3-6: Pavement Layer Thickness for Local Residential Roads*

| Road Type | Sub-base | Basecourse | Notes |
|---|---|---|---|
| Cul-de-sac | N/A | 150mm GAP 40 | (ESAs 100,000) |
| Local Road (< 800 vpd) | 125mm GAP 40 | 100mm NZTA M/4 AP40 | (ESAs 250,000) |
| Local Road (800 – 3000 vpd) | 125mm GAP 40 | 125mm NZTA M/4 AP40 | (ESAs 500,000) |

These typical designs are based on an insitu subgrade having a soaked CBR of 15 over the full depth. If the insitu subgrade does not achieve this strength then it may be improved by undercutting to a minimum depth of 600mm and replacing with an imported subgrade of pit sand, brown rock or other material supplied then compacted to achieve the required CBR value.

If a subgrade of 600mm depth and CBR 15 is not practicable, a specific design will be required as per 3.2.12.1 i) Specific Design.

***Unsealed Pavements***

Unsealed pavements shall be compacted with a minimum compacted thickness of 300mm of well graded granular material with a minimum soaked CBR of 20. The maximum particle size shall be no greater than 100mm. This pavement material shall have sufficient fines to ensure that it does not unravel under the action of traffic. A material typically used on district unsealed roads is a high grade granular rock but will vary depending on locality. A 50mm minimum compacted thickness wearing course shall then be constructed using GAP20. The standard camber of unsealed pavements shall be 1:20-1:17.

### 3.3.13 Road Surfacing

All carriageways must be surfaced with either a chip seal or asphaltic concrete but must be consistent with adjoining surfaces. Interlocking block paving or concrete will be considered on a case by case basis, the final surfacing type to be approved by Council.

Asphaltic concrete (type to be approved by Council) is required on industrial roads, roundabouts, urban arterial roads, all cul-de-sac turning circles and any other site subject to high turning movements. On cul-de-sac heads, asphalt shall be applied until the carriageway becomes a constant width.

#### 3.3.13.1 Chip Seal Surfacing

The first coat shall be a two coat 3/5 chip seal for most residential roads. A further coat of chip seal must be applied between 3 and 18 months later as part of the project cost. If the second coat seal is going to be applied more than 12 months later, the defects liability period will need to be extended. Other chip seal designs may be considered and approved by Council.

#### 3.3.13.2 Asphaltic Concrete Surfacing.

Asphaltic Concrete may be used as an alternative surfacing to chip seal. There are stricter requirements for pavement stiffness if asphalt is to be used. Selection of an appropriate mix for arterial and industrial sites is to be agreed with Council. For further details and requirements see clause 3.4.7.4.

Alternative asphaltic concrete products, such as Stone Mastic Asphalt (SMA) or Open Graded Porous Asphalt (OGPA), may be used with Council approval.

#### 3.3.13.3 Concrete Block Paving

Concrete block pavers shall not be used without specific approval from Council. The concrete block pavers shall comply, and laying shall be in accordance with, NZS 3116 ‘Concrete segmental and flagstone paving’.

Pavements in NZS 3116 titled ‘Light vehicular’ are not acceptable for road surfacing.

### 3.3.14 Road Drainage

#### 3.3.14.1 General

All roads shall be provided with facilities for the collection and disposal of both stormwater and subsoil water suitable to cope with the stormwater level of service for the area. Refer Stormwater Chapter 4. Designs shall consider the following factors:

a) Groundwater recharge through soakage systems
b) Quality of water discharged to receiving environments either directly or via connection to an existing piped network
c) Requirements of the Northland Regional Council
d) Overland flow paths. Generally urban and industrial roads should be lower than adjoining land and rural roads higher than surrounding farmland.
e) Water discharged from adjoining land (including current and future land use)
f) Public safety
g) Minimising of future maintenance requirements

h) Capacity of any existing piped network
i) Cyclists
j) Reduction of peak discharge rate
k) The depth of water in secondary flow paths should not exceed the flotation depth of vehicles of 150mm (see Clause 3.2.14.8).

### 3.3.14.2 Kerb and Channel, Vertical Kerb and Island Kerb

All profiles are to be founded on the subgrade with a CBR of at least 15. Where pavement depth is greater than 150mm, the profile shall be laid on a minimum of 75mm of compacted GAP40. For kerbs with tight radii (<5 metres), or carriageway narrower than standard, 'Heavy Duty Kerb and Channel' shall be used. Refer to Drawing D3.3.3.

***Urban Roads***

a) Kerb and channel shall be provided on both sides of the carriageway in all urban areas unless swales and raingardens are proposed. Refer Clause 3.3.14.11. Kerb and channel will only be required on one side of the road with a single crossfall.
b) Mountable kerb and channel is not permitted in built up areas
c) Subsoil under-channel drains shall be provided along kerb lines including medians, roundabouts and traffic control islands as shown on the Drawing D3.4.1 except where it can demonstrate that they are not necessary (e.g. where the underlying soil has a high porosity or at high points in the topography)
d) Additional subgrade drainage may be required

***Industrial Roads***

Any road, street or lane constructed within an industrial zone (as specified in the relevant District Plan) shall be designed to meet the geometric standards for arterial roads and incorporate industrial kerb and channel in accordance with Drawing D3.3.3.

***Rural Roads***

a) Kerb and channel shall be required where necessary to control stormwater runoff. Generally, it may be considered for construction adjoining cut and fill batters to control potential scouring of the water tables and embankments.
b) Subsoil drains shall be installed adjoining all cut batters.

Refer to Drawing D3.4.1.

### 3.3.14.3 Dish Channels and Depressed Kerb and Channel

Dish channels are not to be used in carriageways. Where drainage is required for bus or parking bays a depressed kerb and channel should be used. The design profile should be the same as Commercial Channel Crossings, shown on Drawing D3.3.2.

For dish channels within footpaths or accessways, these are to be founded on subgrade with a CBR not less than 7. Refer to profiles in Drawing D3.3.3.

### 3.3.14.4 Slot Drains

Slot drains are not to be used in greenfield developments. However, they may be accepted for use in brownfield areas. The use of surface channels and catchpits is more desirable. Slot drains can be used to cater for vehicle break over angles. Refer to Drawing D3.3.7.

### 3.3.14.5 Catchpits

Catchpit spacing and location shall be designed to the following criteria:

a) Catchpit spacing is to have a:
   (i) Maximum gross area drained (carriageway, berm and footpath) = 900m²
   (ii) Maximum area of carriageway drained = 450m²
   (iii) Maximum of = 90m
   (iv) Maximum where stormwater from private houses connect to kerb and channel = 60m

b) Preferred location of catchpits:
   (i) At intersections, at the kerb line tangent point
   (ii) Upstream of pedestrian crossing points or cycle crossing cutdowns
   (iii) At changes of gradient on steep roads
   (iv) Cul-de-sac heads
   (v) Mid lot, to avoid vehicle and pedestrian crossing points or cycle crossing cutdowns.

c) A double catchpit is required:
   (i) At the lowest point in a sag vertical curve
   (ii) At the ends of a cul-de-sac where water falls to the end
   (iii) On all channels where the gradient is steeper than 1:20.

d) Catchpits in swales require a specific design

e) Catchpit grates will be cycle-friendly designs

Catchpits shall be of the type referred to in the Stormwater Chapter 4.

#### 3.3.14.6 Batter Drains

Batter drains shall be located outside of the transport corridor. Refer to Drawing D3.4.1.

#### 3.3.14.7 Subsoil Drains

Unless specified otherwise or agreed to by Council, piped subsoil drainage shall be provided to protect road formations from deterioration or loss of strength caused by a high water table and as part of swale stormwater systems. Design shall be in accordance with NZTA specifications F/2 and F/5. Refer to section 3.3.19.3 of NZS4404 for more details.

All piped subsoil drains shall discharge by gravity into a suitable component of the public stormwater system or approved discharge point.

For typical details of subsoil drains see Drawing D3.4.1.

#### 3.3.14.8 Sub Drain Outlet

Subsoil and batter drain outlets shall be to catchpits or manholes.

In rural situations, where no catchpit is available, the outlet shall be anchored.

#### 3.3.14.9 Side Drains and Water Tables

Rural roads shall have normal crossfall to side drains/water tables formed on each side of the carriageway except where the road is on embankment above adjacent land without available formed drains. In such cases, the road may be designed so as to provide for sheet run-off to the adjacent land surface provided natural pre-existing drainage patterns are not altered.

For all situations where side drains are required they shall be sized to suit the flows discharging to them. Side drains shall be intercepted at regular intervals and discharge via open drains or pipes to an appropriate discharge point. All discharge points shall have outlets protected from scour and shall be located to minimise the risk of slope instability.

The discharge of stormwater shall not be allowed to cause damage to the receiving property. The discharge of concentrated stormwater shall be in a ‘secondary flow path’ easement and be subject to the approval of affected properly owners. Natural or nonconcentrated stormwater shall be shown to be neither diverting catchments nor significantly changing peak flows or flow patterns.

Where side drains and water tables can’t safely channel the stormwater flows, kerbs will be required.

### 3.3.14.10 Secondary Flow Provisions

At all points where sump blockage may occur or where design capacity may be exceeded, which could lead to overflow into private property, the provision of designed secondary flow paths protected by public ownership shall be made. Refer to Stormwater Chapter 4.

The design of roads that facilitate stormwater overland flow within the carriageway require a design methodology that does not result in ponding areas greater than 150mm deep in a 2% ARI. For more information on overland flow path design, refer to Stormwater Chapter 4.

The stormwater design for developments may use the road as a secondary flow path and therefore requires to be designed for 1% ARI.

### 3.3.14.11 Swales and Stormwater Sensitive Discharge Techniques

Berms, swales, rain gardens, and other low impact stormwater sensitive discharge shall be of a sufficient width to allow for adequate growth any plants and ease of maintenance, refer to Stormwater Chapter 4 for specific guidance on stormwater devices. Stormwater devices are to be located in the berm area. The berm must be of sufficient width to accommodate the devices, utility services (if needed), plant growth and to allow for maintenance. Unless specifically approved by Council, swales shall not be located in the centre of the road.

It is essential that swales in urban areas are carefully designed so that they do not detract from amenity values and can be readily maintained.

Vehicle, pedestrian and cycle crossing points need to be defined and provided for as part of the swale design and construction. Consideration should be given to provision of traversable side slopes for safe passage of errant vehicles in the event of a crash.

### 3.3.14.12 Road Culverts

Catchment discharge shall be designed in accordance with the Stormwater Section and any applicable Regional Council rules and consent conditions.

Refer to the NZTA's Bridge Manual (SP/M/022) for waterway design at bridges and culverts.

All culverts parallel to the road shall have compliant traversable culvert safety ends installed to eliminate culvert end and headwall snagging hazards. Refer to NZTA Specification M23: Road Safety Hardware (including interim acceptances).

## 3.3.15 Parking

### 3.3.15.1 General

The transportation corridor should be designed to accommodate the parking requirements contained in the relevant district plan. Alternative widths and layouts may be suitable where provision for parking in defined areas is clear of the through traffic.

Where on-road cycle lanes are immediately adjacent to this parking/passing area, additional width shall be provided in accordance with the NZTA Cycling Network Guidance – planning and design.

Parking bay pavement shall be constructed to the same standard as the road. Crossfall requirements are the same as for the carriageway.

### 3.3.15.2 On Road Parking - Transportation Corridor

The provision of on road parking is valued by motorists. For the parking requirements of a given road corridor, refer to the relevant district plan.

See Drawing D3.1.8 for the layout of road parking areas. Parking provisions for motorcycles shall be considered in areas where activities in adjacent properties are likely to generate high on-street parking demand for this type of vehicle.

For inset parking bays, the minimum radius for the kerb lines in the parking area shall be 5m.

### 3.3.15.3 Cul-de-sac Parking

To facilitate a clear movement lane, indented parking bays and parking in the middle of cul-de-sac heads may be considered.

### 3.3.15.4 Mobility Parking

Mobility parking spaces shall be designed according to NZS 4121: Design for Access and Mobility – Buildings and Associated Facilities.

A pedestrian cut down immediately adjacent to the mobility parking space shall be provided to facilitate safe and easy egress to and from the footpath.

Mobility spaces shall have a blue coloured surface and have the required line marking to define the space in accordance with the specifications set out in section 3.3.22 and in Drawing D3.9.4.

### 3.3.16 Footpaths, Pedestrian Accessways and Walkways

Footpath provisions are contained in the relevant district plan or in the absence of detail refer to Table 3.2 NZS 4404.

#### 3.3.16.1 Location, Width, Crossfall and Grade

Except where otherwise allowed for in the relevant District Plan, footpaths shall be provided on both sides of the road and located in the centre of the berm. See Drawing D3.1.3.

Footpaths shall have the minimum clear width between obstructions such as signs and service poles.

In locations with high concentrations of pedestrians (e.g. shopping areas, outside schools and leading to schools, hospitals, halls or other places of public assembly) footpath widths require specific design in consultation with Council. Additional width may be required where angle parking adjacent to the footpath is anticipated.

Footpath crossfall shall typically be 1:100 sloping towards the kerb and channel. Localised footpath crossfall in the range of 1:50 to 1:33 may be permitted where levels make the typical crossfall impractical. Crossfall on footpaths in high pedestrian use areas such as shopping centres should be 1:100 or less.

Where footpath gradients are steeper than 1:12, a non-skid surface shall be provided. The maximum gradient for any footpath shall be 1:8; otherwise, alternatives such as a “zig zag” will need to be used. Where gradients are between 1:12 and 1: 8 and exceed 9 m in length, then a 1.2 m square flat section shall be provided at 9 m (maximum) intervals.

Footpaths shall not be depressed or raised by vehicular crossings[2] unless adjacent to the kerb – refer D3.1.4. Footpaths shall have a continuous surfacing treatment across the vehicle crossing.

New footpaths shall as a minimum be constructed in concrete (minimum 25 MPa), reinforced with 665 mesh, and minimum 125mm thick unless specified otherwise in a document endorsed by Council.

No coloured additives shall be used.

[2] The crossing area must be built to the appropriate crossing specification.

### 3.3.16.2 Pedestrian Cut-downs

Pedestrian cut-downs shall be provided at all road intersections and pedestrian crossing facilities. The crossings shall be sited to facilitate desirable pedestrian, wheelchair and mobility scooter movements across the road and where possible drainage facilities shall be sited to reduce the flow of stormwater in the channel at the crossing entrance.

Pedestrian cut downs shall satisfy the NZTA Pedestrian Planning and Design Guide with particular care taken to ensure:

a) There is no vertical up stand at the face of the kerb and channel within the pedestrian cut down
b) Longitudinal and transverse gradients of the footpath and road adjacent to the pedestrian cut down are minimised in order to facilitate ease of access by users – especially for those in wheelchairs
c) Break over angles for mobility devices through the crossing point do not create facilities that are unsafe for or not traversable by these devices. Refer to Drawings D3.3.2 and D3.6.2

### 3.3.16.3 Pedestrian Accessways

Accessways may be provided to link one road to another in order to improve pedestrian and cyclist access. These are to be provided as a last resort where they cannot be eliminated through revised road layouts. They are not a substitute for good design.

Pedestrian accessways shall be designed in accordance with NZS 4404 Section

3.3.11.1. In addition, they shall also include:

a) A sealed shared footpath/cycleway that is a minimum of 3.0 m wide
b) If it is necessary to incorporate steps into the access way, a ramp shall also be provided that is suitable for use by wheelchairs, mobility scooters and cyclists. Refer 3.3.16.1 for grades appropriate to these users.
c) Barriers may be required to manage speeds and potential conflict points.

### 3.3.16.4 Walkways

Rural residential subdivisions should make provision for pedestrian access along grass berms.

### 3.3.17 Facilities for Vision Impaired Pedestrians

Facilities for visually-impaired pedestrians (i.e. TGSI - tactile pavers) shall be installed in accordance with the NZTA Specification 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) Other points where significant numbers of pedestrians cross an access way or side road
c) Railway crossings
d) Signalised intersections and signalised pedestrian crossings
e) Zebra crossings
f) Other areas of high pedestrian activity such as shared zones, pedestrian malls, shopping centres and bus stops

Refer Drawing D3.6.3 for minimum requirements.

### 3.3.18 Cycle Facilities

Cycling facilities shall be provided in accordance with the relevant district plan, and on any other route identified in a structure or other cycling plan as part of a primary or secondary cycling route. Such facilities may be a marked on-road cycle lane, a shared off-road cycleway/footway or a dedicated cycleway.

Provision for cyclists should be in line with Austroads Guide to Road Design, Part 6a: Pedestrian and Cycle Paths and the NZTA Cycling Network Guidance.

Off-road facilities designed for use by cyclists, either exclusively or shared with pedestrians shall have a minimum width in accordance with the relevant district plan, if appropriate. Off road cycle ways or shared paths shall have a maximum gradient of 1:8 and have a minimum lateral clearance of 700mm and minimum overhead clearance of 2.5m from any fixed object (including trees).

Cycle lanes or cycleways shall be surfaced with either concrete or asphaltic concrete. Interlocking block pavers are not suitable for cycling except as entry treatments or similar short lengths.

On road cycle lanes shall be marked to NZTA's Traffic Control Devices Manual and Drawings D3.9.1 and D3.9.2.

## 3.3.19 Vehicle Crossings/Entrances

### 3.3.19.1 General

The vehicle crossing design must allow vehicles to use the crossing without scraping while preventing stormwater entering the vehicle crossing/driveway from the street.

### 3.3.19.2 Residential Vehicle Crossings

The crossing shall be shaped to prevent stormwater from the road running down the driveway onto private property. No water from an adjacent property shall be allowed to discharge across the berm to the carriageway. A freeboard of 200mm shall be provided (i.e. height above the channel or pavement edge) to contain stormwater on the road unless it can be shown that such a condition is impractical and stormwater will not enter property vehicle crossings/driveways as a result.

Vehicle crossings shall be provided between the edge of the carriageway and the road boundary at the entrance to all private ways, lanes and to any lot at the subdivision or development stage.

Where there are multiple access points at the subdivision or development stage, crossings shall be left to be constructed at the building consent stage.

The number and location of vehicle crossings shall be in accordance with the requirements of the relevant District Plan.

Vehicle crossings shall be designed to enable the 99th percentile car to use them to ensure break over angle does not cause grounding any part of the vehicle. Refer NZTA Traffic Note 48 Light Vehicle Sizes and Dimensions - street survey results and parking space requirements. Also refer to Drawing D3.3.1.

Pavement design shall be adequate to carry the expected load over its design life, including heavy vehicles during construction. Refer Drawings D3.3.2 and D3.3.5.

Vehicle crossings shall be designed in accordance with the NZTA's Pedestrian Planning and Design Guide to accommodate the needs of pedestrians such that the footpath is continuous through the site (Refer to Drawing D3.3.1). Vehicle crossings shall not interfere with the profile of the footpath or the berm except that minor filling may be permitted between the property boundary and the footpath. Retaining walls or structures are NOT permitted to encroach onto the berm and no lowering of the berm is permitted.

Vehicle crossings shall be surfaced with concrete or asphalt to match the adjacent footpath surfacing. Where there is no existing footpath the crossing may be surfaced with either concrete or asphalt. In all cases, a construction joint shall be provided at the property boundary.

The crossfall of the vehicle crossing shall be towards the kerb and channel.

Any redundant vehicle crossing to a property will be removed at the time of constructing a new entrance into that property.

#### 3.3.19.3 Commercial and Industrial Vehicle Crossings

All lots in areas zoned for commercial or industrial activity and all developments in other zones for commercial or industrial activities must have an industrial standard crossing. Dimensions and construction details are provided in Drawing D3.3.2 and D3.3.5.

For wide commercial vehicle crossings in areas of moderate to high pedestrian use, consideration shall be given to reinforcing the priority of the footpath over the crossing. Use of different surfacing types and colours or other measures may be appropriate.

#### 3.3.19.4 Rural Vehicle Crossings/Entrances

A vehicle crossing shall be provided at the development stage at the entrance to all private accessways/Rights of Way, 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).

Rural crossings shall be designed to accommodate the largest vehicle that is likely to access the site.

On sealed roads, vehicle crossings shall be provided between the surfaced road edge and the lot boundary at a defined and formed access point to every rural lot. The crossing shall be sealed to the road boundary and to a standard not less than that of the adjacent road surface. If the access slopes up from the road the crossing shall be sealed to a minimum distance of 10m from the edge of the carriageway.

On unsealed roads, vehicle crossings shall be provided between the unsealed carriageway edge and the lot boundary at a defined and formed access point to every rural lot. Any vehicle crossings proposed to be sealed within the road reserve shall only be sealed to a point at least 2m (or other practical distance that can be justified) set back from the edge of the unsealed carriageway i.e. the sealed access shall not extend up to the edge of the unsealed carriageway.

The designs for all rural vehicle crossings shall ensure that uphill entrances are not graded towards the edge of the carriageway, stormwater is diverted to water tables, and debris does not flush onto the road and create a danger to cyclists and motorcyclists (e.g. initial negative gradient away from the carriageway may be required).

Any gate shall be positioned a minimum distance from the edge of the carriageway as shown on Drawing D3.3.4

The design, including visibility and sight lines, shall be in accordance with NZTA Guidelines RTS 6. If traffic volumes entering or exiting the driveway exceed 40 HCV per day, or HCV's represent more than 1:5 of the vehicle manoeuvres, or the location of the driveway is affected by vertical geometry (i.e. located near the crest of a curve), then specific design will be required to demonstrate that the driveway is located such that the safe operation of the adjacent road is not affected. See Drawing 3.3.4 for dimension and construction details

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 of 300mm diameter with compliant traversable culvert safety ends to minimise safety risk eliminate culvert end and headwall snagging hazards. Refer to NZTA Specification M23: Specification for Road Safety Hardware (including interim acceptances). The drain may be moved closer to the boundary to allow the vehicle crossing to be shaped as necessary to ease access into and out of the adjacent property. Rural crossings shall be designed so that access is available for the largest vehicle that is likely to access the site and for the control of stormwater and debris runoff.

### 3.3.19.5 Bus Stops and Shelters

Bus stops shall be provided on all bus routes, both existing and planned. The bus routes are determined by the Northland Regional Council, Public Transport Unit. During the design phase, the location and design criteria for bus stops shall be confirmed with the relevant Council and the Northland Regional Council Public Transport Operations Manager.

Bus stops and shelters shall be designed to NZTA Guidelines for Public Transport and Infrastructure and Facilities, with the following amendments or emphases.

Numbering refers to clause numbers in the ARTA document.

### *Table 3-7: NZTA Guideline amendments or emphases*

| | |
|---|---|
| **2.1.2** | Bus bays shall cater for 13.5m buses. Articulated buses are not currently in use in the Northland. Appropriate road use controls shall be applied to allow buses to move safely and conveniently into and out of the stop such that the bus can stop parallel to and close to the kerb. |
| **2.2** | All bus stops shall be fully accessible. New bus stops shall have a kerb height between 150mm to 180mm at lip of channel above the road surface, over the full length of the bus stop. The kerb height shall allow the ramp from the bus to sit at a grade of 1:12 (max). Existing bus stops shall be progressively improved to meet the requirement. |
| **3.2** | New bus stops shall be sited such that houses along the route are within 400m of a bus stop. |
| **4.1** | Litter bins are required only at ‘signature’ stops |
| | Real time information displays are to be mounted on a separate pole. |
| | ‘Standard’ type bus stops shall be used on the outward journey where there is no Orbiter route transfer or stop. |
| | ‘Regular’ type bus stops shall be used on the inward journey and where there is an Orbiter route transfer or stop. |
| | ‘Signature’ bus stops shall be used at very high usage locations as determined by Council |
| **4.4** | The bus stop sign shall be attached to a standalone pole with the RP-5 parallel to the road and a supplementary sign perpendicular to road (facing the pedestrian). |
| | If a bus stop pole is being installed on the Orbiter route, a 2.4m pole shall be installed to cater for the Orbiter sign (supplied by WRC). |
| | Signs must be located sufficiently back from the kerb line to avoid being hit by a bus and in a location to avoid nuisance to footpath users and bus patrons. |
| **4.4** | Bus shelters shall be installed at all inward bus stops and all Orbiter journey bus stops. Priority for installation of shelters at existing bus stops includes: |
| | Number of users per day. |
| | Use by vulnerable users (school children, elderly or those with wheelchairs or mobility scooters). |
| | Exposure to weather elements (rain, wind, sun). |

| | |
|---|---|
| | The shelter design including size, shape, location and materials shall be as agreed with Council. Generally, shelter colour shall be consistent with existing shelters. See Drawings D3.8.13, D3.8.14 and D3.8.15. |
| **4.4** | Seats and leaners shall be provided where appropriate at the direction of Council. |
| **5** | Bus stops shall have a suitable bus tracking path into and out of the bus stop. Desirably, an 18m entry taper and 9m exit taper. These areas cannot have vehicles parked in them at any time, but can consist of intersections, driveways, crossings and cycle lanes. |
| **5** | Bus boarders (half and full) should be considered in circumstances where parking is in high demand, speed limit is at or below 50km/h or where traffic calming measures are deemed desirable. |

### 3.3.20 Road Lighting Design

#### 3.3.20.1 Introduction

This section sets out the requirements for the design, construction, approval, auditing, upgrade and maintenance of the Council's road lighting network.

The Council recognises that the correct level of road lighting is important for the safety and well-being of the community and this document provides the guidelines to achieve the following elements of good lighting design:

- Enable safe and convenient movement of vehicles, pedestrian and cyclists
- Minimise glare, spill lighting and sky glow
- Reduce likelihood of criminal activity at night using CPTED principles
- Reduce energy consumption
- Reduce maintenance cost

This document represents the recommended standards that are acceptable to Council. It is a requirement that any new lighting installations shall:

- Meet the minimum performance standards referred to in this document
- Provide lighting to meet the requirements of AS/NZS 1158 Series.
- Recognise the need to maintain the level of lighting within design levels at minimum cost.
- Utilise equipment that will be available for the foreseeable future such that replacements and spares will be readily available.

These guidelines are not meant to provide a template for the physical road lighting design, but rather to identify and help to meet the design objectives related to the implementation of

energy efficient lighting and effective maintenance processes. They are supplementary to the standard AS/NZS 1158: Lighting for Roads and Public Spaces. Where a conflict exists between any Standard and the specific requirements outlined in this document, the Designer shall seek clarification from the Council.

All new lighting will be LED.

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.

#### 3.3.20.2 Design Drawings and records

In order to demonstrate compliance and to allow accurate construction, all engineering drawings and documents must show the following information:

a) The extent of the works showing existing and proposed roads and pedestrian areas.
b) Proposed and existing significant road features (e.g. kerbs, property boundaries, planting, trees, traffic management devices, bus stops, pedestrian refuge islands and driveway locations).
c) The road lighting layout showing the following:
    i. Luminaire manufacturer, model and optic
    ii. Outreach length and tilt angle
    iii. Column manufacturer and type
    iv. Luminaire mounting height
    v. Column spacing
    vi. Column to kerb offset
d) The lighting design details including:
    i. Design Statement
    ii. Computer calculations (LTP analysis information required by AS/NZS 1158)
    iii. Luminaire photometric data (in IES or CIE format) including their origin and maintenance factor
    iv. If applicable, site visit records/notes regarding the vicinity of HV/LV overhead conductors
    v. Manufacturer’s warranty period.

### 3.3.21 Special Vehicle Lanes

Where special vehicle lanes are required, they shall have appropriate signage, road markings and coloured surfacing.

Special Vehicle Lanes include the following:

a) Bus and electric vehicle lanes
b) Transit lanes - urban
c) High Occupancy Vehicle (HOV) Lanes
d) Cycle lanes.

### 3.3.22 Traffic Control Devices – Line Marking and Signs

The design shall incorporate all required road marking, signs, and other facilities appropriate to the place and link context. Local roads should be designed to minimise the need for traffic signs and marking.

Designs shall satisfy the Land Transport (Road User) Rule, Land Transport Rule: Traffic Control Devices 2004, associated NZTA Traffic Control Devices Manuals, NZTA Pedestrian Planning and Design Guide and NZTA Cycling Network Guidance – Planning & Design Guide.

All proposed road markings, signs and other traffic control devices shall be shown on the plans and approved by Council.

### 3.3.23 Feature Entrance Walls, Berm and Street Furniture

The designer is to ensure that the resulting visual impact of walls, structures, street art, street furniture etc achieve good urban design visual outcomes. Refer to the relevant District Plan and any relevant policy and structure plan documents; early consultation with Council is encouraged.

#### 3.3.23.1 Street Furniture

Seats, litterbins and other street furniture shall be designed and placed in accordance with any requirements of Appendix C or D.

Furniture used shall be compatible with existing street furniture, unless an alternative is specifically accepted by Council.

#### 3.3.23.2 Feature Walls

Feature Walls are not permitted within the transportation corridor.

#### 3.3.23.3 Berm Furniture

With the exception of approved litter bins, seats, fences and bollards, structures or features which are not part of signage or traffic control are not permitted in the Transportation Corridor, unless as part of a structure plan or in accordance with any relevant Council arts or other policy. Prior to installation and design, consultation is required with Council to ensure safety of road users is not compromised.

### 3.3.24 Safety Barriers

#### 3.3.24.1 Pedestrian and Cycle Barriers

Where a footpath or other public access bounds or is adjacent to a steep bank, wall, culvert or other such feature, safety barriers for pedestrian and cyclists are necessary. All barriers shall comply with the design requirements of NZS/AS 1657 : Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation and, where relevant, the New Zealand Building Code, Clause F4.

#### 3.3.24.2 Vehicle Barriers

Alternative engineering measures that improve the information that road users receive from the road environment shall be considered prior to the installation of a roadside barrier include, but are not limited to:

a) Relocation or modification of hazardous objects
b) Marking of hazardous objects
c) Road geometry and pavement surface
d) Pavement markings
e) Reflective raised pavement markers
f) Street lighting
g) Permanent warning signs
h) Chevron sight boards
i) Frangible sight rails
j) Ground modelling and planting

Where safety barriers for vehicles in urban areas are necessary, they shall comply with the design requirements of NZTA RTS 11: Urban Roadside Barriers and Alternative Treatments.

Where safety barriers for vehicles in rural areas are necessary, they shall comply with the design requirements in AS/NZS 3845: Road Safety Barrier Systems.

### 3.3.25 Fencing

Refer to Clause 3.4.12 or Public Spaces Chapter 7 for fencing requirement styles.

### 3.3.26 Trees and Landscaping

Refer to Landscape Section for details on trees and landscaping in transport corridor.

### 3.3.27 Structures and Underpasses

#### 3.3.27.1 Bridges and Large Culverts

For any project where a bridge is proposed, the bridge concept plan must be discussed and agreed with Council before detailed design commences.

Bridges and culverts may require separate resource and building consents. All bridges and culverts shall be designed in accordance with the NZTA Bridge Manual (SP/M/022).

Particular features that are to be considered/covered in the design shall include, but are not limited to:

a) **Widths/lengths**

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 relevant District Plan.

b) **Safety barriers**

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) **Batter slope protection**

All culverts shall have anti-scour structures to protect batter slopes, berms, and carriageways.

d) **Clearance over traffic lanes**

Where passing above traffic lanes, bridges shall have a full clearance height of 5.2m. The bridge shall be signed to highlight the maximum safe design vehicle height.

e) **Foundations**

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) **Provision for services**

The provision of the structure for use 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) **Waterway design**

Refer to the Stormwater Chapter 4.

h) **Inspection and maintenance**

The design shall include provision of any necessary access facilities to and within the structure in order to undertaken inspection and maintenance activities.

i) **Provision for lighting**

All of the above features shall be documented in the Design and Access Statement submitted at the time of the Engineering plans.

### 3.3.27.2 Pedestrian Underpasses

Pedestrian underpasses may be required in locations where high traffic and risks to pedestrian safety has been identified and maybe required as part of a structure plan walking/cycling strategy/policy. Underpasses will be required to have adequate width and height and access provisions which allow full use of pedestrians, mobility scooters, wheelchair access, visually impaired pedestrians and cyclists. The Underpass is to have minimum internal dimensions of width 4m, and height 2.5m.

Underpasses will provide sufficient natural and artificial lighting so as not to create undesirable dark places, designs must take into account stormwater disposal, and pumping stations are not permitted due to on-going maintenance issues.

Careful consideration to visual design outcomes is required; the design of wing walls, underpass structure, stairs, ramps etc., is to result in good urban design visual outcomes and compliance with CPTED principles.

Pedestrian underpass walls to be painted in ‘Hit Grey’ or other colour required by the relevant Council, and lighting shall be in accordance with the requirements set out in clause 3.2.20.11 above.

### 3.3.27.3 Retaining Walls

Retaining walls which are located within the Transportation Corridor will likely require a building consent; retaining wall designs which have been undertaken by a suitably qualified engineer will be required.

### 3.3.28 Traffic Signals

Traffic signal installations are to be designed in accordance with Austroads Guide to Traffic Management Part 10: Traffic Control and Communication Devices.

Refer also to Section 3.7 Traffic Signals.

### 3.3.29 Traffic Calming Devices

In order to achieve the desired design speed environment, traffic calming devices may be required within the transportation corridor. The Austroads Guide to Traffic and The Traffic Control Devices Manual and NZTA Speed Management Guide – Toolbox and Appendices should be used to guide development of these devices.

Standard details are provided for the following devices:

- Roundabouts – mini asphaltic concrete D3.10.1
- Raised pedestrian ramp D3.10.5 and D3.10.6

### 3.3.30 Over-Dimensional Vehicle Routes

The Council may specify over-dimensional vehicle routes in its transportation/traffic bylaws.

When completing any improvements or changes to infrastructure the clearance requirements for over-dimensional vehicles (and their loads) shall be taken into account. Reference shall be made to applicable standard and consultation undertaken with the Heavy Haulage Association to confirm appropriate provisions are provided.

## 3.4 Construction

This section covers the methods, specifications and materials to be used when constructing transportation assets.

### 3.4.1 Pavement Materials

Councils may have differing aggregate requirements and these will need to be confirmed prior to design.

All materials shall be approved by Council prior to their use.

#### 3.4.1.1 Pit Sand

Imported sand used in the formation of the lower sub-base pavement, footpaths, shared paths and paved areas, shall be ‘run of pit’ sand, free of organic matter and well graded. It shall be

made up of clean particles of silica or hard stone containing minimal silts, clays, and pumices. This also applies to the pit sand if used as imported subgrade for concrete work.

#### 3.4.1.2. GAP Aggregates

The GAP aggregate shall comprise crushed aggregate and must be free of all nonmineral matter.

The crushing resistance shall be not less than 100 kN when the aggregate is tested according to NZS 4407 Test 3.10 'The Crushing Resistance of Coarse Aggregate under a Specified Load'. An aggregate shall be considered to have met the requirement if the

sample produces less than 10 percent fines when loaded so that the specified peak load is reached in 10 minutes.

In this case, the test shall follow the standard method in all other respects. If the aggregate passes the test, it shall be reported as having a crushing resistance 'greater than (the load specified)'.

The aggregate shall have a quality index of AA, AB, AC, BA, BB, CA or CB when tested according to NZS 4407 Test 3.11 'The Weathering Quality Index of Coarse Aggregates'.

The sand equivalent shall not be less than 25 for carriageway pavement metal when the aggregate is tested according to NZS 4407 Test 3.6 'The Sand Equivalent'.

Where the GAP20 is to be used on the footpath the sand equivalent shall not be less than 25 when tested according to NZS 4407 Test 3.6 'The Sand Equivalent'.

***Grading Limits***

When tested according to NZS 4402 Test 2.8.2 'Subsidiary Method by Dry Sieving', or Test 2.8.1 'Preferred Method by Wet Sieving' where aggregates contain clay or other fine material causing aggregation of the particles, the grading of the aggregate shall fall within the respective envelope defined in Table 3-10.

***Table 3-10: Gap Aggregate Grading Limits***

| | Percentage Passing | | |
|---|---|---|---|
| **Test Sieve Aperture** | **GAP 65** | **GAP 40** | **GAP 20** |
| 63.0mm | 100 | | |
| 37.5mm | | 100 | |

| | Percentage Passing | | |
|---|---|---|---|
| **Test Sieve Aperture** | **GAP 65** | **GAP 40** | **GAP 20** |
| 19.0mm | 40-65 | 63-81 | 100 |
| 9.5mm | | 40-60 | 52-76 |
| 4.75mm | | 25-45 | 33-57 |
| 2.36mm | | 16-35 | 20-44 |
| 1.18mm | | 9-27 | 12-35 |
| 600 micron | | 5-20 | 7-25 |
| 300 micron | 10 max | 1-15 | 4-20 |
| 150 micron | | 10 max | 12 max |
| 75 micron | | 7 max | 8 max |

***Grading Shape Control***

The weight in each fraction shall lie within the limits defined in Table 3-11.

***Table 3-11: Gap Aggregate Grading Fraction Limits***

| Fractions | Percentage of material within the given fraction | |
|---|---|---|
| | **Gap 40** | **Gap 20** |
| 19.00 - 4.75mm | 25-49 | - |
| 9.50 - 2.36mm | 14.36 | 19.45 |
| 4.75 - 1.18mm | 7 - 27 | 11 - 35 |
| 2.36 - 600 micron | 5 - 22 | 6 - 26 |
| 1.18 – 300 micron | 3 - 18 | 3 – 21 |
| 600 – 150 micron | 1 – 131 | |

### 3.4.1.3 Granular Rock Fill Material

This material is a non-specific rock aggregate intended for use as a subgrade improvement layer.

This subbase 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 suitability of the material will be assessed on its grading, crushing and weathering resistance, and clay content relative to its use. Evidence of the material's suitability will be required for approval by Council prior to its use.

#### 3.4.1.4 NZTA M/4

This material shall comply in all respects with NZTA M/4 specification.

### 3.4.2 New Pavement Construction

#### 3.4.2.1 Subgrade Layer

Use of stabilisation additives in the subgrade is subject to specific design and council approval (see section 3.3.12) as follows:

a) The subgrade layer shall be constructed to meet the requirements of the pavement design and NZTA's Specification F/1 : Earthworks Construction. Wherever possible, the natural insitu material shall be used in construction of the subgrade by implementing compaction or other methods of modification to meet the required subgrade strength. Where the insitu material is unsuitable to be used as subgrade, or is otherwise excluded from use, it shall be replaced by imported

b) subgrade material. The imported subgrade material for the pavement shall be fit for purpose and shall be subject to approval by Council before use. Options may include 'run of the pit' sand, selected quarry run rock or other material approved by Council. The suitability of alternatives will need to be demonstrated.

c) The subgrade material, whether insitu or imported, shall be compacted to a depth of not less than 600mm. It shall be placed in layers not exceeding 150mm (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 insitu tests or, in the case of non-cohesive material, by a suitable calibrated Scala Penetrometer test.

d) 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 Test 4.1.1 or Test 4.1.3.

e) 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. The reduced level of any point shall be within the limits 0mm above to 20mm below the designed or nominated level, as establish by stringing.

The surface shall be finished so that all points are within 15mm below a 3.0m straight edge laid at any point on the surface. See section 3.8.2 for testing requirements.

f) Compaction shall cease if the material shows signs of excessive weaving or heaving and shall not recommence until the problem has been resolved.

g) If the compaction of the subgrade layer does not meet the required criteria, then the following options are available for consideration

(i) The Contractor may opt to carry out further compaction to achieve the required level of compaction, or

(ii) Council may choose to replace not less than 100mm compacted depth of the subgrade layer with subbase metal. Once compacted, the surface shall be trimmed to grade and retested to prove the required strength has been achieved, or

(iii) The Contractor may, subject to the approval of Council, opt to correct the non-compliance of the subgrade by means of one of the following remediation methods:

- the use of geogrid and/or geofabric
- stabilisation of the subgrade
- stabilisation of the subbase aggregate
- stabilisation of the basecourse aggregate
- a combination of the above.

It should be noted that approval by Council of the application of one or more of the above options does not relieve the Developer/Contractor of responsibility for attaining the required final pavement strength.

***Note:*** *extended exposure of the subgrade to wet weather causes degradation of the subgrade's performance, the entire surface of the subgrade should be protected to ensure it is smooth, compacted, firm and uniform.*

### 3.4.2.2 Recovered Material

Recovered material may be specified for use as the subbase layer for the construction of a new pavement, subject to prior approval by Council.

Where recovered material is to 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.

Recovered material is to be reclaimed in such a way that no contamination with clay occurs.

No seal or asphalt from the old pavement shall be included in the recovered material to be used.

Other than the recovered materials consequential characteristics, the pavement layer shall be prepared as specified.

#### 3.4.2.3 Subbase Layer

NZTA's Specification B/2: Construction of Unbound Granular Pavement Layers shall apply except where modified by the following:

a) The subbase layer shall be constructed to the final shape shown on the accepted Construction Drawings
b) No subbase layer material shall be placed until the subgrade has been satisfactorily completed and approved by Council
c) The reduced level of any point on the surface of the subbase layer shall be within the limits 10mm above to 10mm below the designed or nominated level as establish by stringing
d) The surface shall be finished so that all points are within 15mm below a 3m straight edge laid at any point on the surface
e) The subbase (and basecourse if applicable) beneath the kerb and channel must extend at least 400mm beyond the back of the kerb. See Drawing D3.1.1.

#### 3.4.2.4 Basecourse Layer

NZTA's Specification B/2: Construction of Unbound Granular Pavement Layers shall apply except where modified by the following:

a) The basecourse layer shall be constructed to the final shape shown on the accepted Construction Drawings
b) No basecourse layer material shall be placed until all previous pavement layers have been satisfactorily completed and approved by Council

c) The tolerances and testing requirements as described in section 3.8.2.

### 3.4.3 Ripping and Cement Stabilisation

Construction of any stabilised pavement layers shall be in accordance with NZTA Specification B/5: In-Situ Stabilisation of Modified Pavement Layers. Council approval is required for use of stabilisation techniques, see section 3.3.12.

### 3.4.4 Testing

The pavement layers shall be tested and each layer approved by Council before construction of subsequent layers begins. For details of the testing and tolerances required, see section 3.8.2.

### 3.4.5 Concrete Works

This section covers all concrete work for footpaths, shared paths, various kerbing, kerb and channel, catchpits and vehicle crossings. These shall all be formed to the dimensions shown in the Drawings (D3.3.1, D3.3.2, D3.3.3, D3.3.5 and D3.3.7).

#### 3.4.5.1 Formwork

Where not covered in this specification, formwork shall generally comply with the requirements of NZS 3109.

Wherever necessary, formwork shall be used to support and confine the concrete and shape it to the required dimensions. Joints and linings shall be sufficiently tight to prevent loss of water from the concrete.

All timber for formwork shall be of an approved quality and type. For kerbs and channels formwork shall be ex 40mm material provided that 15mm timber or other suitable material may be used on short radius curves.

Formwork shall be of a sufficient depth to fully support all vertical faces. Where it supports exposed surfaces, formwork shall be long lengths dressed smooth on one face and both edges.

Timber strips for chamfers shall be machined all round to be true to shape and form and they shall be kept in good order. Alternatively, the chamfer or bullnose may be formed with a specific floating tool or dressed fillets.

Steel forms shall be of approved design and shall be maintained in good condition. The joints between lengths shall be secured accurately during concreting to maintain a good line in the finished work.

Forms shall be designed to be easily removable without damaging the green concrete and shall be kept thoroughly clean and oil or wax dressed to prevent adhesion of concrete or rust staining. Forms for curved kerbs shall be brought to a true curve by springing the timber evenly.

The shape, strength, rigidity, mortar tightness and surface smoothness of re-used forms shall be maintained at all times. Warped or bulged timber is not permitted. Timber which has been used shall have the surfaces which are to be in contact with the concrete thoroughly cleaned and treated before being used again.

#### 3.4.5.2 Concrete Mix and Proportions

Concrete mixes shall be proportioned to be workable, capable of being thoroughly consolidated by the means of compaction available and to provide the specified strength of concrete. The concrete may be either ordinary grade, high grade or special grade as defined in NZS 3109.

The concrete used shall be either mixed on the site or supplied ready-mixed. In every case, the concrete production shall be in accordance with NZS 3104 : Specification for Concrete Production.

The strength of concrete as defined in NZS 3109 shall be 28-day cured in-place minimum strength 25 MPa for all the above works.

#### 3.4.5.3 Placing Concrete

The Contractor shall give due notice to Council of the time it is intended to place any concrete, and no concrete shall be placed until approval has been obtained from Council.

Concrete shall not be placed on frozen ground, nor shall it be placed in unfavourable conditions, which may be detrimental to the quality and finish of the concrete. Unfavourable conditions shall be deemed to include low temperatures (below 5°C with temperature descending, or below 2°C with temperature ascending), excessively hot, dry conditions, excessively wet conditions, or any conditions making it impractical to work and finish the concrete adequately.

Immediately before placing the concrete, the foundations shall be lightly dampened, and formwork shall be cleaned out. In all cases surplus water shall be removed before concrete is placed.

The concrete shall be placed so 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. All concrete shall be handled from the mixer, or from the agitator truck mixer to the place of final deposit as rapidly as is practicable, by methods which prevent segregation.

Unless otherwise approved, in no case shall more than 30 minutes elapse between discharge of concrete from the mixer/agitator truck and final placement. Under no circumstances shall partially hardened concrete be placed in the work.

Where a channel is finished with a sand/cement mortar coat, the mortar shall be placed within two hours of placing the concrete, provided that when hot dry conditions are prevailing, the allowable time shall be reduced to 1 hour.

If for any reason a delay of more than 2 hours occurs, an approved PVA bonding agent shall be used to ensure the mortar is adequately bonded to the concrete.

Before fresh concrete is placed upon or against any concrete which has already hardened, the surface of the hardened concrete shall be thoroughly scabbled, cleaned and cleared of all laitance, loose or foreign material.

#### 3.4.5.4 Reinforcement

All reinforcement other than ties and stirrups shall be deformed unless otherwise detailed. The length of lapped splices (without hooks) shall be not less than 32 bar diameters in length.

Steel reinforcement, at the time the concrete is placed, shall be free from loose flaky rust, mud, oil or other coatings that will destroy or reduce the bond.

Reinforcement shall be accurately placed, adequately supported and secured against displacement before or during concrete placement.

The minimum cover to all main reinforcing steel shall be 50mm unless otherwise specified.

#### 3.4.5.5 Curing of Concrete

Strict attention shall be paid to adequate curing, which is an important factor in attaining the required strength for the concrete.

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 sprinklers or damp covers will need to be used.

All concrete surfaces not in contact with formwork shall be cured by the application of a curing compound conforming to the specification ASTM C309 : Specification for liquid membrane - forming compounds for curing concrete.

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.

#### 3.4.5.6 Machine Laid Kerb and Channel

Contractors who intend to construct the kerbs and channels by using an extrusion machine will be required to use ready mixed concrete from a certified plant. The concrete provided shall be designed so that after placement it will accurately retain its shape and present a good surface. Certification of the concrete supplied is required. No subsequent cement washing will be permitted. The machine shall be capable of providing well compacted concrete with the absence of trapped air.

The machine shall not be used to pour curves with radii less than 5m. For these curves the Contractor shall use formwork as specified.

A properly shaped screed shall be used in forming cut downs.

#### 3.4.5.7 Finished Work

Methods shall be used that will provide a smooth, clean and even surface on the exposed faces of all concrete work. These methods shall also put the required finish directly on the structural concrete without the use of mortar renderings, provided that, if specific prior approval of Council is obtained, the channel may be finished with a layer of separately applied mortar. In such a case, the mortar shall consist of not more than 2 parts of approved sand to 1 of cement. It shall be nominally 6mm in thickness and shall be placed before the initial set of the concrete and within 2 hours of placing the concrete.

Alternatively, a mortar layer to the above consistency may be applied in conjunction with the laying of the kerb and channel if the kerb and channel is laid by machine and the machine is designed for such use.

The top and face of the kerb and the channel surface shall be floated over with a steel tool before the mortar has finally set. No depressions which may hold water will be permitted.

The surface finishes of all kerb and channel, whether machine laid or hand laid, shall be uniform in colour, texture and shape.

#### 3.4.5.8 Contraction/Expansion Joints

Contraction/Expansion joints shall be formed or cut along the kerb at a maximum spacing of 3.0m. The slot shall penetrate the concrete by not less than 50mm and the mortar dressed over the cut face. The contractor shall ensure that cold joints are accurately marked so that the subsequent saw cut is in the cold joint. Should cracking occur adjacent to the saw cut a minimum section of 1.5 metres of kerb and channel shall be removed and re-cast.

#### 3.4.5.9 Backfilling against Concrete Work

Backfilling against the kerb and channel or any other concrete structure shall take place as soon as practicable after the concrete has reached sufficient strength, with particular emphasis at curves, corners, intersections and pedestrian kerb crossings but not prior to 36 hours after pouring.

Care shall be taken to ensure that no damage is done to the path, crossing, kerb and channel or other concrete structure when placing and compacting the backfill.

#### 3.4.5.10 Surface Finish (Footpath, Shared Paths and Vehicle Crossing Areas)

All final path and vehicle crossing surfaces shall be true to the lines and levels Specified and ‘broom’ finished. Design considerations aside, the final surface shall not vary by more than 5mm when checked with a 3m straight edge. No finished surface shall hold water.

### 3.4.6 Road Stormwater Drainage (Kerb, Channel and Catchpits) Construction

#### 3.4.6.1 Kerb and Channel in Existing Pavement

Prior to work commencing, the lengths of kerb and channel that are to be removed shall be marked on site and agreed with Council.

#### 3.4.6.2 Saw Cutting

Prior to removal, the kerb and channel shall be cut vertically and at right angles to the alignment to ensure a clean break. The existing sealed surface shall be cut parallel to and at a distance of 500mm, or greater if required, from the existing channel lip. The seal shall also be cut perpendicular to the kerb from the vertical saw cut to the parallel seal cut.

If the kerb and channel to be removed abuts any berm seal (e.g. sealed footpath), the sealed surface shall be saw cut within 5 days, at a distance behind the kerb face suitable for reinstatement. Refer Drawing D3.3.6.

#### 3.4.6.3 Excavation to Pavement Depth

After saw cutting, the kerb and channel and pavement shall be excavated to the proposed pavement depth or deeper if required. The sides of the excavated area shall be trimmed to be as near as possible to vertical. Care shall be taken to ensure that undermining and/or over break does not occur during excavation. All waste material including the old kerb and channel shall be removed from the site and appropriately disposed of.

#### 3.4.6.4 Subgrade Preparation

The exposed subgrade (at the required depth) shall be tested using a standard Scala Penetrometer refer to section 3.8.3. The prepared subgrade shall be compacted to the CBR specified. If the material fails, this initial test it shall either be:

a) Further compacted, if the material is suitable, to improve the CBR value, or
b) Excavated and removed from site, then backfilled with pitsand and compacted to the subgrade level.

All pitsand backfill shall be compacted in lifts of not more than 100mm. The subgrade area either insitu or imported shall be trimmed and shaped to accommodate the specified lines and levels given and compacted to provide uniform support for the pavement course.

All tree roots found in the subgrade or pavement area during excavation shall be removed (subject to Council Arborist approval) and are to be severed 0.5m behind the back or front of the kerb and be removed off site. Any root greater than 50mm in diameter shall be cleanly saw cut. No such roots shall be cut without the prior approval of Council if they are within the dripline of the tree.

***Note**: extended exposure of the subgrade to wet weather causes degradation of the subgrade's performance, the entire surface of the subgrade should be protected to ensure it is smooth, compacted, firm and uniform.*

#### 3.4.6.5 Kerb and Channel Foundation

After the subgrade has been approved, a compacted layer of GAP40 75mm deep shall be placed. Compaction shall be to refusal. The surface of the GAP40 shall be smooth and uniform, suitable for the placing of the kerb and channel concrete.

### 3.4.6.6 Kerb and Channel Placing

Refer Clause 3.3.14.2 for details on concrete placement.

### 3.4.6.7 Joining to Carriageway

After the kerb and channel concrete has reached sufficient strength, the carriageway shall be married into the existing carriageway (with banding) and new kerb and channel lip. If not already achieved during the kerb base construction, the carriageway shall be excavated to the existing subgrade and at least 200mm deep at the channel face. The excavation base shall be flat and level up to the edge of the saw cut seal. All excavated faces shall be vertical.

The subgrade shall be compacted to a CBR of at least 10. The basecourse metal (NZTA M/4 or GAP40) shall be placed on the prepared subgrade in layers not exceeding 150mm and compacted to refusal. The depth of basecourse is dependent on the surfacing, either asphalt or chip seal, but not less than 200mm (i.e. 25mm of asphalt surfacing).

### 3.4.6.8 Kerb and Channel in New Pavement

In accordance with clause 3.4.5.6, except all references to carriageway protection and reinstatement shall not be required for this activity.

### 3.4.6.9 Catchpits

Refer to Stormwater Chapter 4 for details; the details also show a list of the permitted precast components.

The construction specification described in Stormwater Chapter 4.

Catchpits shall be accurately positioned so that the grate and kerb block fit neatly into the kerb and channel. Rectangular pits shall be oriented with the longer side parallel to the kerb. Grates are to be cycle friendly.

### 3.4.6.10 Subgrade Drainage

Refer to Drawing D3.4.1 for details. NZTA specifications F/2: Pipe Subsoil Drain Construction and F/5: Corrugated Plastic Pipe Subsoil Drain Construction shall apply.

Where subsoil drains are required, as shown on the Drawing or directed by Council, they shall be placed behind the kerb unless shown or directed to be in front of the kerb.

The subsoil drains shall consist of an approved filter drainpipe, 100mm to 150mm diameter, or equivalent, in a trench backfilled with an approved filter material around the conduit. The conduit shall have a grade not less than 1:200 to discharge into the catchpit.

#### 3.4.6.11 Additional Subsoil Drainage

Where directed, any permanent wet spot in the subgrade shall be drained to the subsoil drain. Where the wet area is below the level of the subsoil drain, it shall be drained by connecting to the nearest stormwater system.

#### 3.4.6.12 Other Requirements

NZTA F/2 filter material shall not be used as a filter material in close proximity to HDPE slotted pipe. Unless otherwise designed and approved by Council, pea-metal shall be for backfilling around HDPE slotted pipe. Where backfilling a subsoil drain with filter material the minimum cover shall be 100mm. Where a strip drain is approved, backfill is to be permeable sand.

The invert of subsoil pipes at the catchpit shall not be less than 100mm above the invert of the catchpit outlet.

### 3.4.7 Road Surfacing Construction

The relevant NZTA specifications listed in Clause 3.2.2 shall apply to road surfacing procedures and materials.

Exceptions to the specifications include:

- All references to the basis of payment contained within the specifications are deleted;
- Reference to the Contractor's obligation with respect to the foreshortening of the maintenance requirements of the seal coat (NZTA P/3 & P/4) is deleted.

Application rates, cutback percentage and the percentage of adhesion agent is to be specified by the Developer/Contractor and forwarded to Council with design calculations for approval at least 24 hours prior to application.

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 25mm.

#### 3.4.7.1 Waterproofing First Coat Chip Seal

A two coat chip seal shall be applied to the prepared basecourse surface but only when the air temperature is greater than 10°C in the shade as detailed in the NZTA P/3.

The first layer shall consist of the supply and spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include one part per hundred (p.p.h) adhesion agent and be spread at a rate of 1.2 litres/$m^2$ residual (measured at 15°C).

The first layer chip shall include the supply, spreading and rolling of Grade 3 chip at a spread rate of 75 $m^2/m^3$. It is essential that the spreading of the first chip layer is carefully controlled such that the chips are evenly spread and are no more than one layer thick over the entire surface.

The second layer shall consist of the supply and spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include one p.p.h adhesion agent and be spread at a rate of 0.8 litres/$m^2$ residual (measured at 15$^o$C).

The second layer of chip shall include the supply, spreading and rolling of Grade 5 chip at a spread rate of 150 $m^2/m^3$.

Refer to 'Removal of Surplus Chip' in clause 3.4.7.3.

### 3.4.7.2 Chip Seal Resealing

This treatment shall be applied on carriageways to produce a uniform texture on surfaces that have an existing seal coat and potentially repair patches.

Prior to resealing all surfacing and pavement defects must be repaired. The resealing shall not be applied until 28 days after asphalt patching or levelling has been completed, or the basecourse repairs have been two-coat sealed.

The second coat chipseal carried out between 3 and 18 months after the waterproofing first coat shall consist of supply and spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include 1 p.p.h adhesion agent and be applied at the rate of 1.3 litres/$m^2$ residual (measured at 15°C). The chip layer shall consist of the supplying, spreading and rolling of Grade 5 chip. If specified, a dry locking coat of Grade 5 or 6 chip shall then be supplied and applied at a rate of 300 $m^2/m^3$.

### 3.4.7.3 Removal of Surplus Chip

When the sealed surface is to be opened to traffic, all surplus chip shall be removed within 48 hours of the completion of rolling. For sites that are not open to normal traffic, chip sweeping may be delayed but must be completed before opening the road to normal traffic.

All surplus chips shall be removed from grass berms, driveways, parking areas and footpaths. Follow up sweeps will be required to ensure that all loose chip is collected and removed from the site for a period of one month following chip application.

### 3.4.7.4 Asphaltic Concrete

Where design traffic volumes in residential areas are less than 800 vehicles per day, and there are no additional turning stresses created by intersections, a single coat grade 5 membrane seal shall be used with a residual bitumen application rate of 1 L/m².

Where traffic volumes are higher or there are greater stresses, a waterproofing chip seal shall be applied to the prepared basecourse surface in accordance with section 3.4.7.1. The asphalt concrete shall be placed no sooner than 14 days after the application of the waterproofing chip seal.

Asphaltic concrete paving shall consist of the supply and spraying of a tack coat with a quick breaking bituminous emulsion at an application rate of 0.3 litres/$m^2$ and the supply, spreading and rolling of asphaltic concrete or an alternative mix as approved by Council.

For local residential roads with less than 800 vehicles per day and no additional turning stresses, the default mix is an NZTA M/10 DG10, with a minimum thickness of 25mm.

For residential roads with greater than 800 and less than 3000 design vehicles per day or have greater stresses due to intersections the default asphalt design is an NZTA M/10 AC10, with a minimum thickness of 35mm.

For commercial/industrial roads, or those designed for greater than 3000 vpd a specific design must be approved by council.

The asphaltic concrete shall ramp to transition back to the adjacent existing surfaces as illustrated in Drawing D3.5.2. 3.4.7.5

***Block Paving-Carriageway Bedding Course for Block Paving***

All bedding course shall be laid in accordance with either Clay Paving Design and Construction or NZS 3116 : Concrete Segmental and Flagstone Paving and comply with Drawing D3.3.5.

***Laying of Paving Blocks***

All paving blocks shall be laid in accordance with NZS 3116.

***Edge Restraints***

Refer to Drawing D3.6.1 for details of the type of edge restraint.

Edge restraints shall be one of the following:

a) Kerb and channel

b) Traffic island kerb
c) Concrete separating strip
d) Paving blocks on edge cast in concrete
e) Timber edging

All pavers must be cut using a power saw unless specified otherwise.

#### 3.4.7.6 Line Marking Reinstatement

Line marking must be applied within 48 hours of applying surfacing, or in the case of chip seal within 48 hours of the surface being swept. If the road is not open to normal traffic, this may be delayed but must be carried out before the road is opened to normal traffic.

A re-mark may be required prior to vesting depending on wear and deterioration of the markings.

### 3.4.8 Berms

Berms will typically be grassed but may be landscaped if it is impracticable to maintain as grass.

All berms and landscape planting design and implementation within the road reserve shall be in accordance with D3.1.4 and Clause 7.3 and 7.4 of the Landscape Section.

Berms that are to be grassed shall:

a) Have a minimum subgrade of CBR 7
b) Have a minimum compacted depth of topsoil of 75 mm
c) Be seeded in accordance with the Landscape Section, Clause 7.3.6.
d) Be free of debris and perennial weeds

Berms are to be mown during the defects liability period as well as prior to take over by Council.

### 3.4.9 Footpaths, Cycle Paths and Vehicle Crossings

This section outlines the work required to construct, reinstate or repair footpaths, vehicle crossings and away-from-road cycle paths.

#### 3.4.9.1 Alignments, Lines and Levels

The edge lines of kerbs, footpaths, shared paths and vehicle crossings shall be perfectly straight between tangent points, and on curves shall sweep round without kinks, flats or angles in a smooth, true arc to the radius shown or directed.

Design levels and alignments shall be strictly adhered to and the grade from level peg to level peg shall be even, provided always that at changes of grade the angle between the grades shall be eased so as to form a vertical curve or other form of smooth transition.

The entire berm area shall fall, at an even grade where possible, from the property boundaries to the kerb and channel.

#### 3.4.9.2 Break out, Removal and Disposal of Existing Berm Features

All existing berm features that are to be removed shall be broken up and lifted out to reduce damage to the surrounding features. The outer limits of these features shall be saw cut, except in the case of paving blocks or grass verges, before removing to provide a tidy interface between existing and replacement work.

Where salvaging of materials (e.g. catchpits, gratings, frames, stormwater piping) is specified, care shall be taken to ensure that as little damage as possible is done to materials. Such units shall be neatly stacked on the site such that they do not obstruct any footpath, vehicle crossing or roadway until they are taken off site. All materials not for reuse shall be removed from site and appropriately disposed of.

#### 3.4.9.3 Excavation to Pavement Depth

Excavation shall be to the pavement depth as shown on Drawing D3.3.5.

The width of all excavation shall be no wider than necessary to construct or reinstate the various berm features.

Where excavation adjoins existing berm features or carriageways, care shall be taken not to undermine the existing surfacing while material is being removed. The sides of the excavated area shall be trimmed to as vertical as possible without being unstable or causing undermining.

#### 3.4.9.4 Subgrade Preparation

The exposed subgrade (excavated to trial subgrade level or pavement depth) shall be tested by using a Scala Penetrometer for compliance with the following CBR values

a) In footpath, cycle paths and traffic island infill CBR value >10 (4 blows per 100mm)

b) In vehicle crossing and kerb and channel areas CBR value >10 (4 blows per 100mm)

If the material fails this test then:

a) The existing subgrade shall be further compacted, to improve the CBR value; or if this is not practicable

b) The unsuitable material shall be excavated, removed from site, replaced with pitsand and compacted up to the trial subgrade level

When undercutting of the subgrade is required (the second option above) the excavation depth and extent shall be instructed by Council. As a minimum, it is to extend 100mm past either side of the edge boards, or the outer limits of the construction area.

***Note**: Small pockets of material may require treatment rather than the entire subgrade area.*

All pits and backfill shall be compacted in lifts of not more than 100mm. The subgrade area, either existing or reinstated, shall be trimmed, shaped and compacted to provide uniform support for the pavement course.

All tree roots found in the subgrade or pavement area during excavation shall be removed. They shall be severed at least 200mm outside the excavation area, removed from site and disposed of. Any root greater than 50mm in diameter is to be cleanly sawn. No such roots within the drip line of the tree shall be cut without the prior approval of Council.

***Note:** extended exposure of the subgrade to wet weather causes degradation of the subgrade's performance, the entire surface of the subgrade should be protected to ensure it is smooth, compacted, firm and uniform.*

### 3.4.9.5 Timber Edging for Asphalt and Paving Block

All footpaths, cycle paths and vehicle crossing edges shall be contained by either a concrete kerb or edging, or by treated timber edge boards, which shall form part of the finished work.

Edge boards shall be held firmly in place with wooden pegs (50 x 25mm) or battens nailed to the outer edge at no greater than 1.0m centres and at every joining board. The pegs shall be a minimum length of 225mm or longer to be driven down into solid unyielding ground. Batter stakes may be used as pegs, driven down into firm ground and trimmed to the correct length. All pegs shall sit 15 to 25mm below the top level of the edge boards.

Edge boards shall be joined with 400mm long boards (either edge board offcuts or 75 x 25mm timbers) which span the joint evenly and are nailed firmly in place at the rear of the edge boards. The top of the joining boards shall sit 15 to 25mm below the top level of the edge board. The spacing of wooden pegs shall be adjusted so that a peg is positioned alongside every joining board. Refer to Drawing 3.6.1.

All timber edging shall be backfilled outside the construction area as necessary to protect the timbers from being damaged or distorted during the preparation and compaction of the pavement course. All edge boards shall be set out using string lines and shall be true and

straight at the completion of the work. All edge boards and pegs will use H4 or H5 treated timber.

If directed by Council, existing timber edging in good condition shall be adjusted for level, re-pegged and incorporated in the new footpath or vehicle crossing. At all times, excavation for timber edging replacement, installation or adjustment shall be the minimum required to provide adequate workspace.

Where the path edge adjoins existing kerb, the top of the kerb shall be treated as the top of the edge board.

#### 3.4.9.6 Pavement Basecourse

The pavement basecourse shall be constructed of bedding sand and/or GAP metal (NZTA-AP metal on occasions) and be compacted to a pavement depth conforming to the Drawing D3.3.5.

For asphalt footpaths and cycle paths, the final pavement surface shall have a tight stone mosaic surface, with no loose aggregate, suitable for the application of a tack coat and an asphalt layer. A skin of GAP 20 may need to be added to GAP 40 areas and compacted into place to achieve this. All pavement courses shall be compacted to refusal in lifts of not more than 100mm.

#### 3.4.9.7 Concrete Surfacing

Concrete surfacing shall be carried out in accordance with clause 3.4.5. Where concrete paths are to be constructed steeper than 1:10, a permanent non-skid surface should be provided (broom finish or similar).

For cross section detail refer Drawing D3.3.5.

In concrete paths, crack control lines shall be formed or cut at vehicular crossing/footpath edges and along the path at a maximum spacing of 5.0m. All crack control lines shall be 25mm deep.

#### 3.4.9.8 Asphalt Surfacing

The prepared pavement 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 generally at an application rate of 0.25 litres/$m^2$. Asphalt Mix shall be laid to the compacted depths shown on Drawing D3.3.4. The final surface shall be flush

with the top of the edge boards and graded uniformly between. Depressions or irregularities that may cause water to pond will not be accepted in the finished surface.

All asphalt shall be laid in accordance with NZTA's Specification P/9: Asphaltic Concrete Paving Construction, except that plant appropriate to the size of the area being surfaced shall be used.

#### 3.4.9.9 Asphalt Overlay

Where asphalt smoothing or overlay is required, the existing surface shall be swept to remove all loose metal and debris prior to the application of the tack coat. Mix 5 asphalt shall be used to smooth irregularities up to a compacted depth of 20mm. Mix 10 shall be used to smooth irregularities up to a compacted depths of 20-50mm and Mix 20 shall be used for compacted depths of 50mm and greater.

### 3.4.10 Private ways

#### 3.4.10.1 Urban *Concrete*

For concrete pavements:

- The minimum depth of concrete is 125 mm for private ways serving two to four household units
- The minimum depth of concrete is 150 mm for private ways serving five to ten household units

Concrete is to be placed on a subbase of 75mm of compacted GAP20 on a compacted subgrade with CBR ≥10. For subgrade criteria < 10 CBR, subgrade improvements are to be made to bring the subgrade strength up to a CBR of 10.

***Other***

Pavement may be interlocking block pavers. Refer to section 3.4.7.5 for specifications.

Stormwater shall not discharge across the vehicle crossing from the private way to the road. Vehicle crossings to private way shall be designed and constructed in accordance with clause 3.3.19 and Drawing D3.3.1.

#### 3.4.10.2 Rural

All rural residential private ways shall have:

- Pavement GAP40 minimum depth 150mm

- Subgrade minimum CBR 15 continuous over a depth of 600mm. For subgrade criteria < 15 CBR, subgrade improvements are to be made to bring the subgrade strength up to a CBR of 15
- The pavement shall be sealed with a 3/5 two coat seal in accordance with 3.4.7.

### 3.4.11 Road Signs

#### 3.4.11.1 Scope

This section covers the specifications for the supply and installation of all road signs.

#### 3.4.11.2 Standards

All signs are to be constructed and installed in accordance with the relevant specifications detailed in Clause 3.2.2 in particular the Traffic Control Devices Manual, and the following:

a) Signs shall be Class 1 wide observation angle (VIP or equivalent) reflective sheeting
b) The face of all signs shall be rivetless
c) The back of all signs shall be coloured ‘aircraft grey’ No. 693 as referred to in BS381C, or similar, with a semi-gloss finish, unless otherwise stated. ‘Slate grey’ (in accordance with the NZTA specifications) is an approved alternative
d) All signs are to have an aluminium substrate
e) Regulatory, warning, street name plates and information signs shall be Class 1 reflectorised sheeting
f) Parking signs shall be non-reflective
g) Where the option exists for square or radius corners, radius corners shall be supplied.

#### 3.4.11.3 Attachment

Signs shall be attached to posts or overhead gantries using Signfix or equivalent brackets as approved by Council. The Contractor shall be responsible for determining sign mounting requirements.

#### 3.4.11.4 Poles

Steel poles are to be either NB56 or NB65 poles appropriate to the type and size of sign required and in accordance with Table 3-12. Poles are to be powder coated white. All poles are to be capped with power coated top caps to match pole.

Timber poles shall be 100 x 100mm H4 dressed framing grade 1 or 2, pre-painted using one undercoat and two topcoats of high gloss exterior white paint.

### 3.4.11.5 Site Installation details for posts and poles

Where installation and/or reinstatement work is required within a sealed surface, the surface must be saw cut around the perimeter of the excavation. The replacement surfacing shall be of a material and placed to match the existing surrounding surfacing.

### 3.4.11.6 Typical Sign Installation and Location

All signs shall be located in accordance with the NZTA's Traffic Control Devices Manual and NZTA's Manual of Traffic Signs and Markings (MOTSAM) Part 1: Traffic Signs, Additional specifications in Table 3-12 shall also apply.

***Table 3-12: Additional Signage Specifications***

| Sign type | Pole type | Pole length | Pole height | Location |
|---|---|---|---|---|
| Regulatory | NB 65 | | 2.5m BOS (above a footpath)<br>2.0m BOS (in traffic island) | Longitudinal Offset:<br>a) 5m (± 1m)* from tangent to intersecting road kerb line (behind kerb line)<br>b) 3m from island nose (in traffic island<br>Lateral offset:<br>a) Poles shall not be closer than 500mm from kerb line. Sign shall not be closer than 350mm from kerb face.<br>b) In centre of traffic island with a maximum offset of 1m from island kerb face. |
| Warning | NB 56 | 3.7m | 2.0m BOS<br>2.5m BOS when above a footpath | In centre of traffic island 500mm lateral offset between sign and kerb line |
| Information | NB 56 | 3.7m | 2.0m BOS<br>2.5m BOS when above a footpath | |
| Free Turn | NB 56 | | 250mm BOS | 1.5m from traffic island nose in centre of traffic island<br>500mm lateral offset between sign and kerb line |
| Street Name | NB 56 | 3.7m | 3.0m TOS (measured to upper blade) | Lateral offset:<br>Minimum 500mm, maximum 1500mm between closest part of name sign and kerb or seal edge.<br>Part of the signs blade should be located within 1500mm of the kerb face but provide at least 500mm clearance to the kerb face or edge of seal.<br>Where this is not possible, the signs may be reverse mounted as long as the footpath is not obstructed.<br>Refer to Drawings D3.7.2, D3.7.3, D3.7.4, D3.7.11, D3.7.12 |
| Tourist Sign | NB 56 | 3.7m | 2.0m BOS<br>2.5m BOS when above a footpath | |
| Route marker | NB 56 | 3.7m | 3.0m TOS | |
| Truck Bylaw | NB 56 | 3.7m | 2.0m BOS<br>2.5m BOS when above | Refer Drawing D3.7.17 |

| Sign type | Pole type | Pole length | Pole height | Location |
|---|---|---|---|---|
| | | | a footpath | |
| No stopping | NB 56 | 3.25m | 2.0m BOS<br>2.5m BOS when above a footpath | |
| Bus Stop | NB 56 | 3.25m | 2.7m TOS<br>2.4m BOS if sign is for Orbiter route | 1m from end of park |
| Bus Stop supplement sign | | | | Aligned to the top Refer Drawing D3.7.16 oriented @ 90 of the associated degrees to adjacent kerb face or edge of Bus Stop sign seal such that it can be seen by approaching motorist |
| Taxi Stand | NB 56 | 3.25m | 2.7m TOS | 1m from end of park |
| Taxi Stand supplement sign | | | Aligned to the top of the associated Taxi Stand sign | Refer Drawing D3.7.16 oriented @ 90 degrees to adjacent kerb face or edge of seal such that it can be seen by approaching motorist |
| Loading Zone | NB 56 | 3.25m | 2.7m TOS | 1m from end of park |
| Parking | NB 56 | 3.25m | 2.7m TOS | 1m from end of park |
| Mobility Parking | MB 56 | 3.25m | 2.7m TOS | 1m back from front of park |
| Keep Left | Knock down socket | 750mm | 250mm BOS | 1.5m from traffic island nose. Refer Drawing D3.7.1 |
| Diverge Sign | Knock down societ | 750mm | 250mm BOS | 1.5m from traffic island nose<br>In centre of traffic island<br>500mm lateral offset between sign and kerb line |
| Chevron Board | NB 56 | 1.1m | 750mm TOS** | Refer Drawing D3.7.10 |
| Chevron in Roundabout | | | 750mm TOS | 1m from kerb face and perpendicular to sight line of approaching vehicles approximately 50m from intersection. Refer Drawing D3.7.10 |
| Route sign (in place of chevron in roundabout) | | | 750mm TOS<br>100mm BOS if the area is not planted | Lateral offset – 500mm from kerb face to sign. If no kerb, ≥1.5m from the edge of seal |
| Median Island<br>Low level street name | NB 56 | 1.1m | 750mm TOS | Refer Drawing D3.7.10 |
| Route Shield | NB 56 | 1.1m | 750mm TOS | |
| ADS sign (on two poles) | | | | Specific design required |
| All signs installed adjacent to cycleways or shared paths shall have a minimum clearance tot eh bottom of the sign of 2.2.m. | | | | |
| ***Key:***<br>TOS – Dimension is the clearance between the top of the sign and the top of the adjacent footpath/berm/traffic island<br>BOS – Dimension is the clearance between the bottom of the sign and the top of the adjacent footpath/berm/traffic island<br>* Tolerance to accommodate possible site constraints | | | | |

| Sign type | Pole type | Pole length | Pole height | Location |
|---|---|---|---|---|
| ** Consideration should be given to road vertical alignment when determining sign height | | | | |

### 3.4.11.7 Parking Signs

Parking signs shall be as detailed in Traffic Control Devices Manual.

### 3.4.11.8 Signs on Cycleways or Shared Walkway/Cycleways

Refer Drawing D3.7.5 for signage of shared cycle path start and end points.

### 3.4.11.9 Street Name Signs

***Design***

Street name signs shall be designed in accordance with the Traffic Control Devices Manual – Part 2: Direction, service and general guide signs, and Table 3-12.

On no exit roads, a 75mm tall separate, supplement plate shall be attached (taped) to the bottom edge of the street name sign.

All signs are to be double-sided, except those on medians or at the head of 'T' intersections. Repeater plates of the primary road shall be erected at every intersection.

***Legend***

The standard abbreviations listed in Traffic Control Devices Manual – Part 2: Direction, service and general guide signs shall be used, with the addition of the term 'Rise' (no abbreviation necessary).

These abbreviations shall have a letter height of 50mm and 75mm for secondary and primary streets respectively.

***Location of Street Name Signs***

Street name signs are to be located in accordance with Table 3-9 above. If there is a utility pole in the proposed location, then the signs shall be attached to it. (See Note 4 of Drawing D3.7.11).

Street name signs at signalised intersections shall be installed in accordance with Drawing D3.12.6.

Poles shall be either NB56 or NB65 steel poles, as appropriate to the type of sign required.

### 3.4.11.10 General Interest Signs (formerly referred to as Amenity Signs)

Refer to section in Traffic Control Devices Manual – Part 2. **Design**

General Interest signs are to be in accordance with the following specification:

### *Table 3-13: General interest sign specification*

| | |
|---|---|
| Letter height | 125mm |
| Letter styles | as for Street Name signs |
| Letter spacing | as for Street Name signs |
| Background depth | 175mm |
| Blade profile | 90° cuts at both ends |
| Colours | Blue reflectorised lettering on a white reflectorized background - all reflectorisation to be Engineering Grade |
| Arrows | Blue reflectorised triangular arrow at the end of sign plates. Refer to D3.7.2, D3.7.3 and D3.7.4. |

***Location***

General Interest signs are to be located in accordance with the following specification:

### *Table 3-14: General interest sign locations*

| | |
|---|---|
| Number of signs | Maximum of two general interest signs per facility |
| Height of sign blade | As for street name signs |
| Lateral offset | As for street name signs |

***Note**: In addition to standard mounting requirements (Drawings D3.7.11 and D3.12.6), General Interest signs are to be attached below existing street name signs.*

### 3.4.11.11 Route, Guide, Service and Tourist Signs

Destinations, routes and facilities to be used on route, guide, service and tourist signage must be as supplied by Council's Transportation team. Refer also to Traffic Control Devices Manual – Part 2.

### 3.4.11.12 School Patrol Signs

Signs shall be manufactured and installed in accordance with Drawing D3.7.15.

### 3.4.11.13 Kea Crossing Flag and Pole

Kea Crossing flags and poles are to be constructed and installed in accordance with Drawings D3.7.13, D3.7.14

### 3.4.11.14 Overhead Gantries

Overhead gantries shall be individually designed in accordance with, and shall comply with the requirements of, NZTA's Highway Structures Design Guide.

The design shall include structural and environmental requirements and the provision of safe maintenance access to the structure, and shall meet the following additional requirements:

a) The gantry design will depend on the proposed size of sign and hence loading and ground clearance
b) Sign mounting uprights shall be spaced at no greater than 900mm centres
c) Overhead gantries may be constructed from either a single piece welded or a bolted outreach arm
d) Gantries shall be hot dipped galvanised after fabrication. All mount bolts shall be galvanised.

The layout drawings for the site locations of all structures and associated maintenance access and traffic barriers shall be submitted to a nominated Safety Auditor for a Stage 3 Design Safety Audit. The contractor shall amend the site layout design to comply with the Safety Audit recommendations or shall submit to the Engineer a proposal that has been prepared by a qualified Traffic Consultant that modifies the Safety Audits recommendations but does not compromise the intention of the recommendations.

No work shall be undertaken on the gantry until the design is accepted in writing by the Engineer.

### 3.4.11.15 Edge Marker Posts

All edge marker posts (EMP) shall be constructed in accordance with the NZTA's Specification M/14 : Edge Marker Posts.

EMPs shall be located on rural roads only and in accordance with the MOTSAM – Part 2: Markings.

### 3.4.11.16 Semi - Rigid Barriers (W-Section)

All barriers complete with reflective inserts are to be constructed in accordance with the NZTA's Specifications M/17P: W-Section Bridge Guardrail, P/15P : Fabrication and Assembly of Standard Guardrails and Handrails for Highway Bridges and Bridge Approaches, M/23 : Road Safety Barrier Systems, and with AS/NZS 3845.

Painting of barriers may also be required on a case-by-case basis and should be confirmed with the relevant Council. All painting shall consist of at least two finish coats of water based commercial grade paint (colour to be specified by Council). All dirt, grime and loose and flaky paint shall be removed from the surface prior to painting. It may be necessary to undercoat in some areas as required. All painting is to be carried out in accordance with the manufacturer's specifications. Reflective inserts are to be retained.

#### 3.4.11.17 Wire Rope Barriers

To be added at a later date

#### 3.4.11.18 Timber Sight Rails

All painting of timber sight rails shall be completed with at least two finish coats of water based commercial grade white paint. All dirt, grime and loose and flaky paint shall be removed from the surface prior to painting. It may be necessary to undercoat in some areas. All painting shall be carried out in accordance with the manufacturer's specifications.

#### 3.4.11.19 Themed Street Furniture (bins, seats, specialised street lighting, etc)

The Council may have towns or suburbs with a particular street furniture theme. For details of these themes, refer to Appendices.

#### 3.4.11.20 Wheel stops

All wheel stops shall be standard pre-cast rubber units, with the top of the wheel stop being no more than 100mm above the adjacent surface.

#### 3.4.11.21 Wayfinding Signage

Wayfinding signage is subject to additional specifications and requirements. See Appendices for options.

### 3.4.12 Pedestrian Barrier Rails and Handrails

Pedestrian barrier rails and handrails shall be constructed and installed in accordance with the following drawings:

- D3.8.7 - CBD pedestrian barrier
- D3.8.8 - Pedestrian balustrade barrier.
- D3.8.9 - Peddestrian barrier detail
- D3.8.10 - Pedestrian accessway fence detail

### 3.4.13 Walkway Barriers and Cycle Racks

All walkway barriers and cycle racks shall be constructed and installed in accordance with Drawings D3.8.2, D3.8.3 and D3.8.11

### 3.4.14 Bus Stops

This section covers the supply and installation of all components necessary for a bus stop including signage, seats, raised accessible kerb lines and bus shelters.

#### 3.4.14.1 Standards

All bus stops shall be constructed in accordance with the NZTA Guidelines for Public Transport and Infrastructure and Facilities, unless Council has requirements which will vary the above standard.

#### 3.4.14.2 Signage

All signage shall be installed in accordance with the requirements set out in section 3.4.11: Road Signage and Street Furniture. However, some locations may require supplementary bus stop signs. See Drawing D3.7.16.

#### 3.4.14.3 Seats

Where seats are required, but there is no shelter, they shall be in accordance with Drawing D3.8.15. Materials and colour to be confirmed by the Council.

#### 3.4.14.4 Accessible kerb lines and tactile paving

Where specified, accessible kerb lines and tactile paving shall be installed in accordance with the ARTA Bus Stop guideline and drawings D3.6.3 and D3.3.8.

#### 3.4.14.5 Shelters

Bus shelters shall be installed as instructed by Council and in accordance with Drawings D3.8.13 and D3.8.14.

The large size bus shelter shall be used in all locations except where an installed shelter would narrow the adjacent footpath to less than 1.2m. The mini shelter shall be installed instead.

Bus shelters shall be painted/powder coated in black semi-gloss.

## 3.5 Line Marking

This section covers all aspects of line marking, including the supply and fixing of reflective and/or non-reflective road studs and delineators, and the removal of line marking.

### 3.5.1 Setting Out and Timing

The proposed line marking is to be set out in accordance with the accepted drawings, and any location marking out provided by Council, with modifications as necessary to make the 'lines' pleasing to the eye.

Where there are inconsistencies between the line marking layout plans and the NZTA specifications, the line marking layout plans shall prevail.

Council's approval of the set out is required prior to marking. In order to achieve this with the least delay, at least 48 hours' notice prior to approval being required shall be given to Council.

Incorrect line marking that has been applied without approval of the set out shall be removed at no cost to Council.

On new surfaces, marking of centreline, limit lines and other intersection markings such as Give Ways shall be completed within 48 hours of completion of the surfacing.

For roads that are not open to traffic, such as new subdivisions, these markings shall be completed before the road is opened to the public.

Other markings on new surfaces shall be completed within seven days of surfacing. For other works such as line removals or maintenance, timing will be specified by Council.

### 3.5.2 Paint Types

At a minimum, all paint shall at least conform to NZTA's specifications M/7 'Class A' type and P/12.

All new line markings shall generally be waterborne/acrylic.

Chlorinated rubber or alkyd is to be used for arterial and collector roads on their final surfacing.

Thermoplastics are to be used in CBD areas.  Alkyd paint must be used on sites that are to be re-marked with thermoplastic paint at a later date.

#### 3.5.2.1 Waterborne/Acrylic Paint

Waterborne paint shall be applied in accordance with NZTA Specifications P/12 and M/7, with the following amendments.

***Table 3-15: Waterborne/acrylic pain specification amendments***

| | |
|---|---|
| Clause 13.1 (a) NZTA P/12 – replace with: | 'The finished dry film thickness shall be 300 microns or greater as defined by the equation in NZTA P/12 ' |

All waterborne/acrylic markings are to be reflectorised in accordance with NZTA P/22.

#### 3.5.2.2 Alkyd Paint

Alkyd paint shall be applied in accordance with NZTA Specifications P/12 and M/7, with the following amendments.

***Table 3-16: Alkyd pain specification amendments***

| | |
|---|---|
| Clause 13.1 (a) NZTA P/12 – replace with: | 'The finished dry film thickness shall be 180 microns or greater as defined by the equation in NZTA P/12' |

#### 3.5.2.3 Chlorinated Rubber

Chlorinated Rubber or similar paint shall be applied in accordance with NZTA Specifications P/12 and NZTA M/7, with the following amendments.

***Table 3-17: Chlorinated rubber specification amendments***

| | |
|---|---|
| Clause 13.1 (a) NZTA P/12 – replace with: | 'The finished dry film thickness shall be 220 microns or greater as defined by the equation NZTA P/12' |

All chlorinated rubber markings are to be reflectorised in accordance with NZTA P/22.

#### 3.5.2.4 Thermoplastic

Where long life or thermoplastic materials are specified they shall be supplied and applied in accordance with NZTA M/20 specification. The type of long-life material proposed to be used and details of type of approval to NZTA M/20 specification shall be submitted with any tender or proposal.

#### 3.5.2.5 Re-markings

A re-mark will be required within 3-6 months (or prior to completion of defects period if shorter) depending on wear and deterioration of the markings. This re-mark will be with the final paint type specified in section 3.5.22 above. Approval must be obtained from

Council prior to completing this re-mark to determine the paint type and final layout of the line marking.

### 3.5.3 Equipment Certificates and Staff Competence

All line marking equipment used for applying paint and glass beads shall have a current NZTA T/8 certification and be in a certifiable state.

All line marking equipment used for applying long life or thermoplastic materials shall have a current NZTA T/12 certification and be in a certifiable state.

The senior operator of each road marking crew must have at least a minimum qualification approved by the Industry Training Organisation (ITO). At least one person in each road marking crew shall be a qualified Traffic Controller (TC) in accordance with the NZTA COPTTM.

### 3.5.4 Raised Pavement Markers (RPM)

All reflectorised pavement markers are to be glass faced (long life) or equivalent with NZTA Specification M/12 type approval.

All pavement markers are to comply with NZTA M/12 (and NZTA M/12 notes). Installation of raised pavement markers shall comply with NZTA P/14, MOTSAM, and any subsequent NZTA document (e.g. RTS 4 ‘Guidelines for Flush Medians’). Further to this, Council may require specific RPM layouts in certain locations.

Where ‘Active’ RPMs are specified, these shall incorporate solar panels and LED lights so that they do not rely solely on reflected light.

### 3.5.5 Removal of Line marking

When redundant line markings require erasure, Council will specify the method to be used.

#### 3.5.5.1 Removal

When ‘removal’ is specified, the line marking material (paint or thermoplastic) shall be removed from the road surface. Typical methods include grinding, sandblasting (wet or dry) and ultrahigh-pressure water cutting, but other methods may be considered acceptable by Council. Care shall be taken so that damage is not caused to the underlying road surface and that ‘ghosting’ of the marking does not occur.

Once complete, the surrounding area shall be swept clean of all sand, paint chips or other debris. This material shall be suitably disposed of with care being taken to ensure that no

solid matter enters any waterway or stormwater system as a result of the removal operation. This may require the placement of filters or similar on catch pits and other drainage features.

Details of methodology, including materials to be used, equipment, staff skills and qualifications and quality assurance shall be supplied with tenders or proposals.

#### 3.5.5.2 Cold Applied Plastic Blackout

Permanent erasure of markings may be specified to be carried out with cold applied plastic (CAP) material.

Existing long life markings or multi-layered line markings should be ground off before applying CAP Blackout. The base coat shall be a two-component cold plastic, designed and formulated for use as a road marking material and complying with NZTA specification M/20. The CAP shall be pigmented to a grey or charcoal colour that is close to the colour of the existing road surface. The product shall be mixed and applied in accordance with manufacturer's instructions.

Where the area to be blacked out abuts markings that are to remain, the edge of the blackout shall be masked off, otherwise an irregular edge to the blackout is desirable to minimise any ghosting effect. While the plastic material is still wet, crushed stone or grit shall be evenly broadcast onto the base.

The grit shall be a sound crushed mineral or synthetic aggregate with 95% passing a 6.7mm BS sieve and no more than 15% passing a 2.36mm BS sieve. The CAP material thickness and grit size shall be matched so that approximately 60% of the grit depth is embedded into the plastic material.

The aggregate shall have a maximum of 2% weak materials when tested using the Australian Weak Particles Test (AS 1141.32).

### 3.5.6 High Friction or Coloured Aggregate Surfacing

High friction or coloured aggregate surfacing is to be applied at locations specified by Council. Both surfacing types generally use a specialised aggregate bonded to the road surface in an epoxy or polyurethane resin so are included in the same specification.

Proprietary surfacing systems shall be applied in accordance with the manufacturer's specification and by the manufacturer's approved applicators.

Documents that relate to this section are the NZTA Specification M/6 : Sealing Chip.

All technical documentation regarding the proprietary product or system to be used shall be submitted.

#### 3.5.6.1 Surface Preparation

The surface shall be clean of any dust, detritus or loose matter. Any oil visible on the surface shall be removed by washing with a detergent solution, followed by flushing with clean water, or other suitable system.

Care shall be taken to ensure that no solid matter enters any waterway or stormwater system as a result of the removal operation. This may require the placement of filters or similar on catch pits and other drainage features.

The surface is to be completely dry before application of the binder.

All existing line marking, pavement markers, catch pits and kerbing shall be suitably masked so that only the road surfacing is coated.

The suitability of application to the pavement at the sites specified shall be discussed with Council using the manufacturer's guidelines.

#### 3.5.6.2 Binder

The binder shall be a suitable epoxy, polyurethane or other approved proprietary product compound. When used in conjunction with coloured aggregates the binder shall be pigmented to the same colour as the aggregate. Thermo plastic binders shall not be used.

The cured binder shall be flexible so that it does not crack or delaminate under traffic loadings on non-rigid pavements.

The binder shall be capable of holding the aggregates so they do not become embedded or dislodged under heavy braking.

#### 3.5.6.3 High Friction Aggregate

The aggregate shall be calcined bauxite or equivalent, which has a PSV greater than 70 when tested in accordance with BS 812-Part 114.

The grading of the aggregate shall be as follows.

a) less than 5% retained on 4.75mm BS sieve
b) less than 5% passing 1.18mm BS sieve

The aggregate shall be clean and free of foreign matter. The aggregate shall comply with the NZTA specification M/6 strength, shape and weathering resistance requirements.

#### 3.5.6.4 Coloured Aggregate

The aggregate shall be a chemically inert, semi translucent, synthetic aggregate that complies with shape, strength and weathering requirements of the NZTA specification M/6 and is coated with colouring compound(s) to produce the specified colour.

The grading of the aggregate shall be as follows.

a) less than 5% retained on 4.75mm BS sieve

b) less than 5% passing 1.18mm BS sieve

The aggregate and binder system shall be designed to achieve a high level of colour retention and resistance to both traffic abrasion and weather such that colour is intact and effective for at least five years from the initial installation. The aggregate shall have a minimum PSV value of 50 when tested in accordance with BS 812-Part 114. The surfacing must be capable of being cleaned by high pressure water jet to remove dirt, grime and debris in order to restore the colour.

#### 3.5.6.5 Mixing, Batching and Application

The manufacturer's guidelines for the mixing, batching and application rates of product shall be followed, unless otherwise directed by Council.

#### 3.5.6.6 Curing and Aftercare

All masking shall be removed together with the binder adhering to it. During the curing period, no disturbances or trafficking of the treated surface is permitted.

The cure time shall be to the manufacturer's recommendations required under the particular site conditions.

Before trafficking, excess chip shall be removed. Along with any subsequent chip which may have eroded off the treatment for a period of one month following opening of surface to traffic.

#### 3.5.6.7 Performance

The minimum performance requirements are:

a) SCRIM Value – shall be at least 0.7 ESC

b) Aggregate Retention – a visual assessment of the surfacing shall be performed to assess the level of coverage and retention. Aggregate retention shall be assessed by determining coverage on any 300mm x 300mm area. The surface shall be rejected if any three locations have less than 95% chip coverage

c) Texture Depth – the surfacing shall be rejected if any three locations have a mean profile depth of 1.0 mm or less (105mm sand circle if determined in accordance with NZTA Specification T/3)

d) Cracking/Delamination/Sliding – the surfacing shall be rejected if there are any of the above conditions present at the end of the three month defect liability period.

#### 3.5.6.8 Cleaning

When cleaning of existing high friction or coloured surfacing is required, a high-pressure water jet or other suitable means shall be used to remove all dirt, grime, debris and the like from the surface. Care shall be taken to avoid damage to the surfacing.

Care shall be taken to ensure that no solid matter enters any waterway or stormwater system as a result of the removal operation. This may require the placement of filters or similar on catch pits and other drainage features.

### 3.5.7 Coloured Markings

When specified, some markings may be required in colours other than white or yellow.

Typical applications are.

a) Green for cycle way markings or bus only lanes

b) Blue for disabled car park spaces

Actual colours will be specified at the time. Such markings shall use the applicable paint type specified in section 3.5.2, coloured to the specified colour. Paint application shall be in accordance with the relevant clauses of this specification.

### 3.5.8 Temporary Markings

When specified, temporary markings may be required that can easily be removed when no longer needed. Such markings shall be capable of withstanding normal road traffic and weather conditions for a period of at least three months, or longer if specified. When no longer required the markings shall be removed without causing damage to the underlying road surface.

Full details of materials proposed for temporary markings, their method of application and removal, and typical properties shall be supplied with any proposal for use. All materials shall be handled and applied in strict accordance with manufacturer’s specifications and datasheets. In particular, all environmental precautions shall be adhered to.

Typical methods of temporary marking include ‘removable paint’ and self-adhesive road marking tape.

### 3.5.9 Non Standard Markings

#### 3.5.9.1 Cycle Symbols

The cycle symbol shall be set out in accordance with the NZTA Traffic Control Devices Manual but may be scaled to be 1200mm or 800mm high as directed by Council.

#### 3.5.9.2 Cycleway 'End'

The word 'End' shall be painted at the end of cycle lanes along with a cycleway symbol, where directed by Council. 'End' shall be 600mm high x 900mm long.

#### 3.5.9.3 Cycleway Hold Bars

Cycleway hold bars are used at signalised intersections with advance cycle 'stopboxes'. The cycleway hold bars shall be 100mm wide with 200mm gap. Refer to Drawing D3.9.1 for more details.

#### 3.5.9.4 Cycleway Hook Turns

Cycleway hook turns are to be provided at signalised intersections where turning right is likely to be considered a difficult manoeuvre for cyclists. Final cyclist provisions are to be confirmed by Council.

#### 3.5.9.5 Speed Cushions and Speed Humps

The approach faces of speed cushions and speed humps shall be painted with reflectorised white triangles to facilitate visibility. The width of the triangles shall be such that there are at least three triangles on each speed cushion and the depth shall cover the full depth of the tapered approach face of the speed cushion.

#### 3.5.9.6 Pedestrian Platforms

The faces of raised pedestrian crossing platforms and full width speed control devices shall be marked with white reflectorised cross-hatching as dimensioned in Traffic Control Devices Rule Diagram M4-2. Unless otherwise stated, poles located within medians shall be installed with a socketed base to allow quick and easy replacement.

## 3.6 Street Lighting Construction

### 3.6.1 Installation

Each streetlight position is an Installation as defined in AS/NZS3000.

All construction work to be undertaken by competent/approved contractors and in accordance with the Electricity Regulations 2010, AS/NZS3000 and the applicable Electrical Codes of Practice. The most recent amendments must be used and approved by the network company.

All installations are subject to test and provision of ESC or CoC.

### 3.6.2 Connection to network

All proposed street lighting connections must be approved by the relevant network company prior to commencement of the project.

The steps to follow in pre- installation and installation stages are outlined below:

- Submit proposed design/ lighting plan to the network company for verification of supply points
- Submit Application for New connections detailing additional load required for new streetlights

In order to liven new lighting installations, the network company will require the following documentation:

- Approved Application for New Connection
- CoC or ESC signed by authorized person
- As-builts in format approved by the network company
- Confirmation of practical completion or 224c sign off.

All parties involved in the street lighting installation shall comply with the network company's design and connections standards and procedures.

### 3.6.3 Installation

All Columns are to be installed in accordance with the manufacturer's specification, electrical codes and health and safety acts.

The column position in developed areas shall be pegged in advance of the work and adjacent property owners notified in writing of the works so that any issues over column location can be resolved before installation begins.

Contractor to submit Corridor Access Request and confirm underground services location prior to groundworks commencing in developed areas.

If the contractor finds underground bed rock (e.g. rhyolite) or finds underground services not allowed for, that precludes installing a column in the desired location, they are to contact the council for guidance rather than simply moving the column.

Any groundwork carried out for installation is to be re-instated to council's standard.

Access doors shall be accessible.

Any damage caused prior to the hand-over to council must be repaired as new with all warranties remaining intact.

Internal wiring, earthing and circuit protection devices to comply with the network company's Design and Construction Standard.

Luminaires shall be installed on columns in accordance with the manufacturer's recommendations. The horizontal axis shall be level and with the specified tilt angle. Where existing brackets or outreaches have a different tilt angle to that specified for new lights, new luminaire with internal tilt mechanism may be used or suitable tilt wedges shall be installed so that the existing luminaires have the same tilt angle as any new fittings.

### 3.6.4 Cables

Underground cable installations shall be provided to all street lighting columns except for lights specified to be installed on existing power poles. Cable route and conductor sizes shall be designed and installed in accordance with network company's requirements. Warranty period for new cables is 12 months.

All new installations shall be designed to be controlled through the Network Owner's control system.

All column installations shall be provided with approved internal termination junction boxes for terminating lighting circuits. These are to be located at the gear openings of each column.

Cables installed vertically on power poles shall be fitted and enclosed in accordance with requirements of the network company.

### 3.6.5 Trenching

Underground cables to be installed to the network company's requirements. In order to prevent damage to road pavement and minimise disruption to the public thrusting must be used under existing carriageways, vehicle entrances and footpaths

Location of the cables in green fields should be as detailed in Drawing D3.1.3 Location of Services in Transport Corridor.

### 3.6.6 Lighting Upgrades

Where lighting columns or circuits are being relocated, extended or upgraded, the existing supply, protective devices and switching control may be reused if it is in compliance with this specification.

In the event that an existing circuit is extended, the network company will confirm if the supply relays and fuses are suitably rated for the additional electrical load of the new lights. The Contractor will be responsible for any costs associated with uprating the supply point, fusing, changing relays or fitting contactor sets associated with the additional lighting load.

All additional fittings and materials used shall be new and consistent throughout the installation. If in-fill lighting or continuation of an existing system the new fittings and materials shall match the existing, if practicable.

### 3.6.7 Existing Luminaires, Columns and Control Gear Made Redundant

The Council's Street Light Maintenance Contractor shall be given an opportunity to acquire any surplus luminaires, columns and associated spare parts made redundant, for the purpose of utilising them as maintenance spares. The Contractor shall be responsible for disposing of any redundant 'not wanted' materials including capacitors containing PCBs.

All non-usable parts are to be disposed of correctly and certificates provided to Council to this effect.

### 3.6.8 Inspections and Testing

Prior to commissioning all inspections and testing required by the network company shall be carried out. Written confirmation is required from the network company that it accepts all underground cabling and circuitry and will assume responsibility for future maintenance and renewal.

A lux survey may be requested by Council at the contractor's cost.

## 3.7 Traffic Signals

### 3.7.1 Scope

This section covers the procedure and requirements for all new or upgraded traffic signals that are to be managed by Hamilton City Council. This includes the design, supply, installation, and commissioning of new and existing traffic signal equipment.

### 3.7.2 Specifications

All traffic signals are to be installed in accordance with the Specifications and Standards listed in Clause 3.1.2. The following Council specifications supersede NZTA P43 requirements.

Where reference is made in any Specification to RCA or Client, this shall be read as Council.

### 3.7.3 Traffic Signal Equipment

#### 3.7.3.1 General

This section contains specific requirements for the supply and installation of the controller, detectors, junction boxes and poles.

#### 3.7.3.2 Traffic signal controller

Unless specified, the coating colour shall the industry standard to match existing controllers in Hamilton.

A sticker shall be placed on each controller box in accordance with the following figure.




*Drawing 1:3-1 Traffic Signal Box Sign*

#### 3.7.3.3 Detector Loop Encapsulation

The approved flexible sealant as referred to in P43 is Plasticast LQB Tixophiate, which is a two part epoxy compound formulated specifically for the encapsulating of traffic signal detector cable loops which are embedded in asphaltic road surfaces.

#### 3.7.3.4 Kerbside Junction Boxes

Access for loop-feeder between detector loop and toby box may be obtained in two ways:

a) **Under kerb access** - to be used in all cases where new kerb and channel is to be constructed; Under kerb access shall consist of 25mm alkathene water pipe laid from the toby box under the kerb and to within 50mm of the top of the seal and within 100mm of the edge of the seal. The access hole in the pavement shall be backfilled, compacted with basecourse material, and sealed.

b) **Saw cut through kerb and channel** - may be used where existing kerb is to be retained. A 5mm wide saw-cut may be made through the kerb and channel and sealed with Sikadur 43 epoxy resin mortar* or equivalent.

#### 3.7.3.5 Shop Verandas, Poles and Other Obstructions

Any obstructions which will interfere with the installation, visibility or operation of the signals will be removed or altered by the Contractor.

Where such obstacles originate in private property, clearance to proceed with this work shall first be obtained from Council. Some delay may occur while the property owner is contacted.

***Note**: All alterations to services will be undertaken by the appropriate service authority*

### 3.7.4 Communications

Unless otherwise specified, all new traffic signals and cameras shall be connected to the HCC City Transportation Unit's (CTU) traffic signal network. This network uses a combination of 4G wireless, fibre and point-to-point links. Either one of these methods may be appropriate for the site. Council will advise the appropriate communication method for the site and in most cases will provide pre-configured hardware for the Contractor to install, such as a router and radio.

A radio must be mounted appropriately (typically attached to a signal pole) to achieve the signal strength requirements. The router shall be housed in the traffic signal controller cabinet.

Each installation must include initial site coverage testing and scoping, power supply to the radio, and all associated ducting and cables including a shielded outdoor grade cat6 cable from the controller to the radio running inside the pole to the radio mounting location.

The traffic signal controller must achieve continuous SCATS communications for a minimum of 48 hours prior to commissioning.

### 3.7.5 Provision of Cameras

Unless otherwise specified by Council a traffic monitoring camera must be installed and connected at all new traffic signal installations or sites subject to major upgrade, with the exception of mid-block pedestrian crossings. All camera hardware must have a minimum warranty period of 12 months from the date of installation.

#### 3.7.5.1 Camera Specifications

Traffic monitoring camera must meet the following technical requirements:

a) Cameras are to be digital, IP based, PTZ, outdoor units
b) Each new installation shall include the camera and PTZ unit, controller and communications interface, power feed, housing, mounting, and pole (if required)
c) Cameras must be compatible with the Milestone and DVTel management systems
d) Unless specified, the required camera viewing distance shall be assumed to be 250m
e) Minimum 12x optical zoom
f) The zoom and stability shall be such that the displayed image at the viewing distance with maximum optical zoom is no larger than the road carriageway, and image shake does not exceed 3% of the image size in any direction
g) Image sensor must be colour CCD with minimum size ¼'
h) Minimum horizontal resolution of 480 lines
i) Appropriate sensitivity and image correction for day and night observations
j) 360 degree pan rotation with image auto-flip, allowing tilt from horizontal to -90 degrees
k) Minimum of 10 pre-set PTZ positions
l) Camera and housing to provide a minimum IP66 ingress protection to IEC 60529, and include a sun shield and condensation prevention
m) Appropriate video compression to communicate over the communications network (H264 is the preferred method)

#### 3.7.5.2 Camera Location and Mounting

The camera should be located such that:

a) Every traffic lane is visible at the intersection limit line
b) Required viewing distance is achieved down each leg
c) Viewing is optimised for legs with adjacent signalised intersections

Unless otherwise specified, mounting on a traffic signal pole such as a Joint Use Mast Arm (JUMA) is permitted where practical.

The Contractor shall supply and install a shielded outdoor grade cat6 cable from the controller to the camera location, running inside the pole to the camera mounting location.

Council must approve the final location prior to installation of pole or camera. A site assessment plan showing the location and visibility of the proposed camera must be provided to Council for approval.

### 3.7.6 Warrantees, Guarantees and Maintenance

All materials and equipment supplied and/or installed (including the installation) shall have guarantees and warrantees in accordance with P43.

Practical completion will not be issued until Kaipara District Council, and the current signals maintenance contractor have approved the works and site operation. Kaipara District Council's Signal Maintenance Contractor will carry out regular maintenance on the intersection immediately following practical completion and if any faulty equipment or installation work is identified, then the Contractor responsible for installing the equipment will be required to fix and/or supply parts to fix the fault at no cost to the Road Controlling Authority.

During the construction and maintenance periods, the Contractor shall also be required to pay all costs incurred by Kaipara District Council's Signal Maintenance Contractor (who has been contracted to maintain the overall intersection) for isolating and making safe any reported faults which can be directly attributed to the signal installation or modification work. This includes any faults in materials, equipment or workmanship. The Contractor will be invoiced separately for this work or more commonly, the amount will be deducted from the contract price or from any maintenance retentions owing.

At the end of the maintenance/defects liability period the equipment shall be handed over in full working order with no defects. Where such defects exist, whether in control equipment, detectors, or signal hardware or in any part of the equipment supplied, these shall be made good at no expense to Kaipara District Council.

### 3.7.7 Design Requirements

#### 3.7.7.1 Filter Turn Warrant

A right turn may be permitted to filter unless any of the following criteria are met:

a) The right turn movement has experienced more than five "right turn against" type injury accidents in the last five years. This requires further consideration – see below

b) Visibility is less than the safe stopping distance at the design speed, either by horizontal or vertical alignment, or where the opposite right turn hides approaching through traffic
c) There are three (or more) opposing through lanes to cross
d) The right turn movement has two (or more) right turn lanes
e) There are two (or more) opposing left turn lanes
f) There is a need to provide protection of the pedestrian crossing at all times.
g) The 85th percentile operating speed of opposing traffic is greater than 70 km/h

Where an existing filtered movement has more than five “right turn against” type injury accidents, two further aspects should be reviewed:

a) The accidents should be investigated to determine if there are any common factors such as time of day. If the accidents predominantly occur during similar periods, consideration should be given to providing a time based filter.
b) Consideration should be given to undertaking a benefit cost analysis for the filter turn, where an intersection relies on a filter movement to operate effectively during peak periods. If travel time savings gained from the filter turn sufficiently outweigh the associated accident cost, the filter turn could be retained.

The decision to allow or prohibit a movement to filter is a complex engineering decision. While the above criteria provide guidance in assessing if a filtered right turn is appropriate, good engineering judgement must still be applied during each assessment.

### 3.7.7.2 Pedestrian Protection

Pedestrian protection shall be provided at all new and upgraded traffic signals

Unless otherwise specified, pedestrians at intersections should be protected as follows:

- Red arrow aspects installed for left turn traffic to provide partial protection (i.e. during the pedestrian walk time)
- Red arrow aspects installed for right turn traffic to provide full protection (i.e. the red arrow remains for the walk and clearance time)

At intersections with low pedestrian and vehicle volumes, protection may be provided using a delayed start for the conflicting vehicle movements

Protection is typically provided during part or all of the walk time, determined on a site by site basis as appropriate for the number of vehicle-pedestrian conflicts. At intersections with high pedestrian volumes where there is greater concern for pedestrian vulnerability, protection

should be provided for the walk time and some or all of the clearance time for conflicting vehicles.

Full pedestrian protection should be considered at sites where an unusual layout causes vehicles to interact dangerously with pedestrians, and consideration needs to be given to conflicting movements to ensure capacity is not overly compromised.

Where a priority pedestrian crossing has no conflicting vehicle movements and is adjacent to a main vehicle movement, the pedestrian phase should allow late introduction of the pedestrian phase if sufficient time is available to complete the crossing within the associated vehicle phase.

#### 3.7.7.3 Advanced vehicle detectors

Advanced detectors can be costly to install and maintain but typically provide efficiency and safety benefits. The suitability, number of detectors and their location shall be assessed on a site by site basis.

At new intersections, advanced detectors should generally be provided on arterial roads and any road with a posted speed limit above 50 km/h.

#### 3.7.7.4 Network Operating Plan

The Hamilton Network Operating Plan covers day to day operation of the network in a way that seeks to optimise the existing infrastructure and reflects the strategic priorities that have been assigned to each of the user modes by location and time of day.

Any new or modified traffic signal site shall be assessed against the strategic intentions discussed in the Network Operating Plan to ensure that they will reflect the defined road user hierarchy and priorities.

### 3.7.8 Traffic Signal Procedure

The procedure set out in the table below applies to all Traffic signals that are to be managed by CTU, including traffic signals that are installed on other RCA networks such as the local State Highway network, Waipa District Council and Waikato District Council.

The table provides an overview of the entire process including the approvals and deliverables required to enable the traffic signals to be managed by CTU.

## *Table 3-18: Procedures: Signal Plans, Software and Commissioning*

| Task | Supply | Description / requirements | Created by | Approved by |
|---|---|---|---|---|
| Brief | Design brief | Design brief given to the signal's consultant describing the traffic signal and civil works required | Client | Signals consultant |
| Justification | Justification report | Report justifying the need for traffic signal control | Signals consultant | Client |
| Design | Report, plan and traffic modelling | Design plans and design report in accordance with relevant standards.<br>Level of service and 95%ile queue lengths for morning and evening peaks<br>A site plan with the preliminary design superimposed showing:<br>• posts, lanterns, streetlighting<br>• detectors<br>• controller<br>• road marking, signage and cycle facilities<br>• phasing diagram and cabling diagram<br>• 5 year CAS data | Signals consultant | Client and City Transportation |
| Peer review | Review report | Peer review audit by external competent traffic signal designer, of design plan and design report<br>Reviewer to supply letter of approval/memorandum with plan number once any amendments have been discussed and noted | External design reviewer | Signals consultant and City Transportation |
| Final design | Drawings and estimate | Final design plans including cable diagrams and phasing Schedule of quantities including cable charts Cost estimate<br>Final design report<br>Pre-construction Safety Audit covering Traffic Signals | Signals consultant | Client<br>Copy of Plans and Safety audit to City Transportation HCC for approval |
| Tender | | Tender documents, schedule, equipment and installation specification<br>City Transportation to check technical documents.<br>Appropriate references to the HCC ITS. | | |
| Controller | Controller Information Sheets (CIS) | Controller Information Sheets (CIS) includes:<br>• Controller type<br>• Lane layout<br>• Detectors | Signals consultant or council approved for | City Transportation Controller |

| Task | Supply | Description / requirements | Created by | Approved by |
|---|---|---|---|---|
| | | • Phasing<br>• Signal group numbering<br>• Timing details both vehicle and pedestrian<br>• Pedestrian crossing distances<br>• Flexi-link details<br>• Special facility requirements | review signal consultant | |
| Controller | Controller software | Controller software including independent WinTraff test of PROM Bench testing of software must be carried out by the contractor prior to commissioning and bench testing Completed bench form supplied (refer P43) | Signals consultant or city transportation nominated consultant | City Transportation Controller |
| Supervision | Supervision | Construction supervision/MSQA | | Client or nominated representative |
| Connections | Connection for communications, cameras and power | Communications: See Clause 3.6.4.<br>The traffic signal controller must achieve continuous SCATS communications for a minimum of 48 hours prior to commissioning.<br>Power: For sites within Hamilton a Wel networks connection form (www.wel.co.nz) must be filled in and a sent to newconnections@vircomems.co.nz (Contact energy) at least six weeks prior to commissioning.<br>A copy must also be sent to the energy manager at Hamilton City Council for creation of new accounts. WEL Networks will provide an ICP and physical connection and return to Contact for the completion of the new connection | Signals Contractor | City Transportation |
| SCATS | System set up and testing | SCATS graphics, related data and linking setup in accordance with HCC Traffic Signals, Operational Standards Document | City Transportation | City Transportation |
| Pre commission checks | Completed site acceptance test (SAT) | Signals contractor shall complete the SAT (refer P43) in the presence of the RCA traffic signal representative (City Transportation) | Signals contractor | City Transportation |
| Commissioning | Authorisation to switch on the traffic signals | Handover of new/upgraded to City Transportation to operate and manage | City signals Transportation and contractor | City Transportation |

| Task | Supply | Description / requirements | Created by | Approved by |
|---|---|---|---|---|
| | | Signed SAT and written approval to switch on the traffic signals by the RCA traffic signals representative (City Transportation)<br>Unless specific approval is given, commissioning shall not take place on a Friday or the day before a public holiday | | |
| Asset information | Asbuilts and associated documentation | Contractor supply all information as stated in P43 including:<br>• Final plans showing ducting and layout<br>• RAMM Asset collection Sheet<br>• C&I sheet<br>• Keys<br>• Test Certificates<br>• Producer statements<br>• Cable termination chart | Signals contractor | Client and City Transportation |
| Safety Audit | Post construction Safety Audit | A post conduction safety audit will be required at all new sites and upgraded signals that are complex or within high speed areas.<br>Client may request a post construction safety audit following any traffic signal upgrades or modifications at their discretion. | Qualified safety auditor | Client/City Transportation |

## 3.8 Quality Systems

This section is intended to describe the formal testing and acceptance requirements of construction. The design portion of this document must be read and complied with fully.

### 3.8.1 Inspections and Acceptance

This section details the inspections and hold points where council acceptance is required before continuing. Site visits may be carried out at any time during construction. Specific details about testing measures are detailed in section 3.8.2.

#### 3.8.1.1 Carriageway Construction Inspections

After completion of the subgrade, sub-base and basecourse layers, testing in accordance with clause 3.8.2.2 shall be carried out:

#### 3.8.1.2 Hold Points

- Kerb and Channel
- Footpath and Cycleway
- Signs and other street furniture
- Street Lighting

The Installation contractor shall provide the following documentation to Council:

a) Approved Application for New Connection
b) Electrical Certificate of Compliance or Electrical Safety Certificate signed by authorised person
c) As built drawings in format approved by the electrical network provider including results of inspections and testing.
d) Streetlight control point form.
e) Lighting pole and luminaire data using RAMM Streetlight Data Form F3.10.
f) Network company's approval sheet

#### 3.8.1.3 Traffic Signals

Traffic signals have a specific procedure set out in 3.7.8.

### 3.8.2 Testing Guidelines

The following are a summary of the testing requirements. The results of each of these tests must be provided to Council.

#### 3.8.2.1 Carriageway Test Spacing

Compaction and material strength tests are to be taken at the following locations and frequency:

***Table 3-19: Test Spacing locations and frequency***

| | | |
|---|---|---|
| For carriageways 4.0m wide and less | Along centreline | 15m spacing between tests |
| For carriageways between 4.0m and 8.0m | At the kerbside wheel tracks | Alternating Sides, 10 centreline metres between tests (20m repetition of testing rows) |
| For carriageways 8.0m and wider | At centreline and kerbside wheel tracks | Staggered across road, 10 centreline metres between tests (30m repetition of testing rows) |

On small sites there must be a minimum of 10 tests carried out.

The kerbside wheel tracks are assumed to be 1m inside the kerb and channel alignment.

#### 3.8.2.2 Subgrade Testing Prior to Design

Subgrade testing should begin at 100mm above the design subgrade level.

Subgrade testing is to be by Scala Penetrometer for all materials that are suitable.

If the material has larger aggregates, then a Clegg Hammer test should be used instead.

#### 3.8.2.3 Subgrade Testing Prior to Sub-base Construction

If subgrade improvement measures have been carried out (such as replacement with Pit Sand, Granular Rock Fill Material, or use of a stabilisation agent) Pit Sand or stabilised materials shall be tested by Scala Penetrometer. Granular rock shall be tested by Clegg Hammer.

The shape of the subgrade shall be measured by stringing.

#### 3.8.2.4 Sub-base Testing

The compaction of sub-base shall be tested by Nuclear Densometer.

The thickness and shape of sub-base shall be measured by stringing. Clegg hammer testing is also required.

#### 3.8.2.5 Basecourse Testing

The compaction of basecourse shall be tested by Nuclear Densometer.

The thickness and shape of basecourse shall be measured by stringing. Clegg hammer testing is also required.

#### 3.8.2.6 Sealed Surface Testing

Just prior to the surface receiving its first surfacing coat, Benkelman beam testing shall be carried out.

#### 3.8.2.7 Footpath Testing

Scala subgrade tests are to be carried out at 15m intervals along the length of the footpath.

#### 3.8.2.8 Private Way Testing

As part of the compliance evidence for the construction of Private Ways, the forms are to be completed and submitted. See F3.11 on page 187.

#### 3.8.2.9 Vehicle Crossings/Entranceways

A minimum of three scala penetrometer tests randomly spread shall be taken to a depth of 300mm below the final subgrade level per crossing. One test per $5m^2$ on crossings greater than $15m^2$ (kerb to boundary).

#### 3.8.2.10 Kerb and Channel

If kerb and channel is constructed on top of the same sub-base pavement as the carriageway there are no additional subgrade or sub-base tests required.

If kerb and channel is constructed separate to the road, the base that the kerb and channel is founded on must be tested every 15m by Clegg Hammer (to sub-base standard). The pavement reconstruction adjacent to the kerb must be tested every 15m by Clegg Hammer prior to surfacing (to basecourse standard).

### 3.8.3 Testing Methods

#### 3.8.3.1 Scala Penetrometer

The Scala Penetrometer shall only be employed where a significant part of the particles pass a 9.5mm sieve.

The CBR vs Penetration graph for sand silt materials is shown on Drawing D3.2.2.

The cone is bedded into the soil with one (or more) blows. The zero point for depth and the number of blows is taken neglecting the bedding blows.

There are 2 methods of recording the results and all test sites must comply.

*Table 3-20: Procedures*

| CBR | Max mm/blow | Min lows/100mm |
|---|---|---|
| 7 | 32 | 3 |
| 10 (footpath and vehicle crossing subgrade) | 23 | 4 |
| 15 (carriageway subgrade) | 17 | 6 |

As a means of compliance for an acceptable CBR in carriageways at the insitu subgrade, the scala readings are averaged for the top 600mm. At the imported subgrade or lower subbase surface, the scala readings are averaged for the full depth of the pavement layer being tested.

For footpath and vehicle crossing subgrade testing, the results are the average of the top 300mm.

#### 3.8.3.2 Lab Tested Soaked CBR

Subgrade samples from the site are to be tested by an IANZ accredited laboratory for their Soaked CBR (California Bearing Ratio).

#### 3.8.3.3 Clegg Hammer

Where the Clegg Hammer is used, it shall be the Standard Australian Digital model with a 4.5kg compaction hammer, using a drop height of 450mm. The test certificate must be less than 12 months old.

Testing is carried out on a surface that has no loose material (removed by scuffing with a stiff hand broom). The maximum Clegg Impact Value (CIV) at the end of the 4th blow shall be recorded and the on-site CBR value shall be taken as $0.07\ (CIV)^2$.

*Table 3-21: Quality Systems Testing – Clegg Hammer Compliance Values*

| Compliance Values | Clegg Impact Value (CIV) |
|---|---|
| Aggregate Subgrade (e.g. Granular rock fill material) | 15 |
| Subbase (trench reinstatement only) | 25 |
| Basecourse (trench reinstatement only) | 40 |

#### 3.8.3.4 Nuclear Densometer

Compaction testing shall be carried out by a suitably qualified operator using a calibrated Nuclear Densometer in Backscatter Transmission mode. The compaction is measured as a percentage of the Maximum Dry Density of the material.

The test spacings for nuclear densometer may be double the standard carriageway test spacings shown in Clause 3.8.2.1 with a minimum of 5 tests per site.

***Table 3-22: Quality Systems Testing – Nuclear Densometer Compliance Values***

| Compliance Values | Minimum Value | Average (mean) Value |
|---|---|---|
| Subbase | 92% MDD | 95% MDD |
| Basecourse | 95% MDD | 98% MDD |

### 3.8.3.5 Benkelman Beam Test

The surface shall be tested prior to sealing with a standard Benkelman Beam test apparatus. The organisation carrying out the tests shall have an IANZ accreditation.

The beam test shall be undertaken in accordance with NZTA's specification T/1 : Benkelman Beam Deflection Measurement except that the recordings for bowl deflection shall not be recorded or used in the deflection calculation.

Deflections conform to the target figures in Table 3-15 below. No more than 10% of the test results shall exceed the 90th Percentile and no single result shall exceed the maximum.

***Table 3-23: Maximum Benkelman Beam Deflections***

| | Average (MM) | 90th Percentile (MM) | Maximum (MM) |
|---|---|---|---|
| **A. On carriageways where asphalt is to be placed (with the exception of where asphalt is to be placed at cul-de-sac heads only):** | | | |
| A1: Residential cul-de-sacs and private ways ≤40 household units | 1.30 | 1.60 | 2.10 |
| A2: All other carriageways up to $10^5$ EDA | 1.10 | 1.35 | 1.80 |
| A3: All other carriageways up to $10^5$ and $10^6$ EDA | 1.00 | 1.20 | 1.60 |
| **B. On other carriageways surfacing situations (factored by 1.5 for block paving):** | | | |
| B1: Residential cul-de-sacs and private ways ≤40 household units | 1.50 | 1.80 | 2.40 |
| B2: All other carriageways up to $10^5$ EDA | 1.25 | 1.50 | 2.60 |
| B3: All other carriageways up to $10^5$ and $10^6$ EDA | 1.00 | 1.20 | 1.60 |

*Table 3-24: Shape and Relative Height Tolerances*

| At top of layer | Centreline and near pavement edge | At channel edge | Deviation from 3m straight edge or camber board |
|---|---|---|---|
| Surface | | | 1: 12mm<br>2: 8mm |
| Basecourse | -5mm to +15mm | 1: 0mm to +10mm | 12mm |
| Sub-base | -25mm to +5mm | -25mm to +5mm | 15mm |
| Subgrade | -30mm to 0mm | -30mm to 0mm | 15mm |

1: Chip sealed surface

2: Asphalt surface (typically 25mm thick)

Construction levels are based on lip of channel, appropriate crossfall and designed pavement layer thickness.

#### 3.8.3.6 NAASRA Roughness

A post sealing NAASRA roughness measure is required. This measure shall be 70 maximum average value with no more than 3% readings in excess of 70 for each traffic lane. The Engineer will not consider remedial measures other than remaking of the pavement surface for NAASRA roughness compliance. The survey result is required to be provided prior to the issue of a practical completion certificate or 224C.

***Roughness Specification***

All road roughness surveys shall be in accordance with the latest revision of the “RAMM Computer User’s Manual”, “RU Technical Recommendation TR12 Roughness Meter Guidelines” and “Standard Operating Instructions for the NAASRA Roughness Meter” or the RIMS “Specification for Road Condition Data Collection”. All results are to be reported as NAASRA counts.

The Project Manager and test operators shall be suitably experienced and familiar with the test equipment and results required.

Measurements are to be taken on the various road types as follows:

- On narrow single carriageway roads measurements are to be taken in the normal driven wheel path. This is likely to straddle the road centreline. The survey is to be completed in one direction only. Data processing techniques should account for instances when the vehicle deviates from the road onto the shoulder.

- On single carriageway, two-lane roads both increasing and decreasing lanes are to be measured. The measurements are to be taken in the wheel paths. Where no obvious wheel path is visible the measurements are to be taken 50 to 70 cm from the edge of the pavement.
- On divided carriageway roads and service lanes survey both increasing and decreasing lanes (both carriageways and service lanes). The measurements are to be taken in the wheel paths; where no obvious wheel path is visible the measurements are to be taken 50 to 70 cm from the edge of the pavement.
- On dual carriageway roads survey both increasing and decreasing lanes (both carriageways). The measurements are to be taken in the most heavily trafficked wheel paths; where no obvious wheel path is visible the measurements are to be taken 50 to 70 cm from the edge of the pavement.

***Laser Profilometer***

The Consultant may use a non-contact laser profilometer to measure the paved roads' longitudinal profile. The profilometer should conform to the ASTM E950-94 standard, have a vertical resolution of less than 0.1 mm, and achieve a roughness measurement accuracy of< 0.1 mm. The Consultant shall record and report the longitudinal profile data and process the profile data to provide and report NAASRA count/km.

The lane roughness calculations are made from the average of the left and right wheel path profiles, and the data recorded and reported as follows:

- Number of wheel paths: two
- Longitudinal profile sampling interval: no more than 25mm
- NAASRA Counts interval 20m and 100m.

Any factors which may influence the survey result must be recorded during the survey and the data corrected accordingly. These factors include, for example, survey speed in congested areas, traffic congestion, sudden braking, and other events.

Some operational practices, such as sudden acceleration or braking during surveys, may also influence the result and operators should avoid these.

***Response Type Roughness Meter***

The roughness data may be collected using a single/dual response-type roughness meter/s or similar, with the instrument calibrated in accordance with ASTM E 144892/98. The roughness data must be reported at 20 m and 100m intervals in NAASRA count/km. The

vehicle speed shall be recorded during the survey and taken into account when calculating the roughness from the raw data.

Factors which may influence data quality must be recorded during the survey and the data corrected accordingly. These include, for example, traffic congestion, pavement construction activities and having to travel off the carriageway.

***Equipment Validation***

Roughness measurement equipment with current NZTA approval for use on the State Highway network may be used without further validation checks. Other equipment must be validated before use as described in the RIMS High Speed Data Collection Guidelines.

### 3.8.4 As-built Data Provision

Refer to Section 1.7.2. RAMM Asset Data Template is available on request.

# APPENDIX 3A: TRANSPORTATION CORRIDOR HIERARCHY TABLES

Following are links to the transportation corridor hierarchy tables for each participating council:

***Table 3-25: Transportation corridor hierarchy tables***

| COUNCIL | WHERE CURRENTLY HELD | LINK |
|---|---|---|
| Hamilton City Council | District Plan | District Plan \| Hamilton City Council |
| Waikato District Council | District Plan | Waikato District Plan |
| Waipa District Council | District Plan | Waipā District Plan - Waipa District Council |
| Matamata Piako District Council | Development Manual, Page 3-2, Table 3.1 | http://www.mpdc.govt.nz/districtplan/DevelopmentManual/Develop mentManual2015.pdf |
| Hauraki District Council | District Plan | Hauraki District Plan - Hauraki District Council |
| South Waikato District Council | CoP **Urban roads** Page 93, Table 4 | http://www.southwaikato.govt.nz/our-services/planning/Documents/COP/code_of_practice_subdivions_p art_7.pdf |
| | CoP **Rural roads** Page 112, Figure 12 | http://www.southwaikato.govt.nz/our-services/planning/Documents/COP/code_of_practice_subdivions_a ppendices.pdf |
| Otorohanga District Council | | District Plan \| Ōtorohanga District Council \| Ōtorohanga \| Waikato \| NZ |
| Kaipara District Council | District Plan | Operative District Plan 2013, Kaipara District Council |

# APPENDIX 3B: TRANSPORTATION ASSET DATA FORMS

### *Table 3-26: Transportation Asset Data Forms*

| No. | Title |
|---|---|
| | **Quality Forms** |
| F3.1 | Basecourse Shape and Relative Height/Clegg Hammer Test and NDM Checklist |
| F3.2 | Sub-base Shape and Relative Height/Clegg Hammer Test Checklist |
| F3.3 | Subgrade Shape and Relative Height/Scala Penetrometer Test Checklist |
| F3.4 | As-built Data Checklist |
| F3.5 | Subgrade Scala Penetrometer Data Form |
| F3.6 | Trench Backfill Compaction Form |
| | **RAMM Forms** |
| F3.7 | Asphalt Data |
| F3.8 | Chipseal Data |
| F3.9 | Pavement Data |
| F3.10 | Street Light Data |
| F3.11 | Privateway – confirmation of Design, Supervision and Construction |
| F3.12 | Privateway construction materials |

# F3.1 BASECOURSE SHAPE AND RELATIVE HEIGHT / CLEGG HAMMER TEST / NDM (CIRCLE ONE TEST)

| | | |
|---|---|---|
| **SUBDIVISION** | **STAGE** | |
| **PLAN NO.** | **CH FROM** | **TO** |
| **TEST LOCATION** | **ROAD NAME/NUMBER** | |
| **CONTRACTOR** | **DATE** | |

| CH | 1.0M FROM K&C (L) | CENTRELINE | 1.0M FROM K&C (R) | KERB SIDE WHEEL TRACKS | |
|---|---|---|---|---|---|
| | | | | LEFT | RIGHT |
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## F3.1

| **Basecourse Shape / Clegg Hammer Test Completed** (Circle one test). |
|---|
| **Clegg Hammer results attached** ❑ |

| | | | | | |
|---|---|---|---|---|---|
| | Pass | Ch. from: | | to: | |
| | Fail | Ch. from: | | to: | |
| | Remedial work required | | Date of calibration | | |
| | Contractor's control Offset pegs or Grader GPS | | | | |
| | **NDM Results attached** | | Dry density used: | | |

**Comments/Required Remedial Work**

| |
|---|
| |

Signature of Developer/Contractor _____

Signature of Council Representative _____

# F3.2 SUBBASE SHAPE AND RELATIVE HEIGHT / CLEGG HAMMER TEST (CIRCLE ONE TEST)

| | | |
|---|---|---|
| **SUBDIVISION** | **STAGE** | |
| **PLAN NO.** | **CH FROM** | **TO** |
| **TEST LOCATION** | **ROAD NAME/NUMBER** | |
| **CONTRACTOR** | **DATE** | |

| CH | 1.0M FROM K&C (L) | CENTRELINE | 1.0M FROM K&C (R) | KERB SIDE WHEEL TRACKS | |
|---|---|---|---|---|---|
| | | | | LEFT | RIGHT |
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## F3.2

| **Sub-base Shape / Clegg Hammer Test Completed** (Circle one test). |
|---|
| **Clegg Hammer results attached** ❑ |

| | | | | | |
|---|---|---|---|---|---|
| | Pass | Ch. from: | | to: | |
| | Fail | Ch. from: | | to: | |
| | Remedial work required | | Date of calibration | | |
| | Contractor's control Offset pegs or Grader GPS | | | | |
| | **NDM Results attached** | | Dry density used: | | |

**Comments/Required Remedial Work**

| |
|---|
| |

Signature of Developer/Contractor _____

Signature of Council Representative _____

# F3.3 SUBGRADE SHAPE AND RELATIVE HEIGHT/ SCALA PENETROMETER TEST

| | | |
|---|---|---|
| SUBDIVISION | STAGE | |
| PLAN NO. | CH FROM | TO |
| TEST LOCATION | ROAD NAME/NUMBER | |
| CONTRACTOR | DATE | |

| CH | 1.0M FROM K&C (L) | CENTRELINE | 1.0M FROM K&C (R) | KERB SIDE WHEEL TRACKS | |
|---|---|---|---|---|---|
| | | | | LEFT | RIGHT |
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## F3.3

| **Sub-grade Shape / Scala Penetrometer Test Completed** (Circle one test). |
|---|
| **Scala penetrometer test sheet attached** ❑ |

| | | | | | |
|---|---|---|---|---|---|
| | Pass | Ch. from: | | to: | |
| | Fail | Ch. from: | | to: | |
| | Remedial work required | | | | |
| | Contractor's control Offset pegs or Grader GPS | | | | |

**Comments/Required Remedial Work**

| |
|---|
| |

Signature of Developer/Contractor _____

Signature of Council Representative _____

## F3.4 AS-BUILT DATA CHECKLIST

The following are the as-built data requirements to be met:

**DRAWINGS**

Drawings must show the following in a clear and uncluttered way:

| | |
|---|---|
| ☐ | Design centreline and chainage |
| ☐ | Clear indication of the area corresponding to the GST register |
| ☐ | Surfacing Changes and types (e.g. cobbled sections, surfacing joins) |
| ☐ | Typical Cross Section (carriageway width, pavement, surfacing, footpath etc.) |
| ☐ | Footpaths |
| ☐ | Traffic Islands |
| ☐ | Parking / Bus Bays |
| ☐ | Streetlighting Location (with differing symbols for streetlight types) |
| ☐ | Tactile Pavers / Signage / Cycle Parking / Bollards |
| ☐ | Kerb and Channel, Catchpits and other drainage related assets |
| ☐ | Any assets that have been removed or made redundant (e.g. road stopping, streetlight relocations). |

Additional details are required for:

1. Subsoil Drains, Soak Holes, Soak Trenches & Culverts (less than 3.4m²)

☐ As-built drawings ☐ Material ☐ Dimensions

2. Structures, including retaining walls in or bordering the road reserve >1m high, bridges, culverts (greater than 3.4m²), underpasses and any other miscellaneous structures. The following must be provided:

| | | | |
|---|---|---|---|
| ☐ | Construction drawings | ☐ | As-builts drawings |
| ☐ | Producer Statements and Code of Compliance (if applicable) | ☐ | Any applicable guarantees and warranties |
| ☐ | Recommended Maintenance Schedule | ☐ | |

3. Stormwater Management Plans (where there is only a transportation asset and not stormwater) for:

| | | | |
|---|---|---|---|
| ☐ | Swale maintenance schedule | ☐ | Detention pond maintenance schedule |
| ☐ | Overland flowpath maintenance schedule | ☐ | Soakage pit observation bore inspection |

4. Detail Sheets for:

- ☐ Pavement
- ☐ Streetlights
- ☐ Asphalt or chipseal surfacing (including chipseal stone PSV testing sheet)

## DOCUMENTS AND FORMS

1. Structures, including bridges, culverts (greater than 3.4m²), underpasses and any other miscellaneous structures

- ☐ Producer statements (PS3)
- ☐ Recommended maintenance schedule
- ☐ Appliable guarantees and warranties

2. Streetlighting

- ☐ Network company's approval
- ☐ Manufacturer warranty documents for lights, columns and coatings
- ☐ Electrical Certificate of Compliance

3. As-built information, including:

- ☐ Streetlight data forms
- ☐ Pavement data forms
- ☐ Asphalt or chipseal data forms

Signature of Developer/Contractor _____

# F3.5 SUBGRADE SCALA PENETROMETER DATA FORM

**Scala penetrometer testing of subgrade materials to determine consistency.**

Company Name

Tester Name

Subdivision Name and Stage

Testing Date

**Testing Results**

| **Road name** | | |
|---|---|---|
| Displacement | | |
| Location | | |
| Blows top 100mm | Centre/Left/Right/Footpath | Centre/Left/Right/Footpath |
| Blows 100 to 200mm | | |
| Blows 200 to 300mm | | |
| **Road name** | | |
| Displacement | | |
| Location | | |
| Blows top 100mm | Centre/Left/Right/Footpath | Centre/Left/Right/Footpath |
| Blows 100 to 200mm | | |
| Blows 200 to 300mm | | |
| **Road name** | | |
| Displacement | | |
| Location | | |
| Blows top 100mm | Centre/Left/Right/Footpath | Centre/Left/Right/Footpath |
| Blows 100 to 200mm | | |
| Blows 200 to 300mm | | |

## F3.6 TRENCH BACKFILL COMPACTION FORM

(to be completed for excavation reinstatement)

As per the National Code of Practice for Utility Operators, sections 5.5.4 and 5.5.5. Clegg Hammer testing is required for Carriageway Basecourse and Sub-base layers, Driveways and Footpaths prior to surfacing.

The target results are:

| | |
|---|---|
| Carriageway Basecourse | CIV 40 |
| Carriageway Sub-base or Driveways | CIV 35 |
| Footpaths | CIV 25 |

Where the excavated area is greater than 0.5m² and less than 5m², one test is required, or for larger excavations, one test per 5m². For backfilling within the carriageway, testing must be carried out for each backfilled layer.

Company Name

Tester Name CAR Number

**Testing Results**

| | | |
|---|---|---|
| **Test date** | | |
| Road name | | |
| House number/location | | |
| Layer (circle one) | Sub-base / Basecourse / Driveway / Footpath | Sub-base / Basecourse / Driveway / Footpath |
| Clegg Impact Value | | |
| **Test date** | | |
| Road name | | |
| House number/location | | |
| Layer (circle one) | Sub-base / Basecourse / Driveway / Footpath | Sub-base / Basecourse / Driveway / Footpath |
| Clegg Impact Value | | |
| **Test date** | | |
| Road name | | |
| House number/location | | |
| Layer (circle one) | Sub-base / Basecourse / Driveway / Footpath | Sub-base / Basecourse / Driveway / Footpath |
| Clegg Impact Value | | |

## F3.7 RAMM ASPHALT DATA

(to be completed for each seal layer on each road section)

| | |
|---|---|
| Subdivision | |
| Road number/name | |
| Start m | Start description |
| End m | End description |
| Width | Date of work |
| Contractor | |
| Asphalt type (circle one) AC / OGPA / SMA / Other | |
| Grading (e.g. M/10 DG10) | |
| Area surfaced ($m^2$) | Average thickness (mm) |
| Laying temperature ($^oC$) | |
| Tack Coat Residual Application Rate (L/m+) | |
| Additional notes (e.g. weather, temp, polymer modification) | |

## F3.8 RAMM CHIPSEAL DATA

(to be completed for each seal layer on each road section)

| | | |
|---|---|---|
| Subdivision | | |
| Road number/name | | |
| Start m | | Start description |
| End m | | End description |
| Width | | Date of work |
| Contractor | | |
| Seal type (circle one) | 1 Coat / Racked in Chipseal / 2 Coat / Other | |
| Seal reason | Waterproofing First Coat / Second Coat / Asphalt Membrane | |
| Area sealed ($m^2$) | | Chip grading (e.g. 3/5) |
| Binder type (e.g. B180/200) | | |
| Chip Source Company | | |
| Chip Source Quarry | | |
| Total Volume of Binder Used (Hot) (Litres) | | |
| Temperature of Binder (+C) | | |
| Residual Binder Rate (L/m+) | | |
| Cutter (e.g. 3pph Kero) | | |
| Other additives with concentrations (e.g. polymer modification RS1, 3%) | | |
| Sealing notes (e.g. weather, temp) | | |
| | Surfacing Chip PSV testing form attached | |

## F3.9 RAMM PAVEMENT DATA

(to be completed for each road section)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Subdivision | | | | | | | | |
| Road number/name | | | | | | | | |
| Start m | | Start description | | | | | | |
| End m | | End description | | | | | | |
| Width | | | | | | | | |
| **Basecourse** | | | | | | | | |
| Date completed | | | | | | | | |
| Thickness | | | | | | | | |
| Grading | | | | | | | | |
| Quarry | | | | | | | | |
| **Sub-base** | | | | | | | | |
| Date completed | | | | | | | | |
| Thickness | | | | | | | | |
| Grading | | | | | | | | |
| Quarry | | | | | | | | |
| **Undercut/Imported/Subgrade (if required)** | | | | | | | | |
| Whole site | | | | | | | | |
| Length | | Width | | | Depth | | | |
| Backfill material | | | | | | | | |
| **Subgrade** | | | | | | | | |
| CBR without stabilisation material | | | | | | | | |
| Stabilised? | | Yes | | No | | Cement | | Lime |
| % Stabilising agent | | | | Stabilised depth | | | | |
| Stabilised CPR | | | | | | | | |

## F3.10 RAMM STREETLIGHT DATA

(to be completed for each change in streetlight type)

| | | | |
|---|---|---|---|
| Subdivision and stage/contract | | | |
| Number of streetlights of this type | | | |
| **General** | | | |
| Date installed | | | |
| Control type Network Streelight Feed / Photocell / Other | | | |
| Origin of power supply Streetlight Circuit / Metered Power Supply | | | |
| **Light** | | | |
| Manufacturer | | | Model |
| Total Power Consumption (W) | | Light Heigh (m) | Tilt Angle (°Degrees) |
| **Outreach** | | | |
| Outreach type Curved / Mitre / Other decorative | | | |
| Outreach distance (m) | | | |
| **Pole** | | | |
| Manufacturer | | | |
| Type Octagonal / Circular / Power / Other decorative | | | |
| Pole height (m) | | | |
| Pole material Galvanised steel / Steel / Other | | | |
| Coating N/A / Painted / Powerd coated | | | |
| Colour (if coated) | | | |
| Mounting Frangible ground plant / Shear base | | | |
| | Manufacturer's Warranty documents for Poles, Lights and Coatings attached. | | |
| | Shown on as-built drawings. | | |

# F3.11 PRIVATEWAY – CONFIRMATION OF DESIGN, SUPERVISION AND CONSTRUCTION

(One form for each privateway or access lot on consent)

File Number:

| | | | |
|---|---|---|---|
| Applicant's Name | | | |
| Applicant's Address | | | |
| CP Engineer's Name | | | |
| CP Engineer's Address | | | |
| Subdivision Name | | | |
| Subdivision Address | | | |
| Number of Privateways | | Number/Reference | |

**DRAINAGE TO PRIVATEWAY (TYPE OF DRAINAGE)**

| | | |
|---|---|---|
| **Soakpits** | Number | |
| Results of Percolation Tests | | |

| | | | |
|---|---|---|---|
| **Piped system** | Number of sumps | | Pipe Size and Length |
| Water tables | Meterage | LHS | RHS |
| | | | |
| Outlet Location and Details (to meet Northland Regional Council drainage requirements) | | | |
| | | | |

| | |
|---|---|
| **Other** (please specify) | |
| | |

The Privateway and entrance to the Privateway detailed meets all the specifications and requirements of the RITS and all the Resource Consent conditions relating to the Privateway in the consent approval dated ……..

Signature of Chartered Professional Engineer _____

Any uncompleted items will be assumed as non-complying.

# F3.12 PRIVATEWAY CONSTRUCTION MATERIALS

Materials used – type and depths (e.g. GAP/WHAP/TNZ M4/Brown Rock/Pitsand)

| | | | | |
|---|---|---|---|---|
| **Basecourse** | Material | | Design | |
| | Depth | | Actual | |
| **Subbase** | Material | | Design | |
| | Depth | | Actual | |
| **Subgrade** | Material | | Design | |
| | Depth | | Actual | |
| **Subgrade** | CBR | | Test Method | |

**Compaction during construction**

| **Tests Used** | **Target** | **Result** |
|---|---|---|
| Subbase | | |
| Basecourse | | |

**Sealing (two coat seal to be provided based on 15 years minimum life span)**

| | | | |
|---|---|---|---|
| Date of Seal | | Grade of Bitumen | |
| Grade of Chips | | Application Rates | |

**Where structures involved (e.g. bridge, culvert, well)**

| |
|---|
| Name and Company of Design Engineer |
| Materials used (i.e. steel/precast RC/insitu RC/gabion) |
| Name of Supervising Engineer |

The Privateway and entrance to the Privateway detailed meets all the specifications and requirements of the RITS and all the Resource Consent conditions relating to the Privateway in the consent approval dated ……..

Signature of Chartered Professional Engineer _____

Any uncompleted items will be assumed as non-complying.

# APPENDIX 3C: DRAWINGS

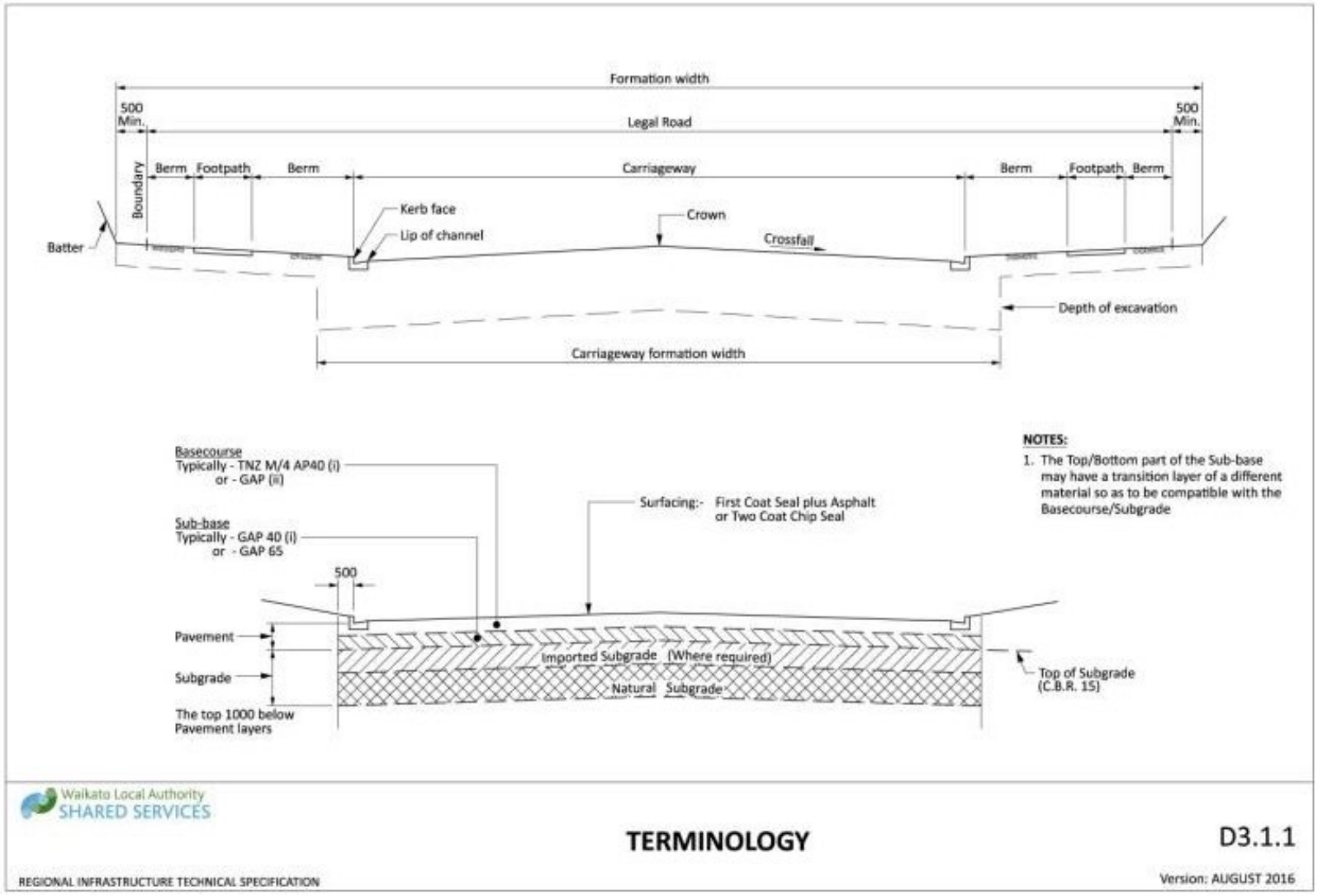
### *Table 3-27: Drawing Register*

| Drawing No | Title |
|---|---|
| D3.1.1 | Terminology |
| D3.1.2 | Roading Terminology |
| D3.1.3 | Location of Services in Transport Corridor |
| D3.1.4 | Cross Section Details Typical Berms |
| D3.1.5 | Boundary Splay |
| D3.1.6 | Standard Residential Private ways |
| D3.1.7 | Cul-de-Sac Head |
| D3.1.8 | On Street Parking Dimensions and Setout |
| D3.2.1 | Normal Carriageway Camber and Construction Tolerances |
| D3.2.2 | C.B.R. v Penetration Graphs for Hamilton Sand Silt Materials |
| D3.2.3 | Trench Reinstatement |
| D3.3.1 | Vehicle Crossing and Pedestrian Cutdown Set Out |
| D3.3.2 | Vehicle Crossing Profiles |
| D3.3.3 | Kerb and Channel Profiles |
| D3.3.4 | Rural Entranceways – Residential, Light and Heavy Commercial |
| D3.3.5 | Cross Section Details for Footpath, Vehicle Crossings and Depressed Kerb and Channel |
| D3.3.6 | Cross Section Details Associated Kerb and Channel Reinstatement Within Existing Pavement |
| D3.3.7 | Concrete Vehicle Slot Crossings |
| D3.3.8 | Accessible Bus Stop |
| D3.4.1 | Location of Subsoil Drainage |
| D3.5.1 | A/C, SMA and OGPA Overlay Details |
| D3.5.2 | A/C Overlay V-Ramp Detail |
| D3.6.1 | Timber Edging Details for Chip Seal, Asphalt and Block Paving |

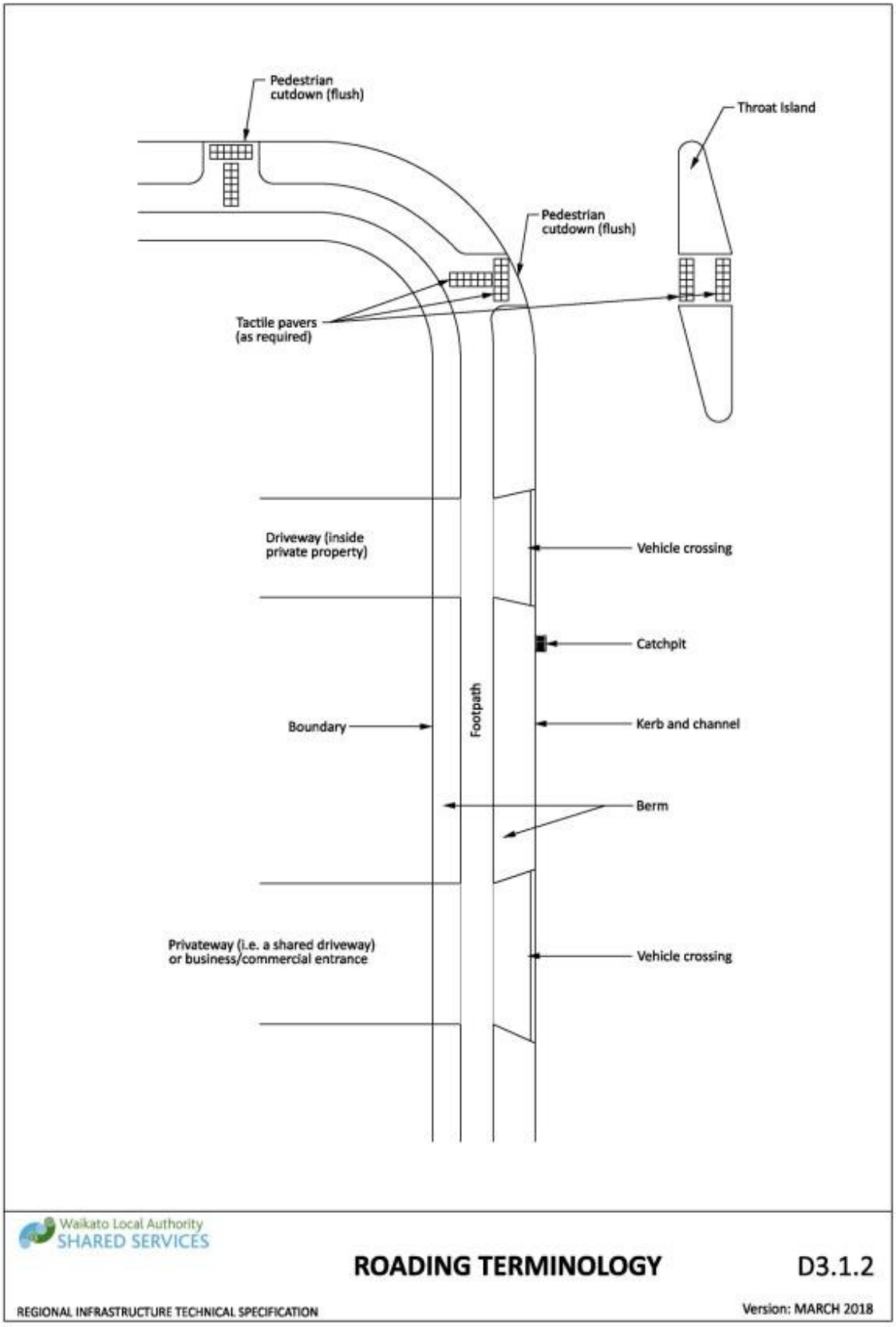
| Drawing No | Title |
|---|---|
| D3.6.2 | Pedestrian Crossing Point Location at Intersections |
| D3.6.3 | Tactile Paving for Vision Impaired |
| D3.6.4 | Pedestrian Facilities in Islands |
| D3.7.1 | Sign Location and Visibility at Intersections |
| D3.7.2 | Street Name Signs Arterial/Collector Intersection |
| D3.7.3 | Street Name Signs Arterial or Collector Intersection with Local Roads |
| D3.7.4 | Street Name Signs Local/Local Intersections |
| D3.7.5 | Cycle Signage for Off Road Cycle Paths |
| D3.7.6 | Neighbourhood Watch Signage |
| D3.7.9 | Ground Sockets for Removable Poles |
| D3.7.10 | Installation of Chevron or Route and Low Level Road Name Sign |
| D3.7.11 | Attachment of Street Name Sign Blades to Poles |
| D3.7.12 | Street Name Plate |
| D3.7.13 | Kea Crossing Flag |
| D3.7.14 | Kea Crossing Flag Pole |
| D3.7.15 | School Patrol Signs |
| D3.7.16 | Bus Stop / Taxi Supplement |
| D3.7.17 | Through Truck Route Marker |
| D3.8.1 | CBD Cycle Rack |
| D3.8.2 | Bike Rack – Ribbon Style |
| D3.8.3 | Bike Rack – Hoop Style |
| D3.8.6 | Lockable Removable Bollards |
| D3.8.7 | CBD Pedestrian Barrier |
| D3.8.8 | Pedestrian Balustrade Barrier |
| D3.8.9 | Pedestrian Barriers |
| D3.8.10 | Pedestrian Accessway Fence Detail |
| D3.8.11 | Pedestrian Handrail or Walkway Barrier |

| Drawing No | Title |
|---|---|
| D3.8.12 | Concrete Base Details for Steel Litter Bins |
| D3.8.13 | Standard 3.5m Bus Shelter Foundation Detail |
| D3.8.14 | Bus Shelter and Mini Bus Shelter |
| D3.8.15 | Bus Stop Seat – No Shelter |
| D3.9.1 | Typical Cycle Advance Stop Lines Layout |
| D3.9.2 | On Road Cycle Lane Connection to Off Road Shared Path |
| D3.9.3 | Clearway and P5 Roadmarking |
| D3.9.4 | Mobility Cardholders Parking |
| D3.10.1 | Roundabout Details |
| D3.10.2 | Flush Threshold (for maintenance purposes only) |
| D3.10.3 | Paved Raised Pedestrian Ramp (for maintenance purposes only) |
| D3.10.4 | Concrete Raised Pedestrian Ramp (for maintenance purposes only) |
| D3.10.5 | Asphaltic Concrete Tapered Raised Pedestrian Ramp |
| D3.10.6 | Asphaltic Concrete Full Width Raised Pedestrian Ramp |
| D3.10.7 | Full Width Raised Pedestrian Threshold – Imprint Patterns and Coloured Surfacing |
| D3.11.1 | Pedestrian Belisha and Warning Globe Detail |
| D3.11.2 | Pedestrian Belisha and Floodlighting |
| D3.12.1 | Traffic Signal Ducting Under-Kerb Access Details |
| D3.12.2 | Fold Down Traffic Signal Pole |
| D3.12.3 | Removable Traffic Signal Pole |
| D3.12.4 | Standard Dimensions for Stop Line Detectors and Advanced Cycle Stop Box |
| D3.12.6 | Street Name Signs at Signalised Intersections |
| D3.12.7 | Traffic Controller Base, Signal Pole and Mast Arm |

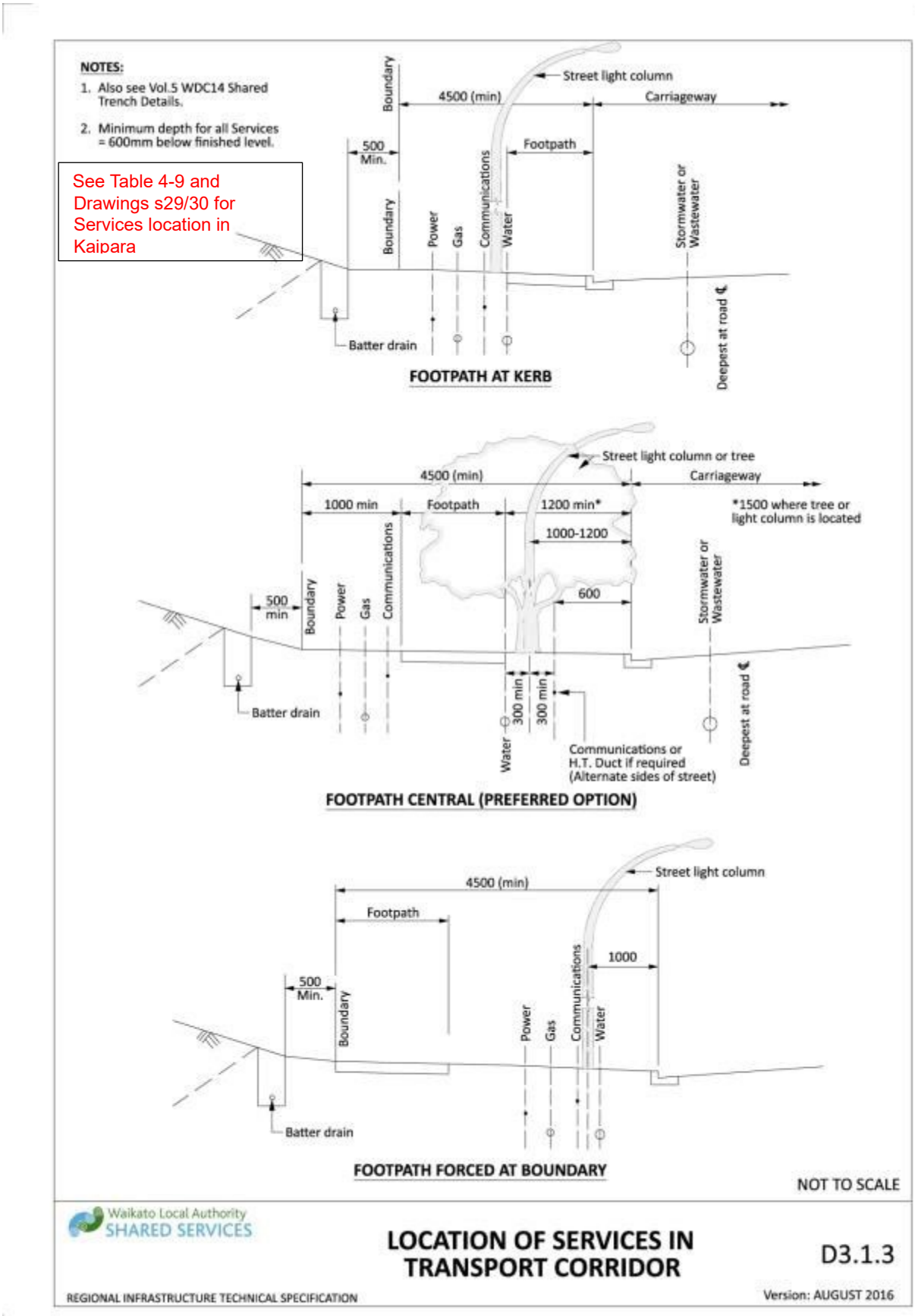
# Section 3 - Transportation



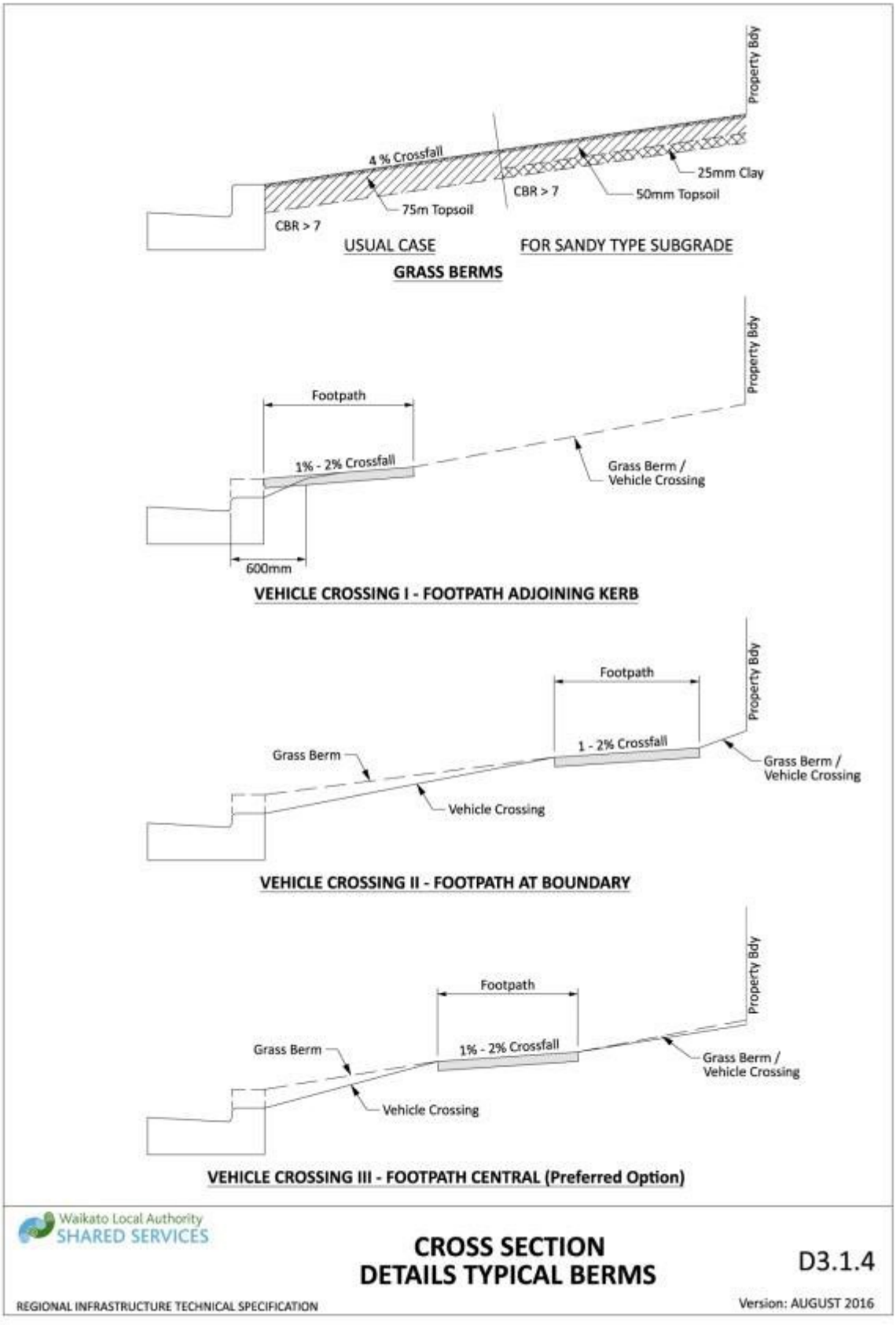

*Drawing 2: 3-1 Terminology*



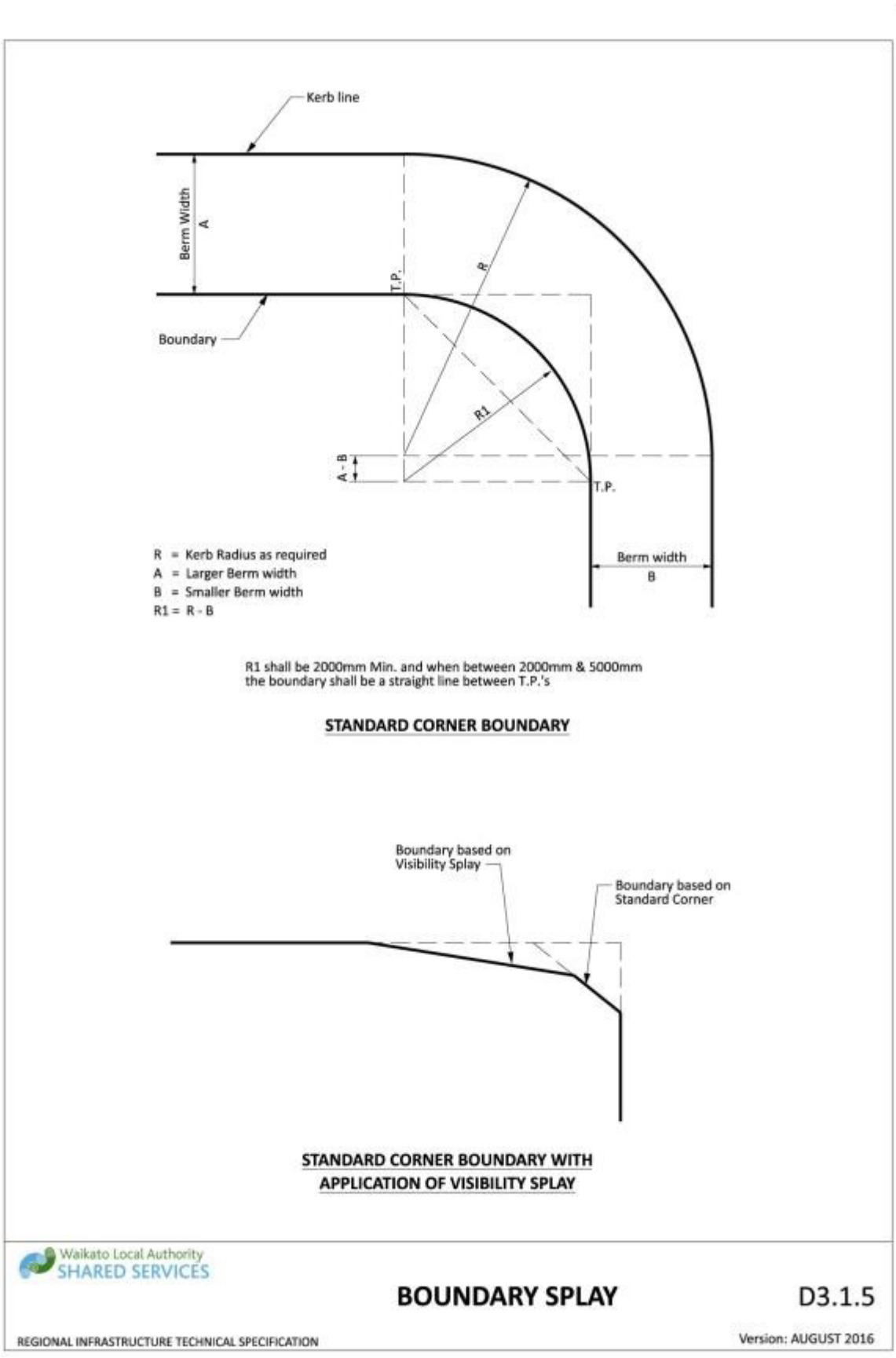

*Drawing 3: 3.1.2 Roading Terminology*



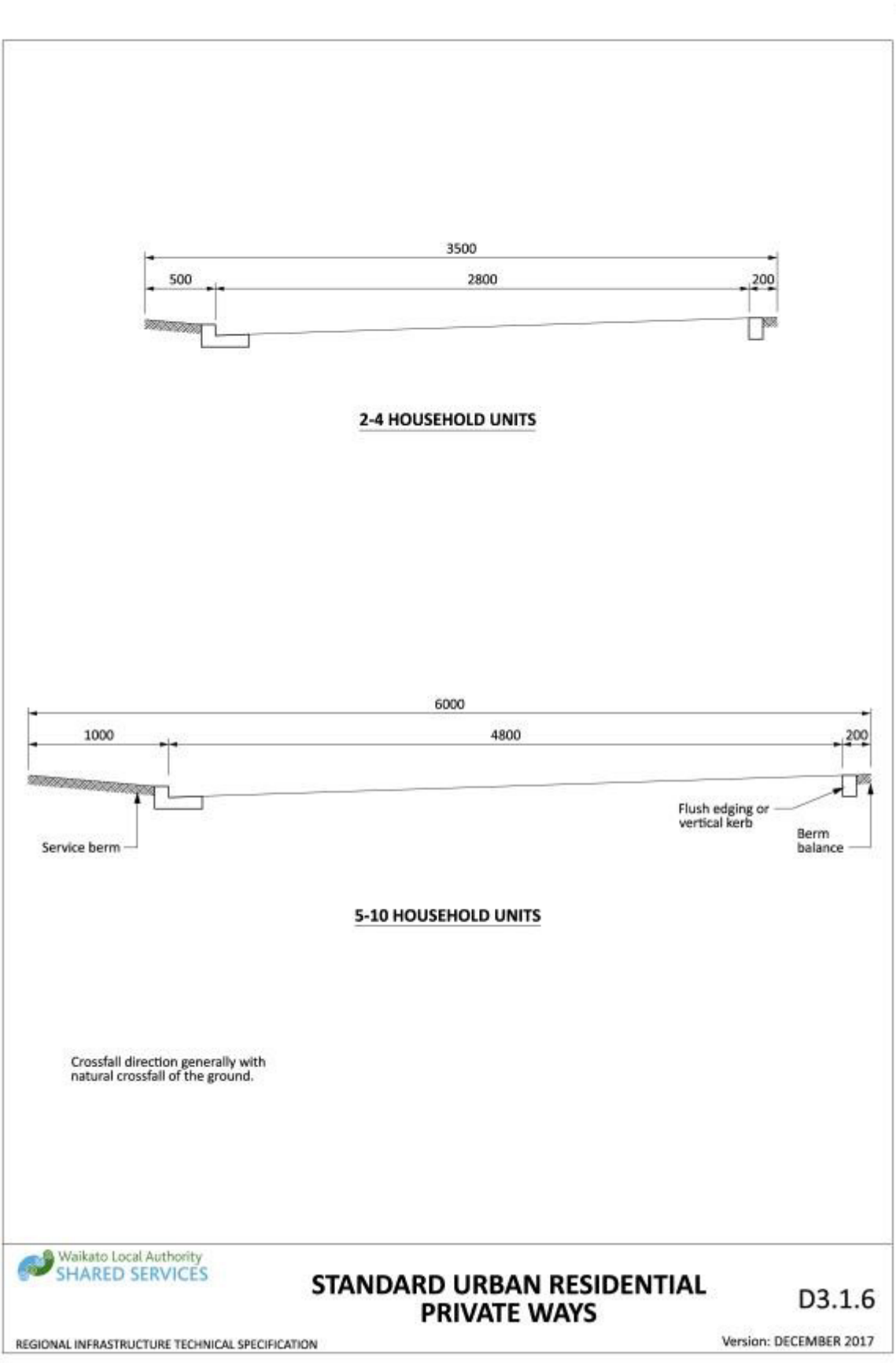

*Drawing 4: 3.1.3 Location of services in transport corridor*



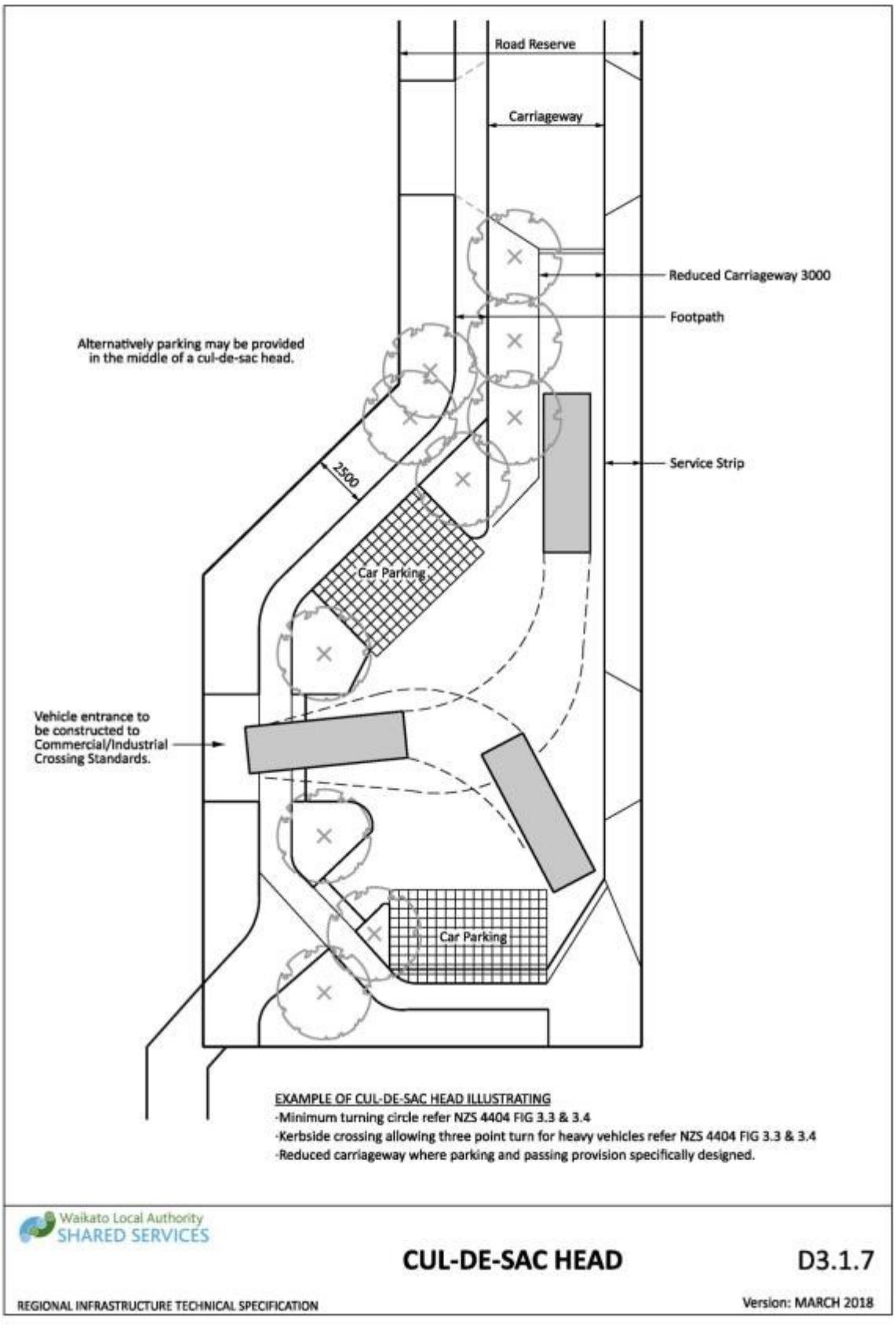

*Drawing 5: 3.1.4 Cross section details typical berms*



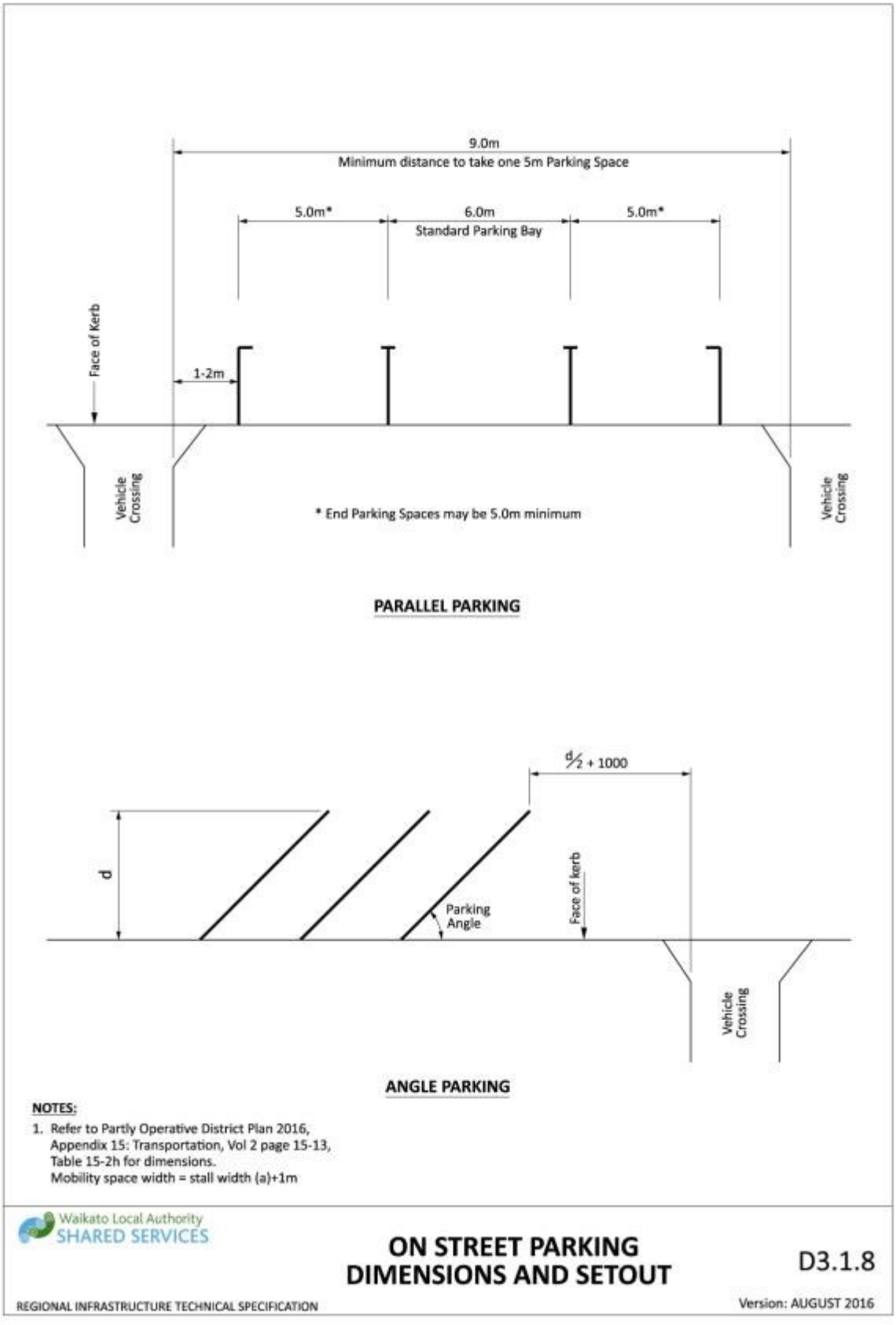

*Drawing 6: 3.1.5 Boundary Splay*



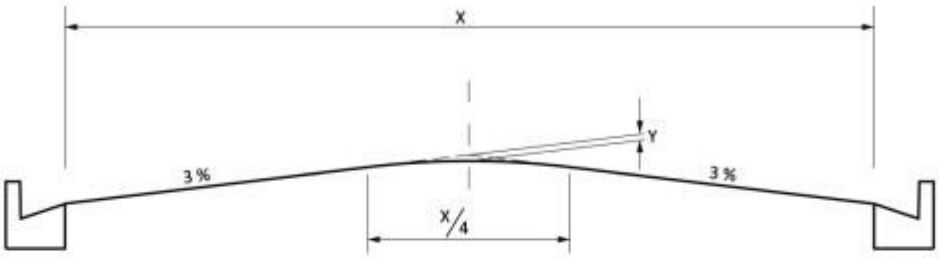

*Drawing 7: 3.1.6 Standard urban residential private ways*




*Drawing 8: 3.1.7 Cul-de-sac head*




*Drawing 9: 3.1.8 On street parking dimensions and setout*




Y (in mm) = 2 X (where X is in metres)
e.g. X= 7.9 (8.5 carriageway)
∴ Y = 2 x 7.9
= 16mm

Crown Height above lip of channel (in mm) = 13X (where X is in metres)

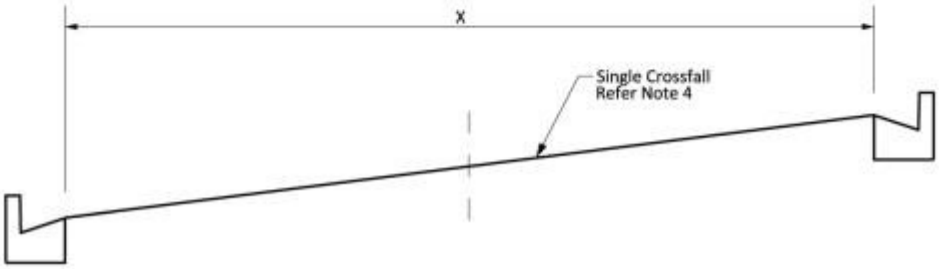



**TABLE OF LEVEL TOLERANCES FOR FLEXIBLE PAVEMENTS**

| At top of Layer | Centreline and near Pavement edge | At Channel edge | Deviation from 3m straight edge or camber board |
|---|---|---|---|
| Surface | | | 1: 12mm<br>2: 8mm |
| Basecourse | -5mm to +15mm | 1: 0mm to +10mm<br>2: -5mm to +5mm | 12mm |
| Sub-base | -25mm to +5mm | -25mm to +5mm | 15mm |
| Subgrade | -30mm to 0mm | -30mm to 0mm | 15mm |

**NOTES:**

1. Chip sealed surface
2. Asphalt surface (minimum 25mm thick)
3. Construction levels are based on lip of channel, appropriate crossfall and designed pavement layer thickness
4. Single crossfall may be permitted in certain circumstances, eg super-elevation or private entrance.

Waikato Local Authority SHARED SERVICES

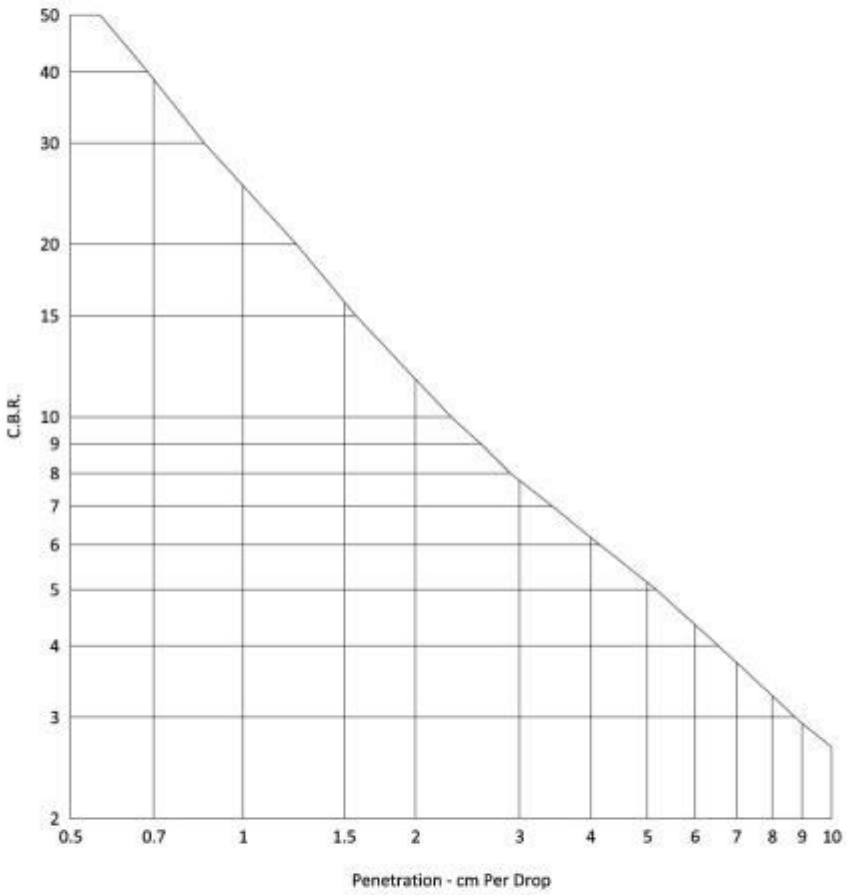
**NORMAL CARRIAGEWAY CAMBER AND CONSTRUCTION TOLERANCES** D3.2.1

REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATION Version: AUGUST 2016

*Drawing 10: 3.2.1 Normal carriageway camber and construction tolerances*

**NOTES:**

1. C.B.R. values obtained from the ground are not applicable where material contains aggregate greater than 10mm in size.
2. Penetration readings are valid after 75mm of penetration into firm material being tested.
3. To use graph below, count number of blows for each 100mm (10cm) approx. of penetration and divide by number of drops. This gives Penetration (cm per blow).
4. Graphs show C.B.R. (California Bearing Ratio) equivalent values on Hamilton Sand Silt materials.
5. Plot is based on research work undertaken by J.F. Briggs, Senior Engineer, M.W.D., Hamilton.




**SCALA PENETROMETER (9kg Hammer)**

Waikato Local Authority SHARED SERVICES

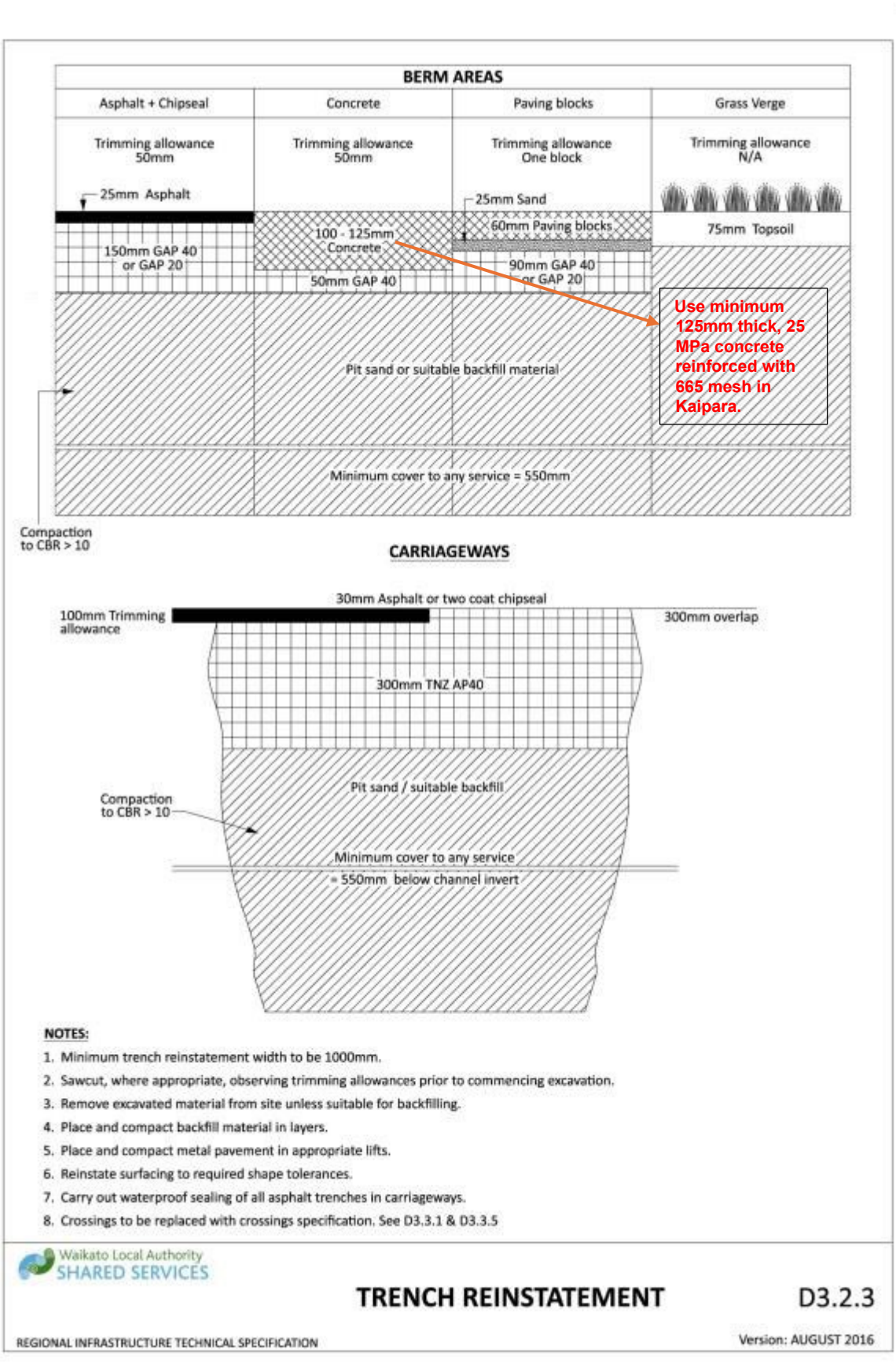
**C.B.R. v PENETRATION GRAPHS FOR HAMILTON SAND SILT MATERIALS**

D3.2.2

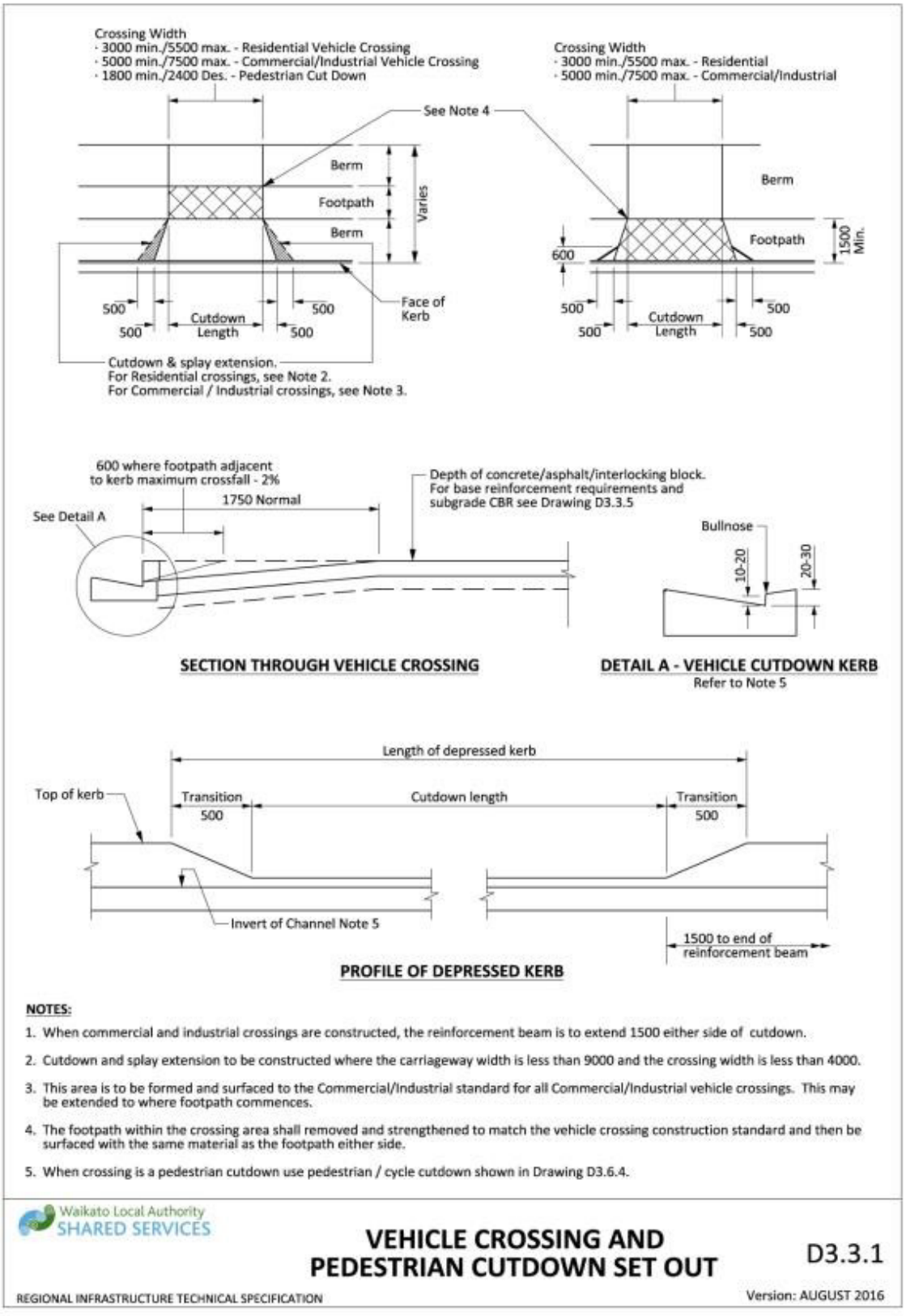
REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATION

Version: AUGUST 2016

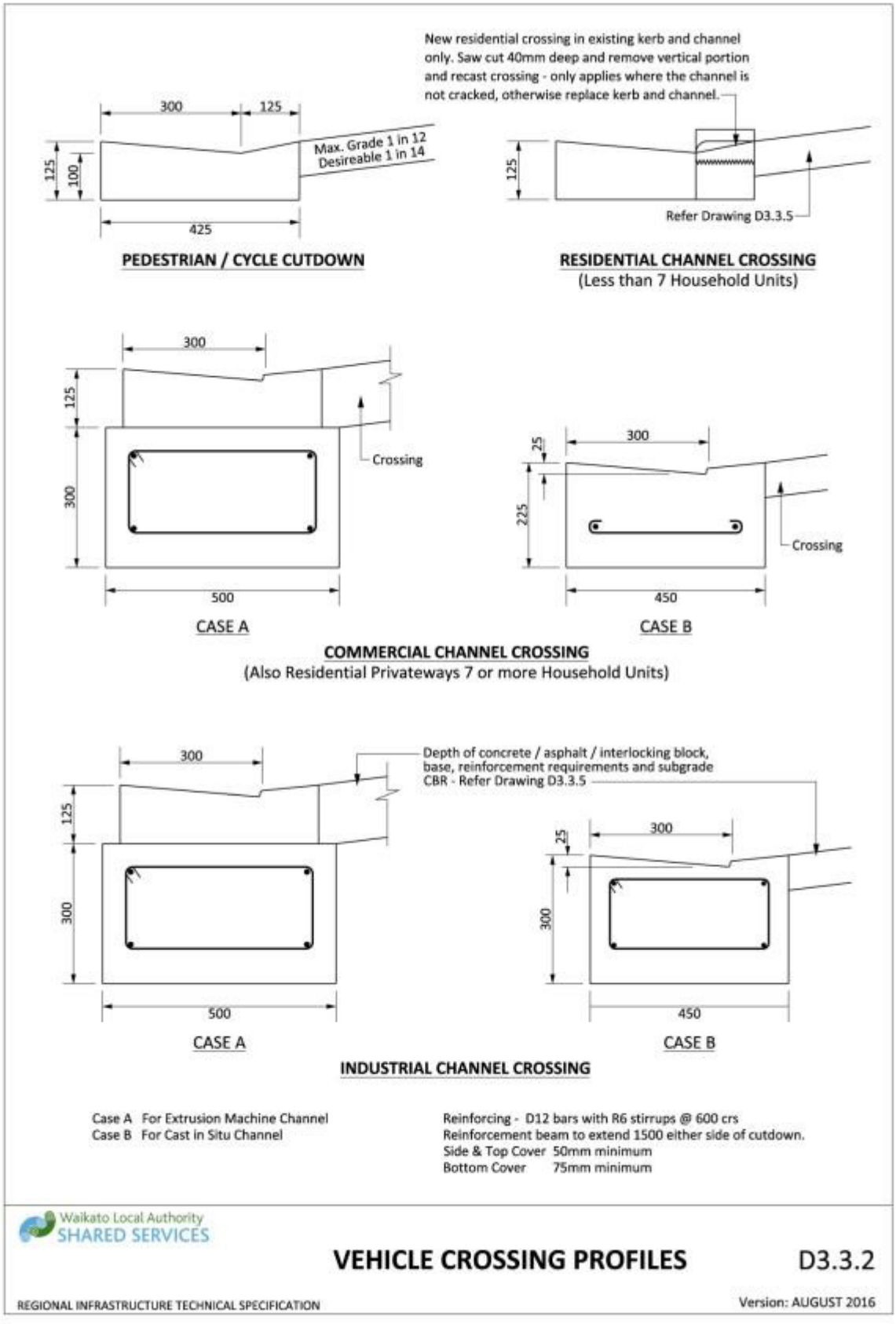
*Drawing 11: 3.2.2 C.B.R v penetration graphs for Hamilton sand silt materials*



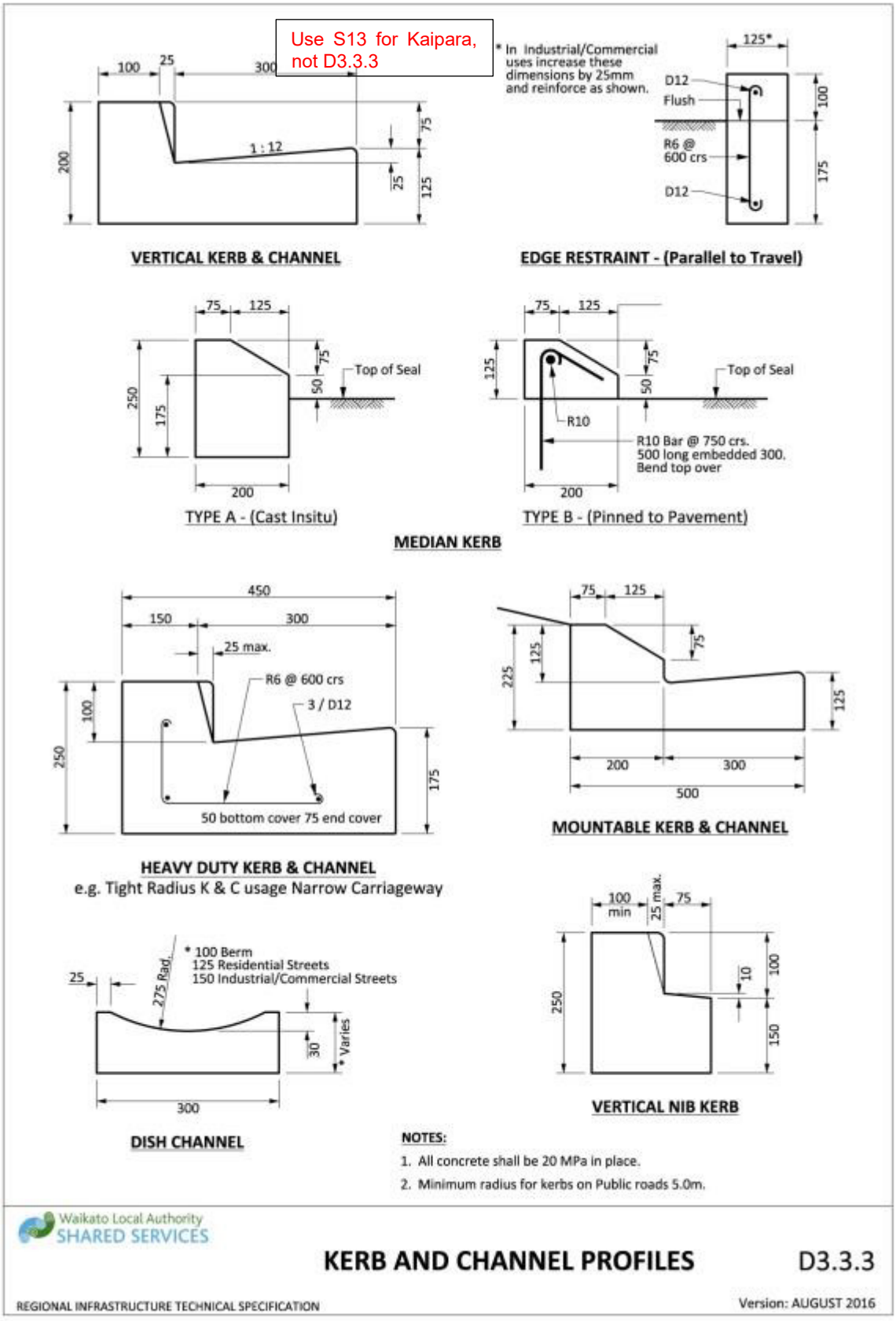

*Drawing 12: 3.2.3 Trench reinstatement*



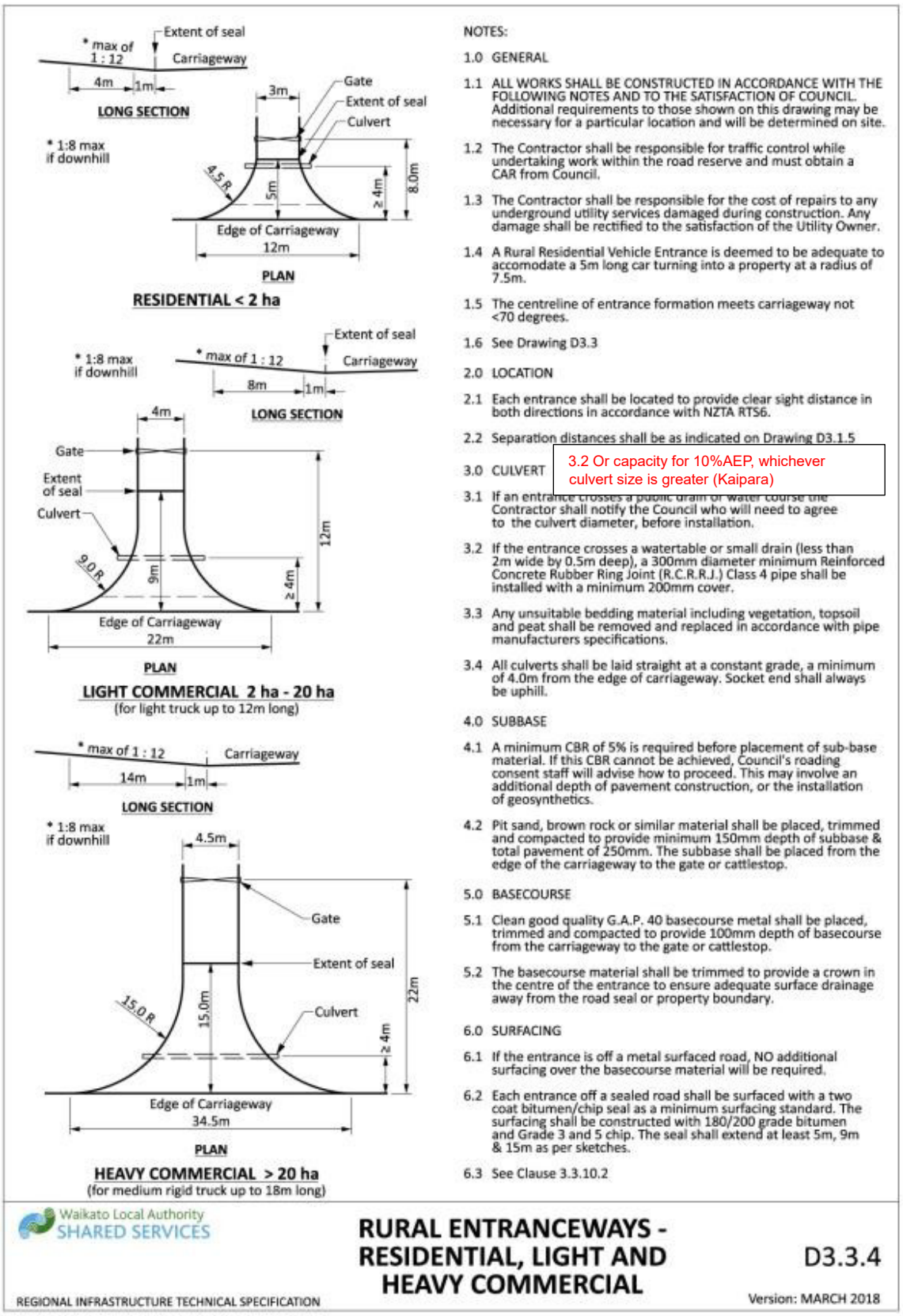

*Drawing 13: 3.3.1 Vehicle crossing and pedestrian cutdown set out*



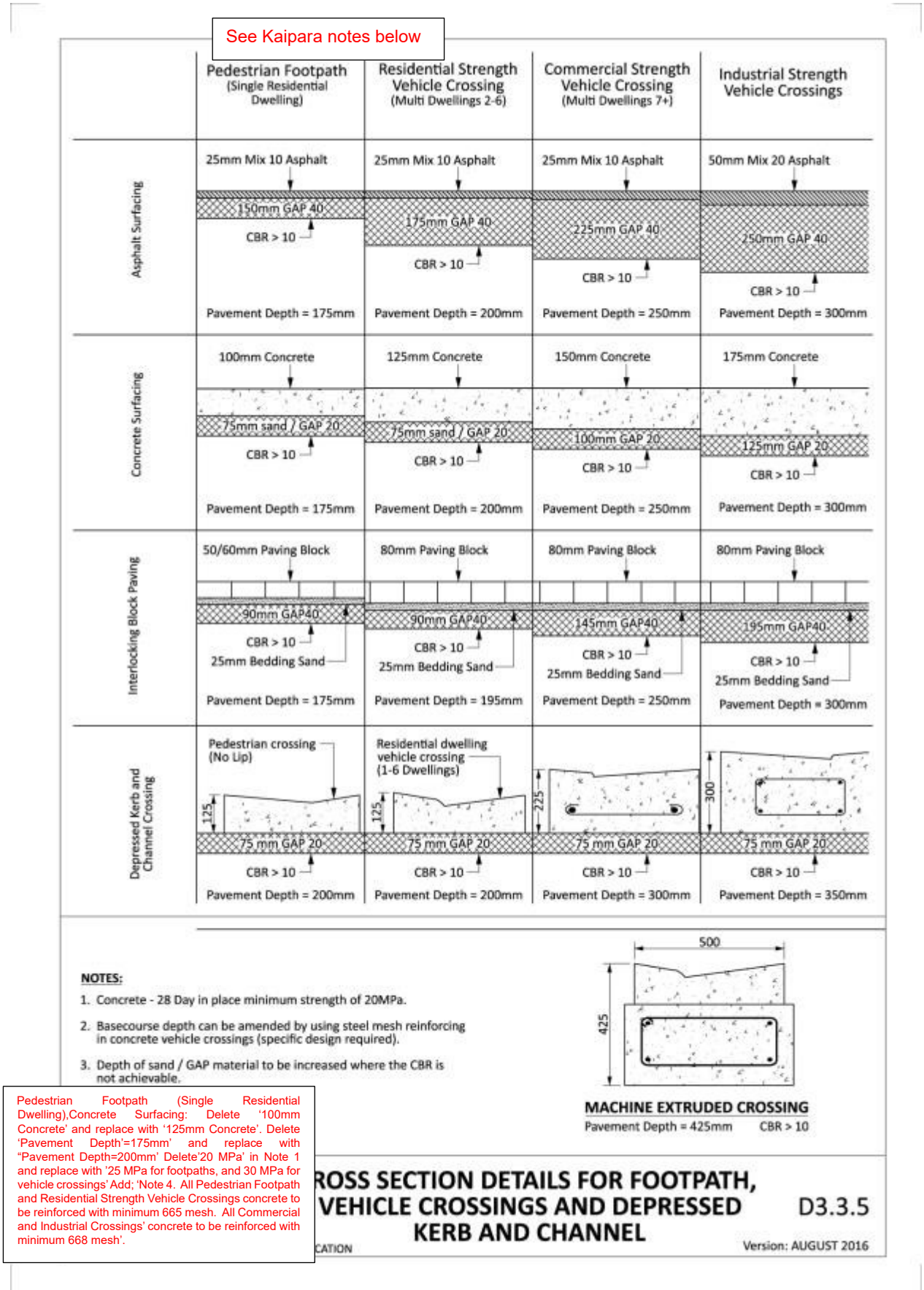

*Drawing 14: 3.3.2 Vehicle Crossing Profiles*




*Drawing 15: 3.3.3 Kerb and channels profiles*

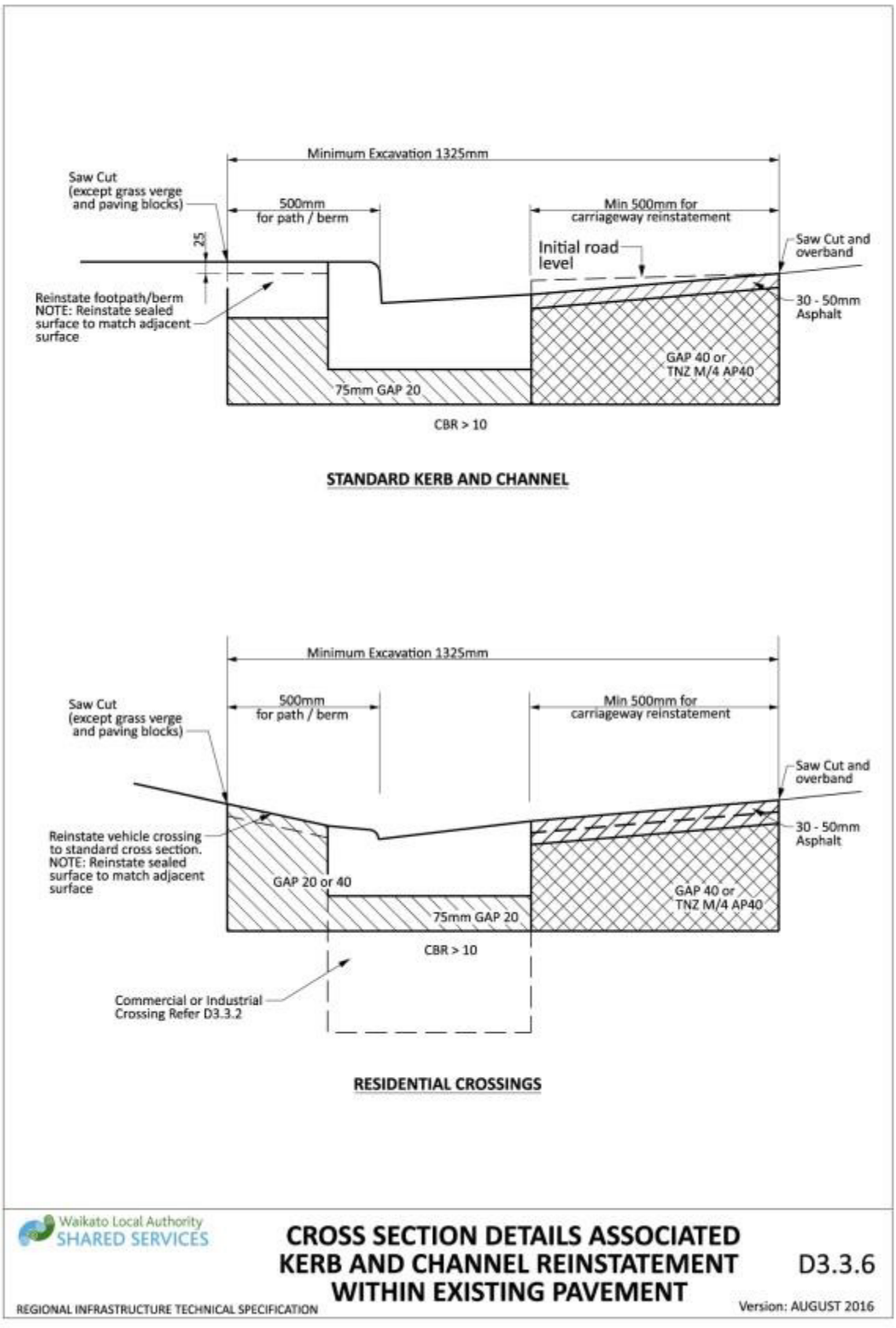



*Drawing 16: 3.3.4 Rural entranceways - residential, light and heavy commercial*

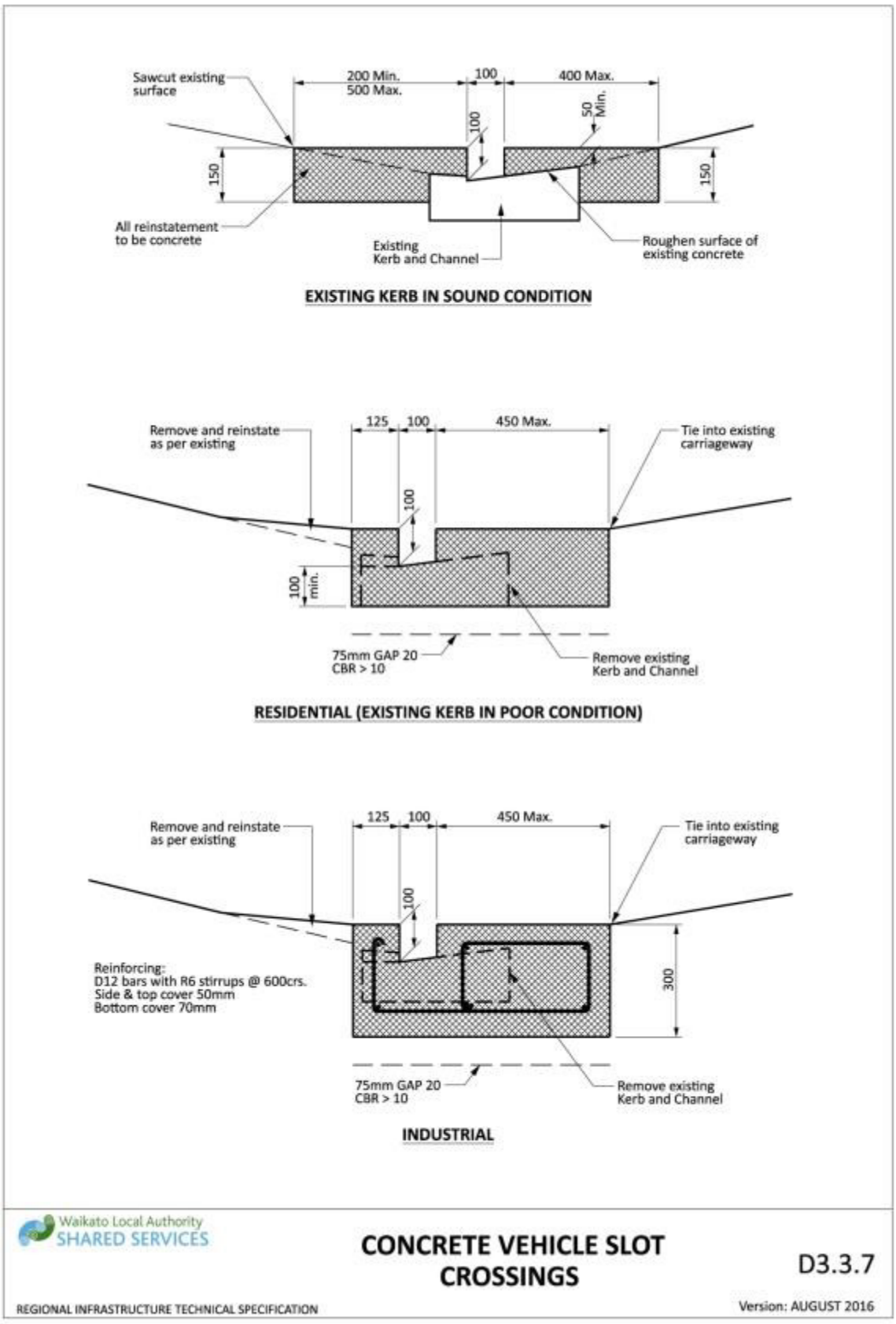



Pedestrian Footpath (Single Residential Dwelling),Concrete Surfacing: Delete '100mm Concrete' and replace with '125mm Concrete'. Delete 'Pavement Depth'=175mm' and replace with "Pavement Depth=200mm' Delete'20 MPa' in Note 1 and replace with '25 MPa for footpaths, and 30 MPa for vehicle crossings' Add; 'Note 4. All Pedestrian Footpath and Residential Strength Vehicle Crossings concrete to be reinforced with minimum 665 mesh. All Commercial and Industrial Crossings' concrete to be reinforced with minimum 668 mesh'.

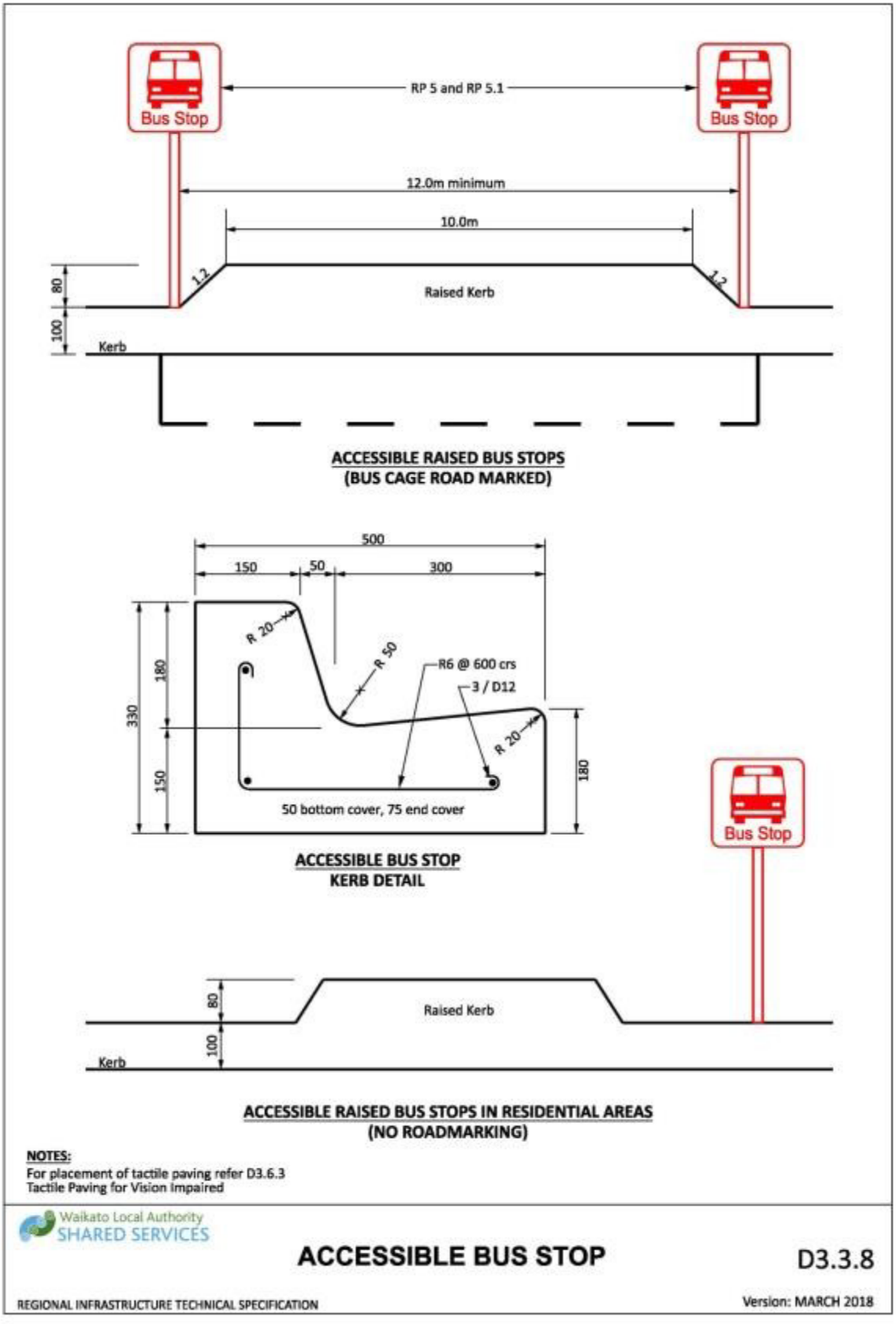
*Drawing 17: 3.3.5 Cross Section details for footpath, vehicle crossings and depressed kerb and channel*



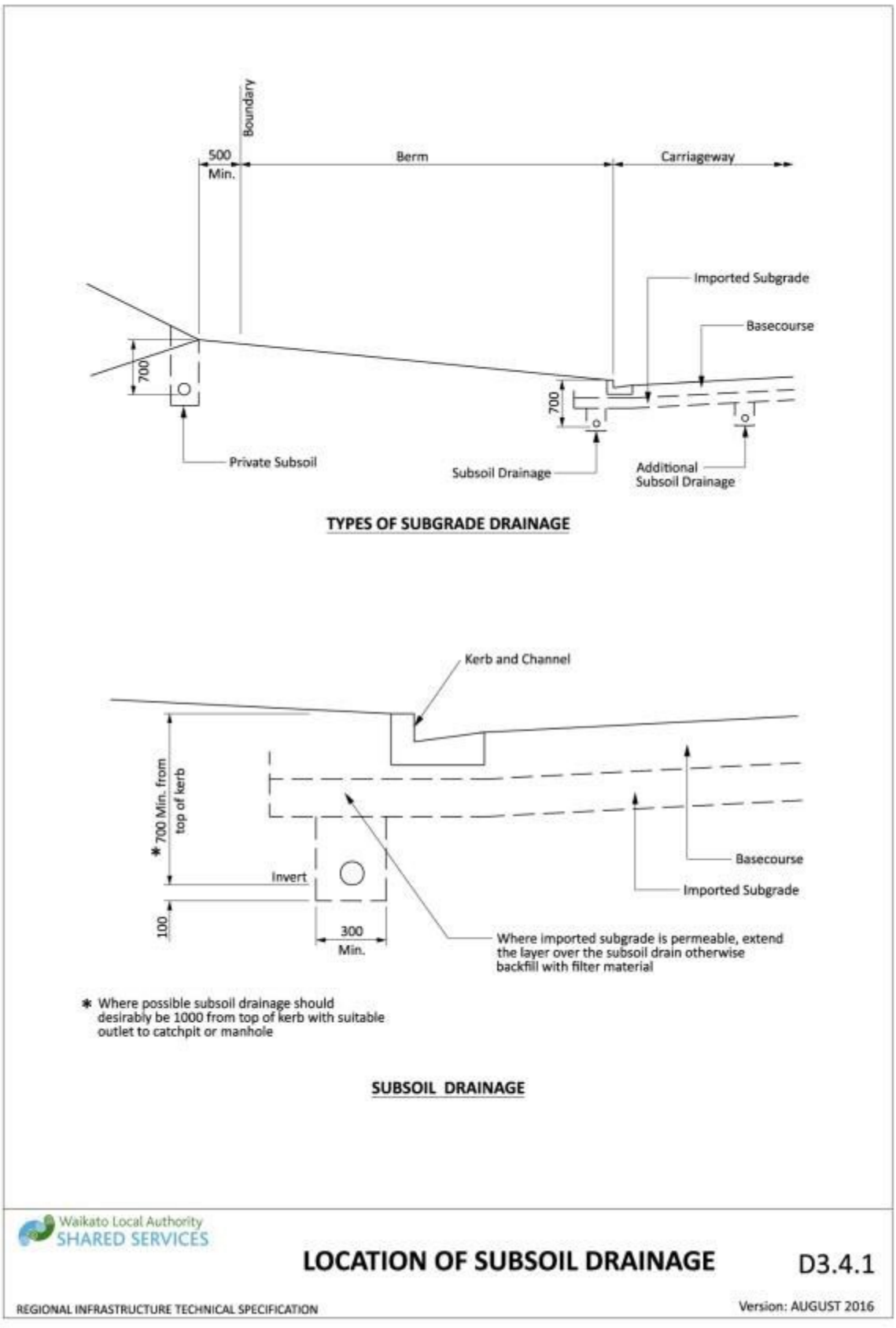

*Drawing 18: 3.3.6 Cross section details associated kerb and channel reinstatement within existing pavement*



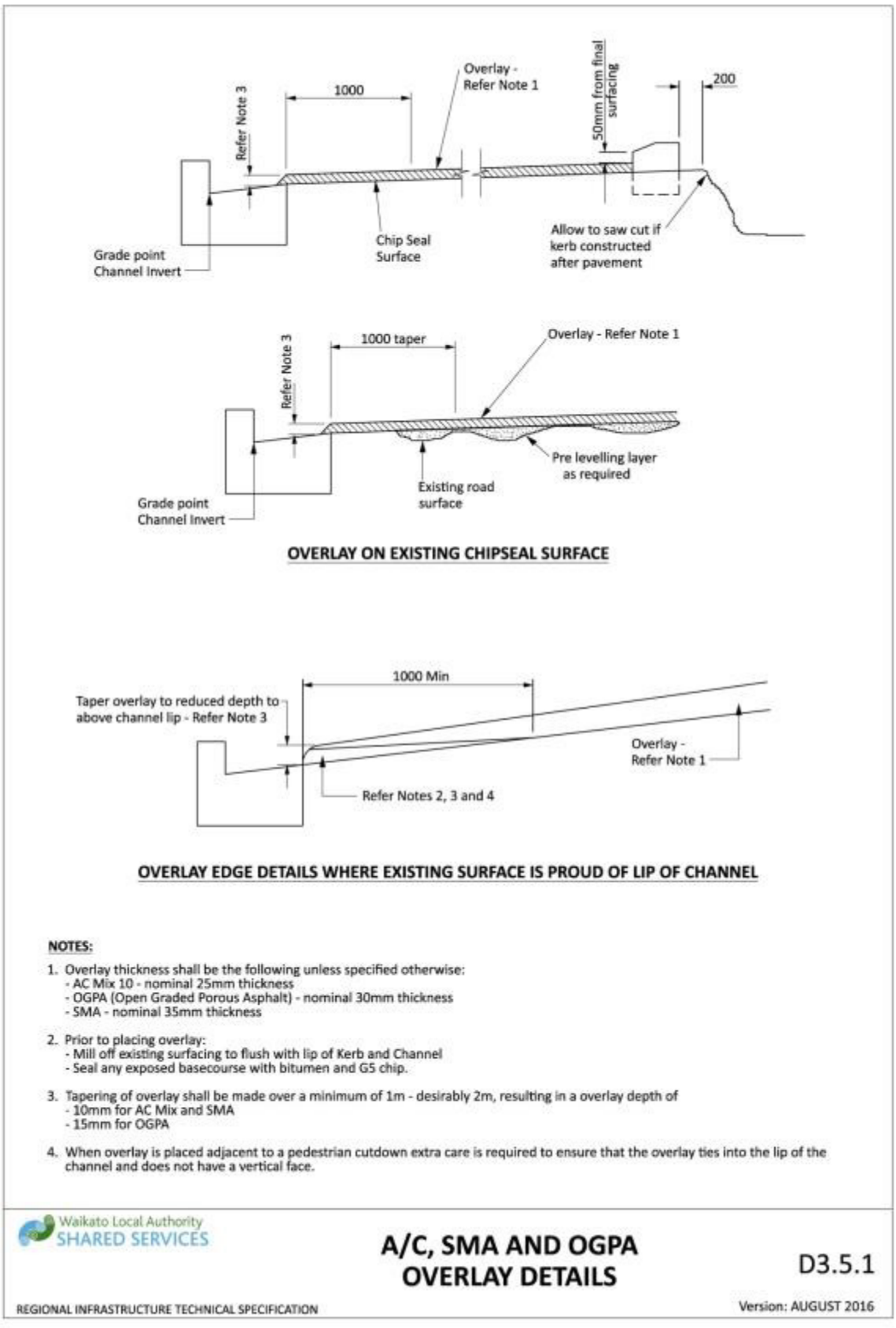

*Drawing 19: 3.3.7 Concrete vehicle slot crossings*



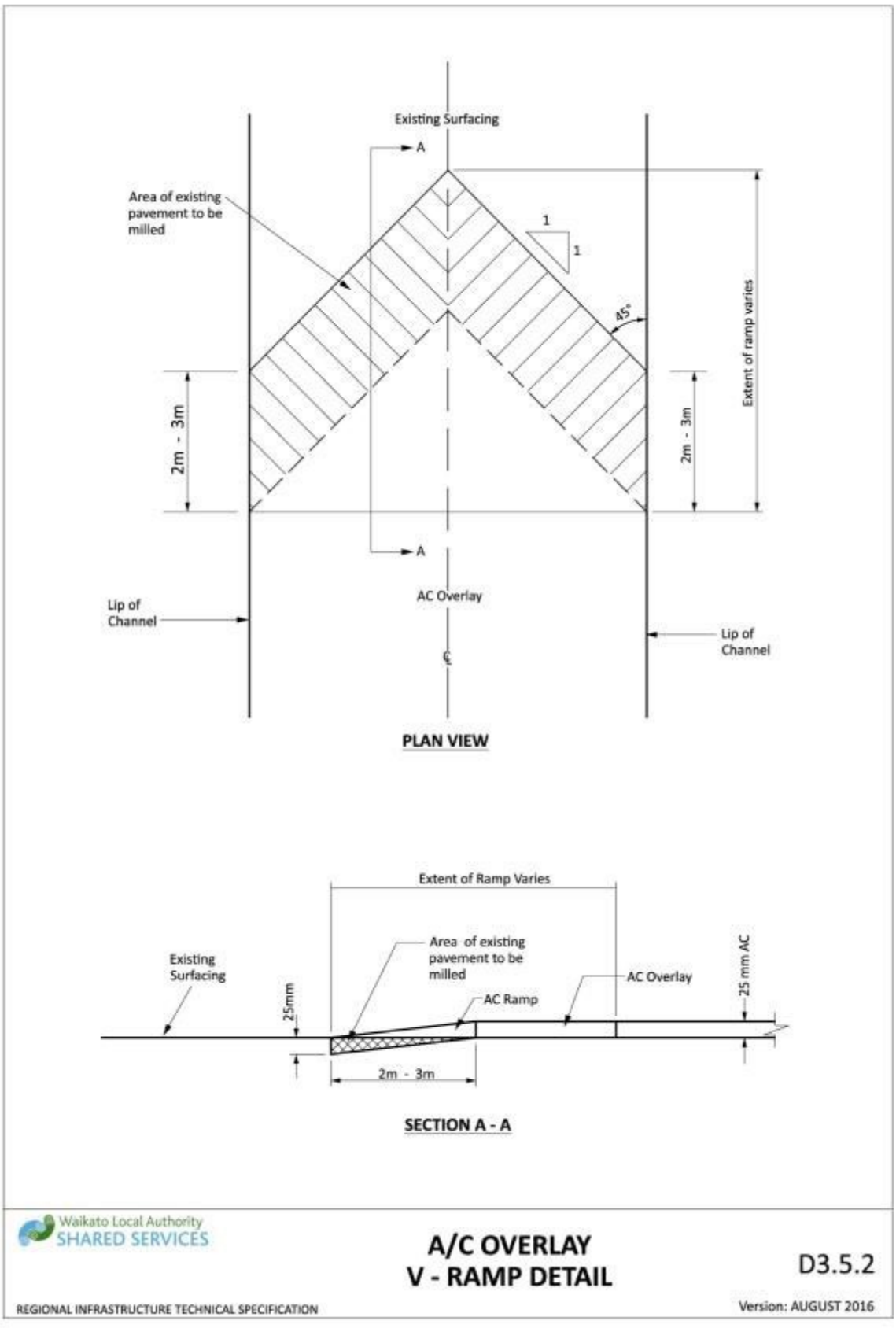

*Drawing 20: 3.3.8: Accessible bus stop*



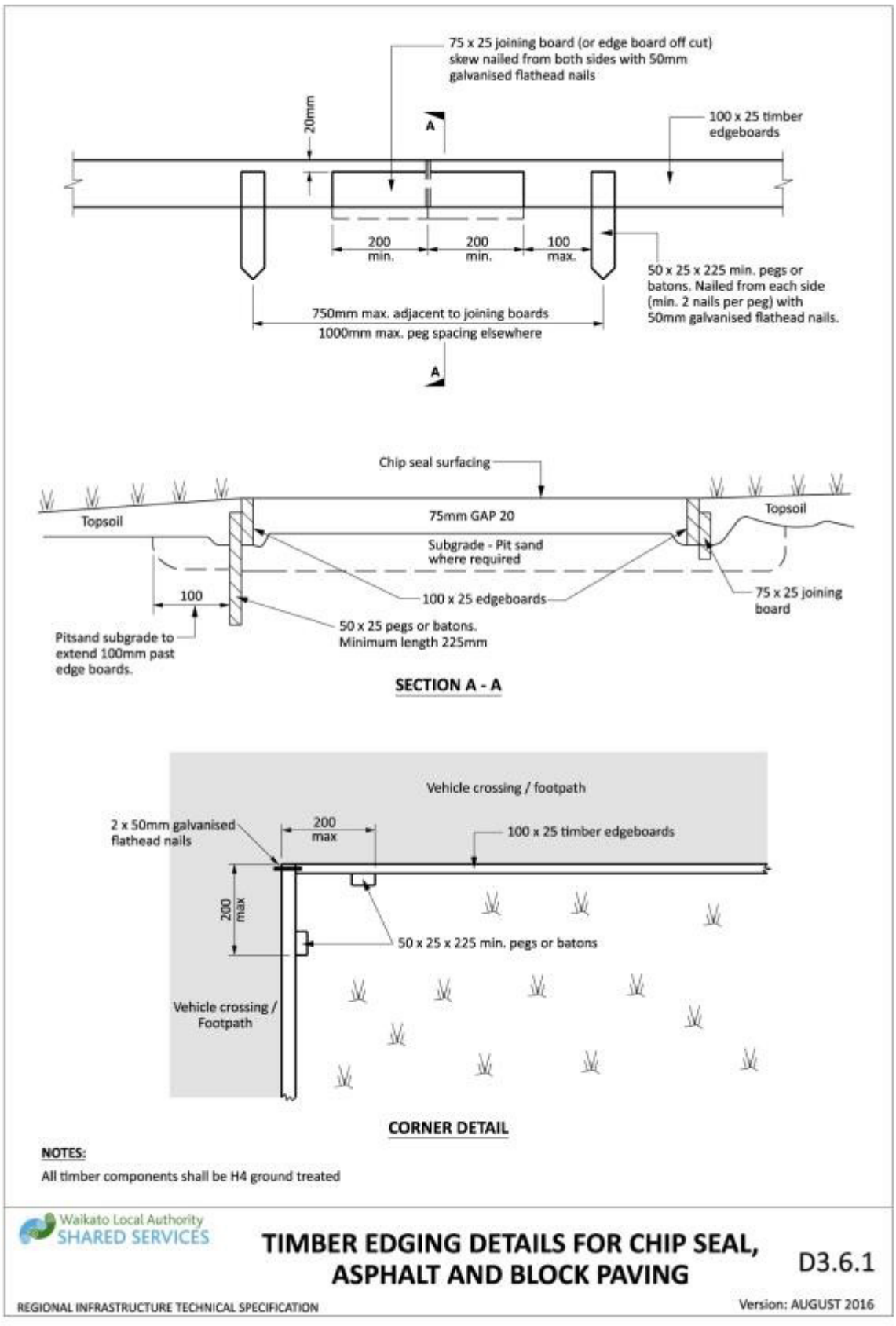

*Drawing 21: 3.4.1 Location of subsoil drainage*



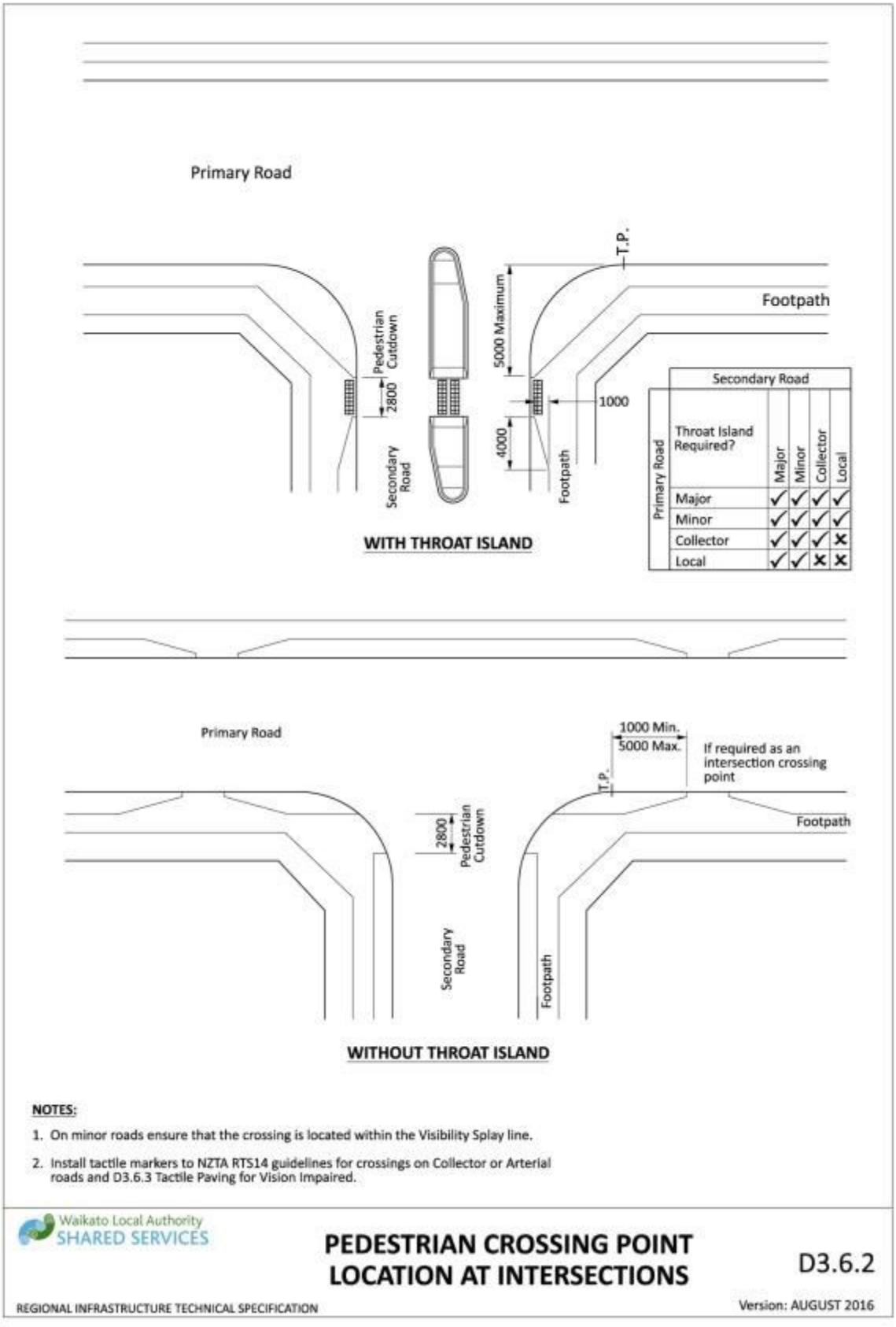

*Drawing 22: 3.5.1 A/C, SMA and OGPA overlay details*



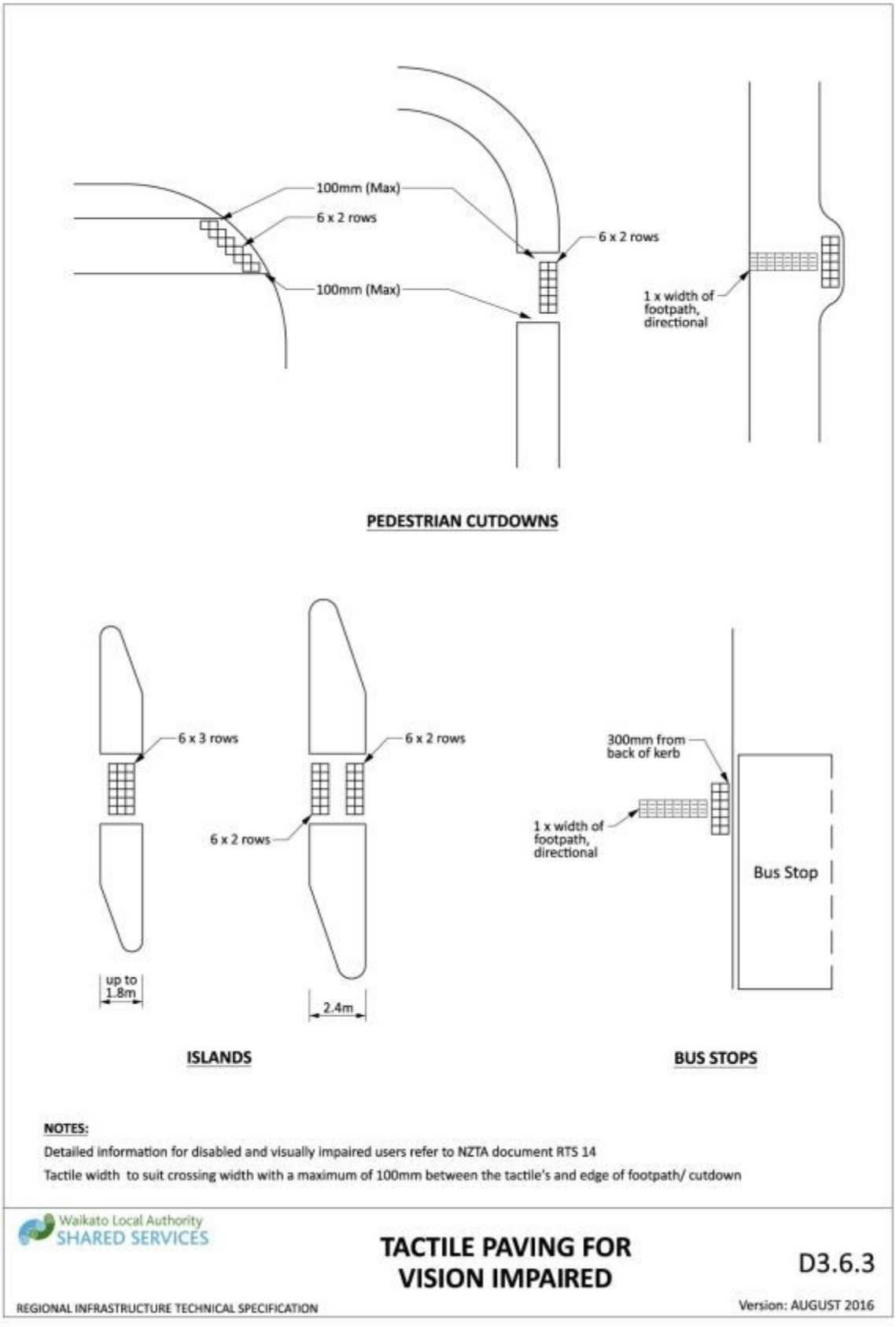

*Drawing 23: 3.5.2 A/C overlay v-ramp detail*



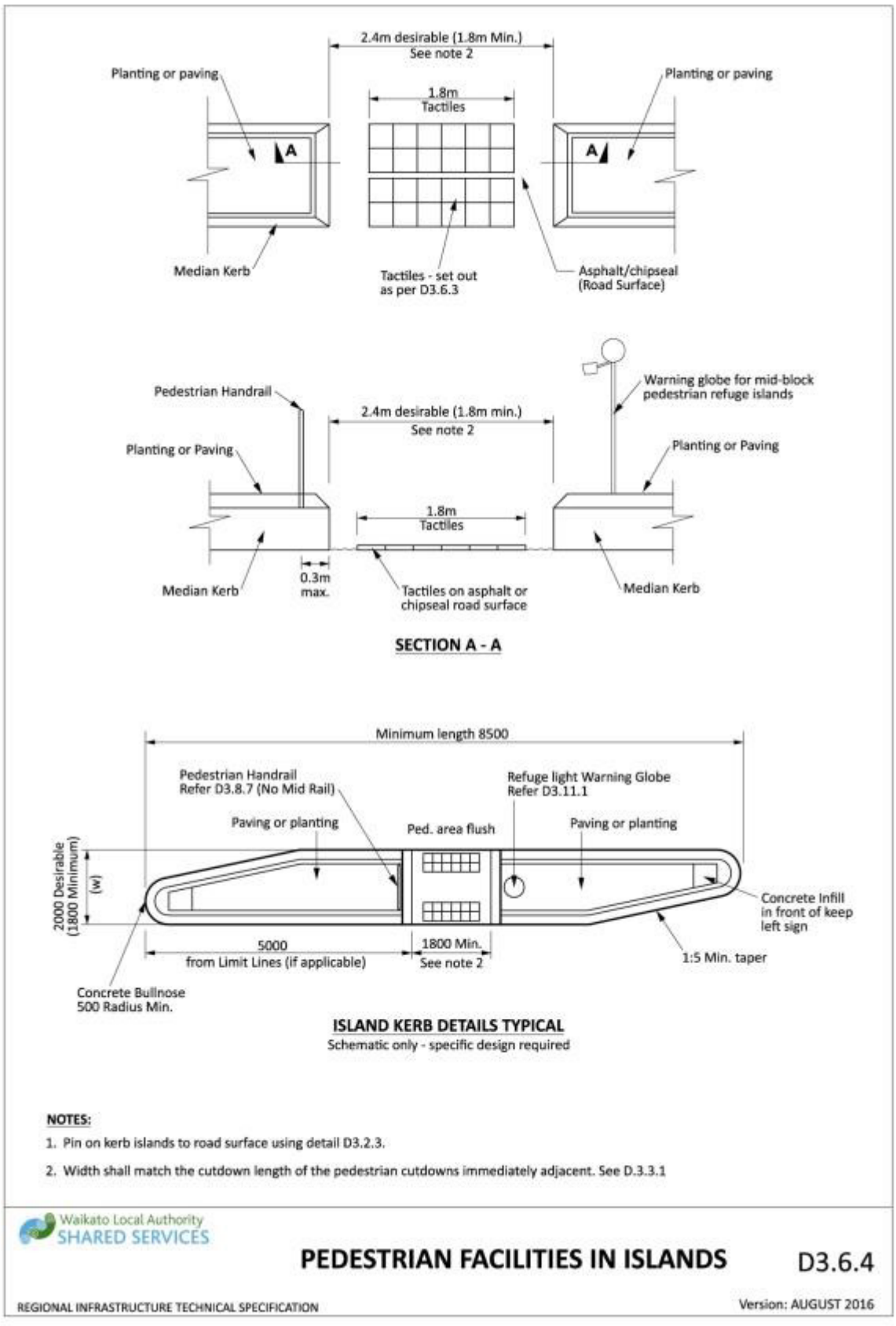

*Drawing 24: 3.6.1 Timber edging details for chip seal, asphalt and block paving*



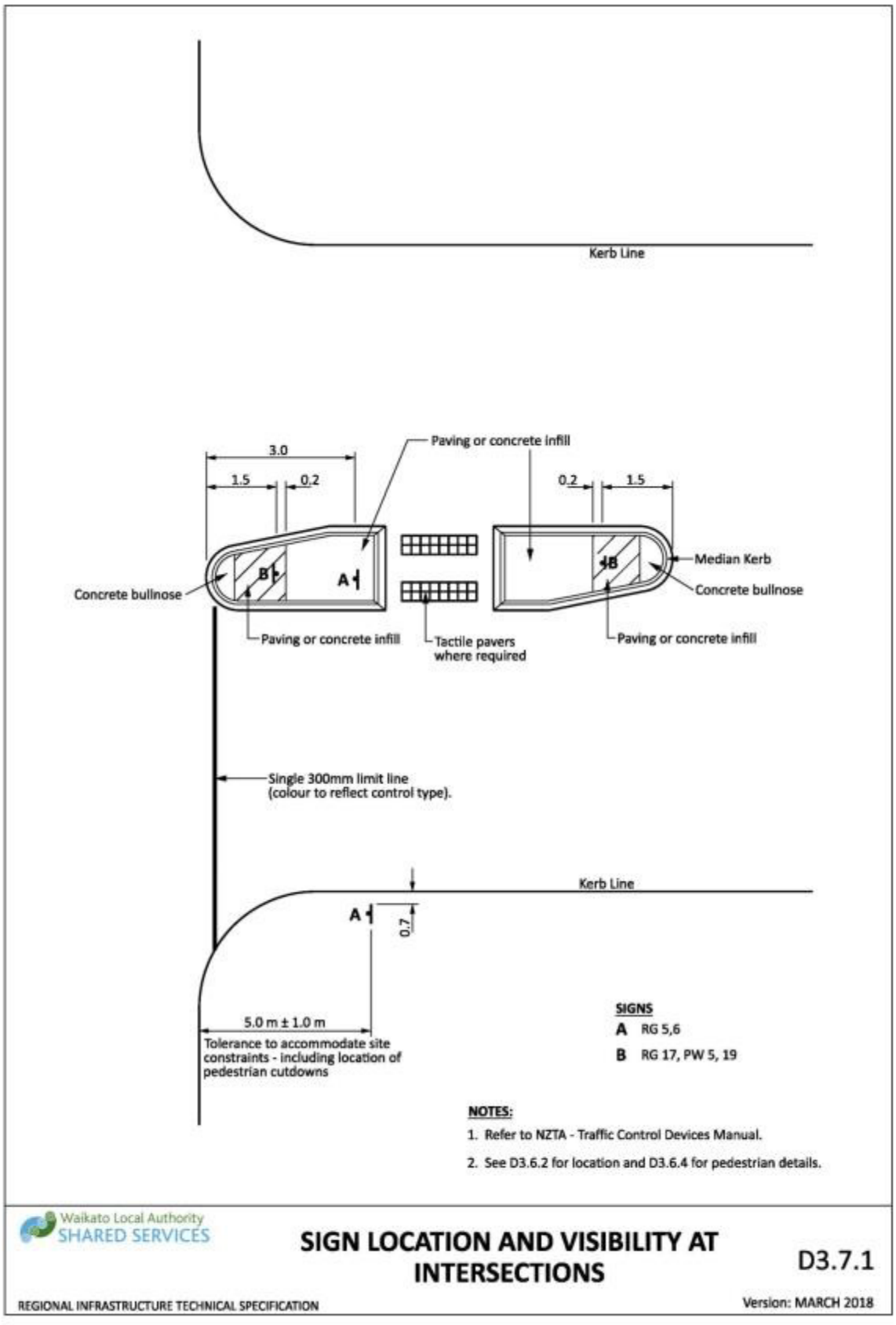

*Drawing 25: 3.6.2: Pedestrian crossing point location at intersections*



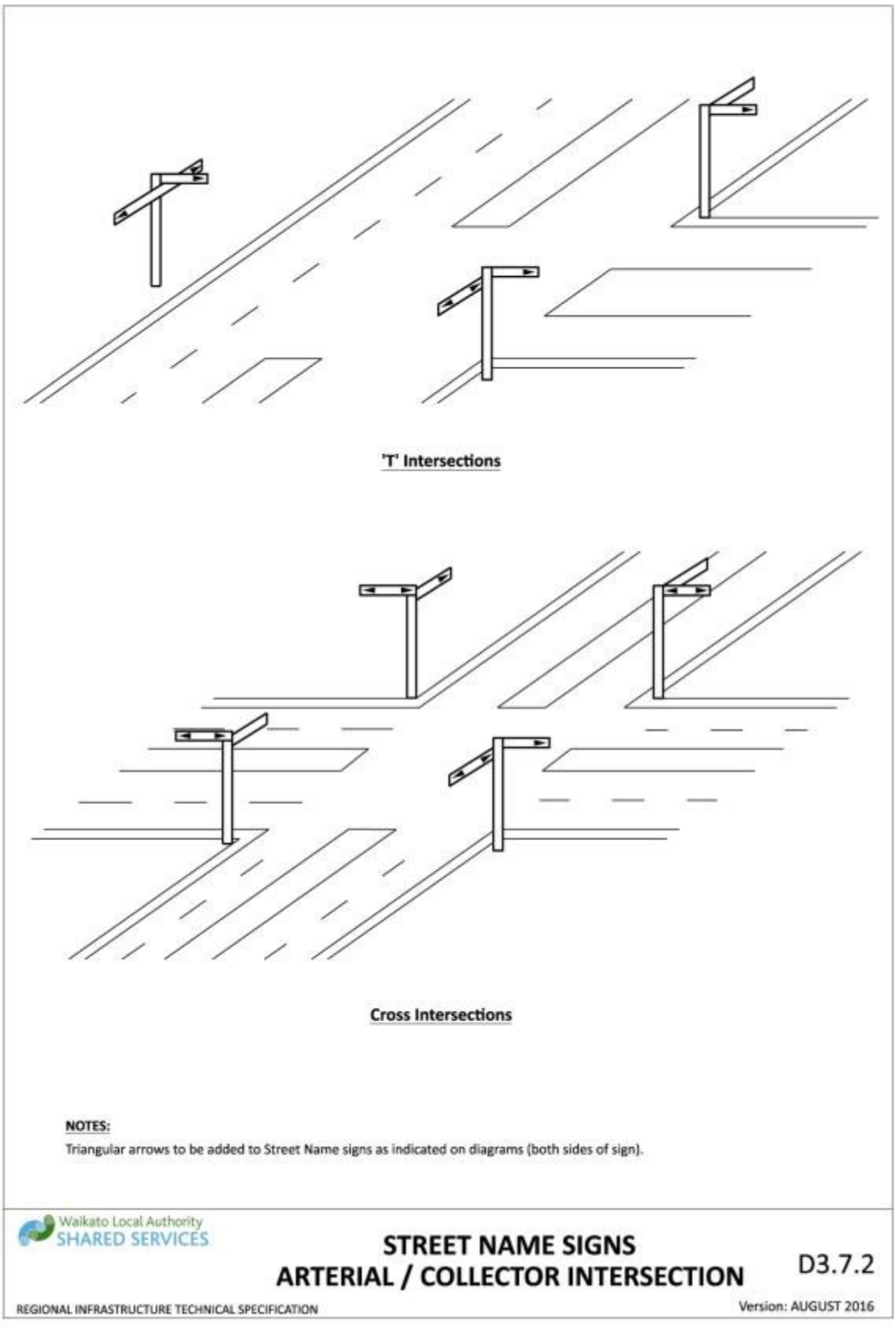

*Drawing 26: 3.6.3 Tactile paving for vision impaired*



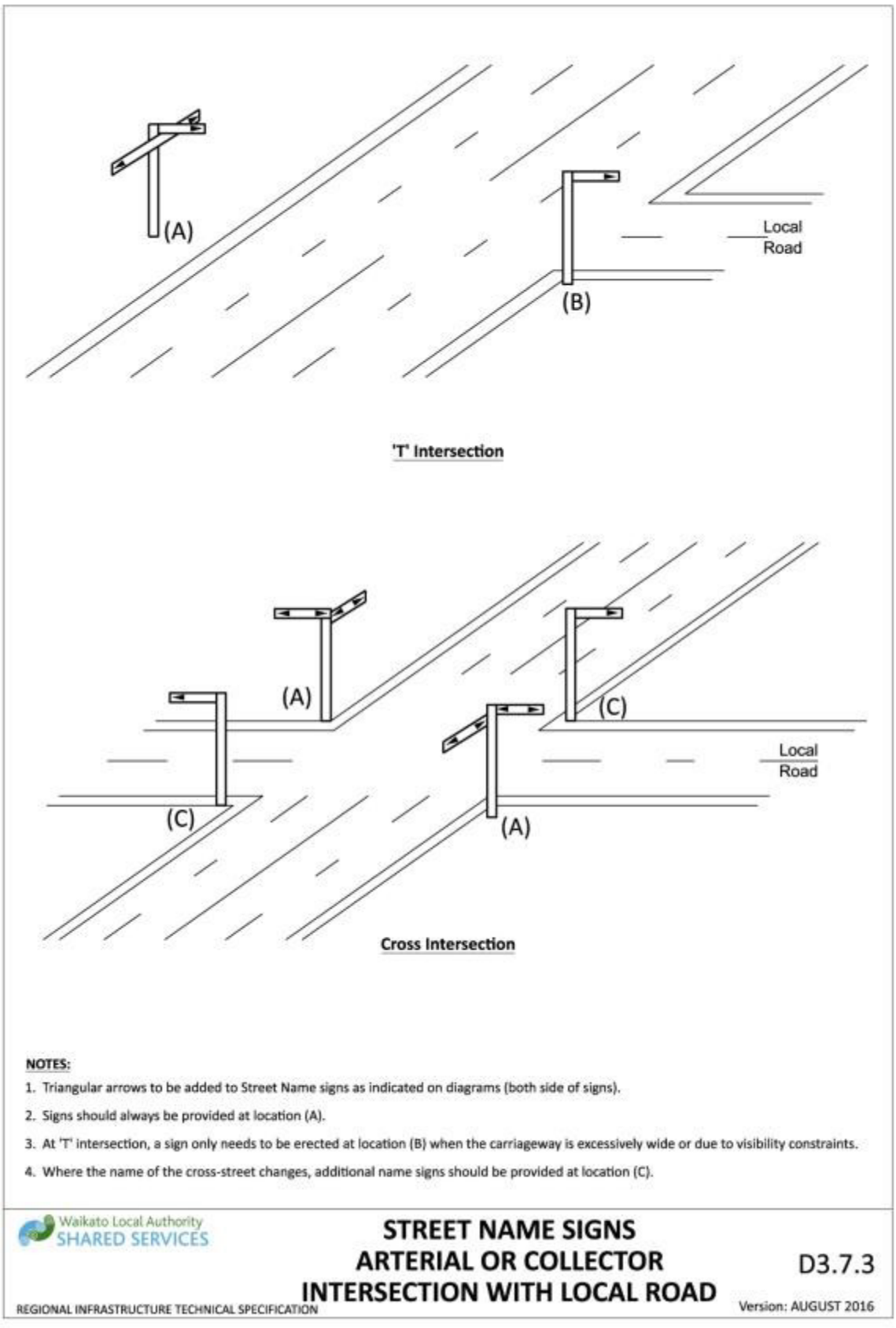

*Drawing 27: 3.6.4 Pedestrian facilities in islands*



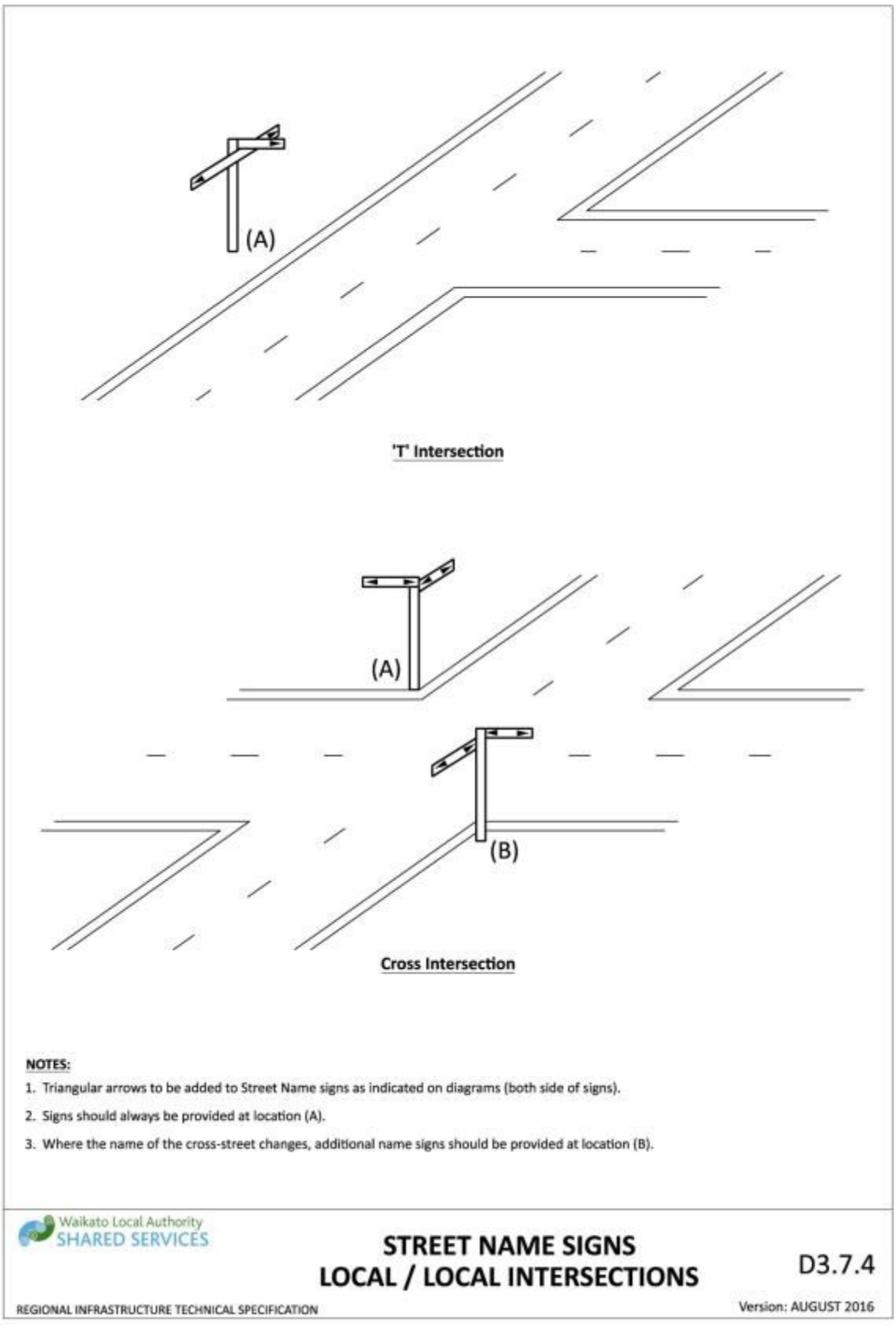

*Drawing 28: 3.7.1 Sign location and visibility at intersections*



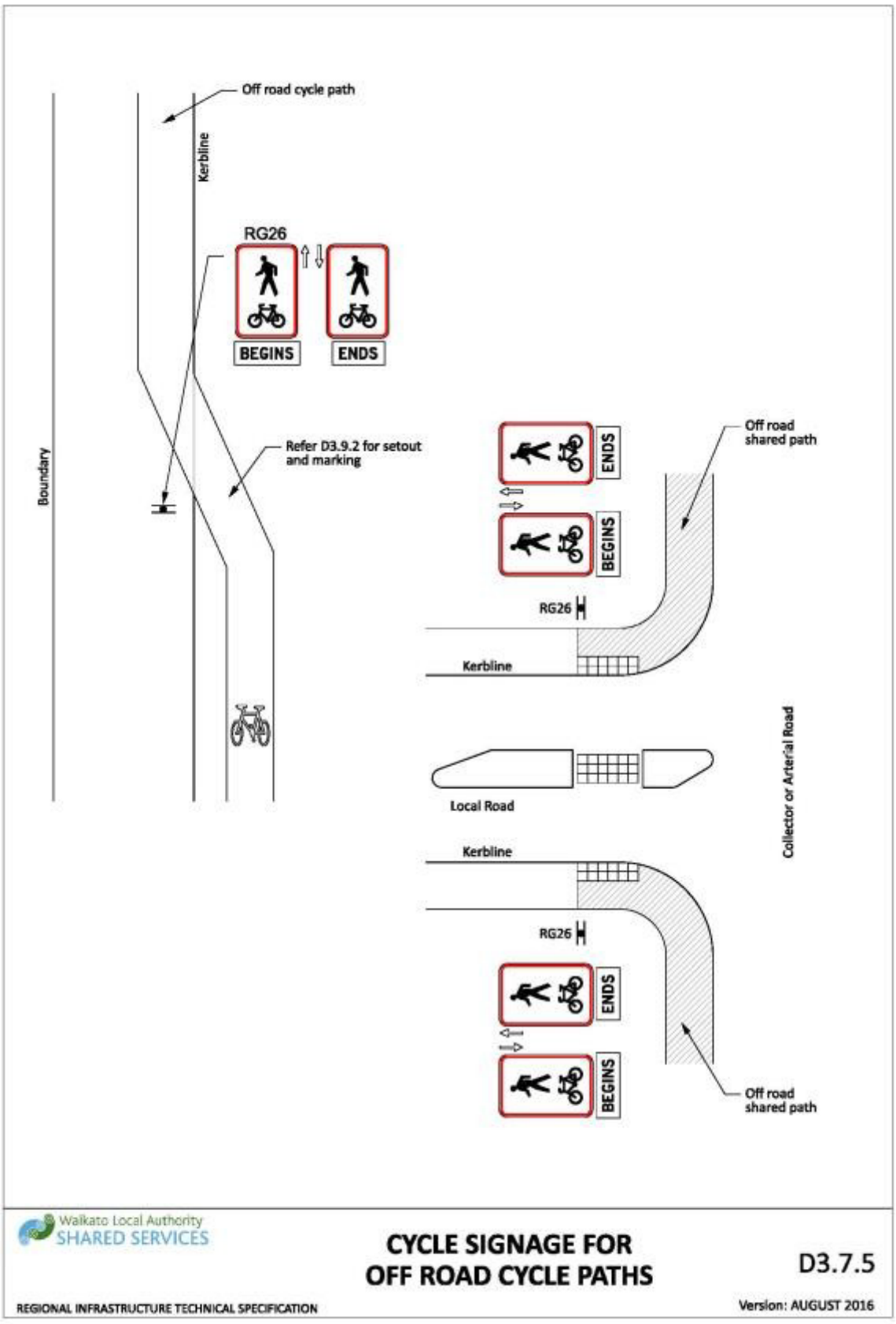

*Drawing 29: 3.7.2 Street name signs arterial/collector intersection*



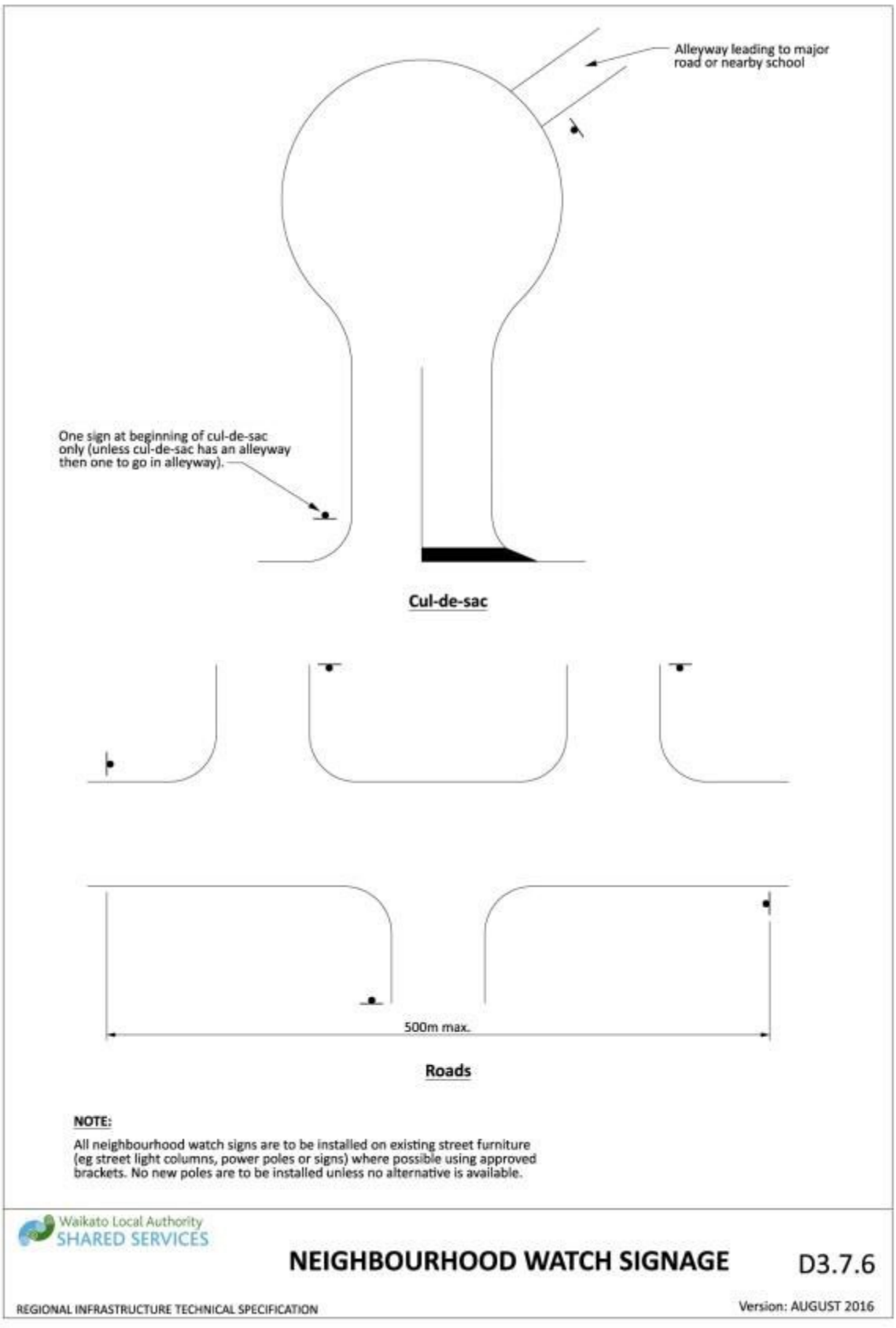

*Drawing 30: 3.7.3 Street name signs - arterial or collector intersection with local road*



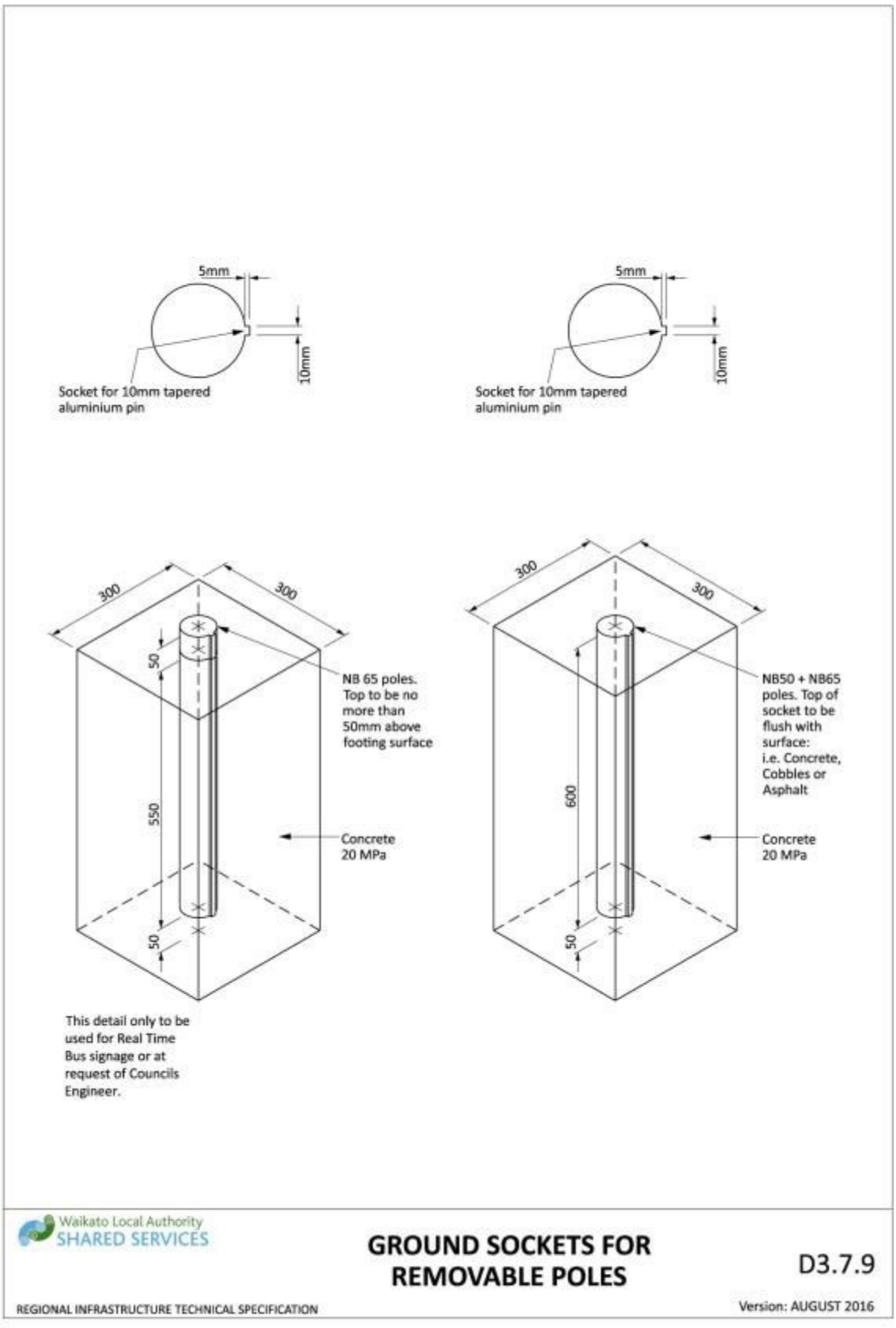

*Drawing 31: 3.7.4 Street name signs local/local intersections*



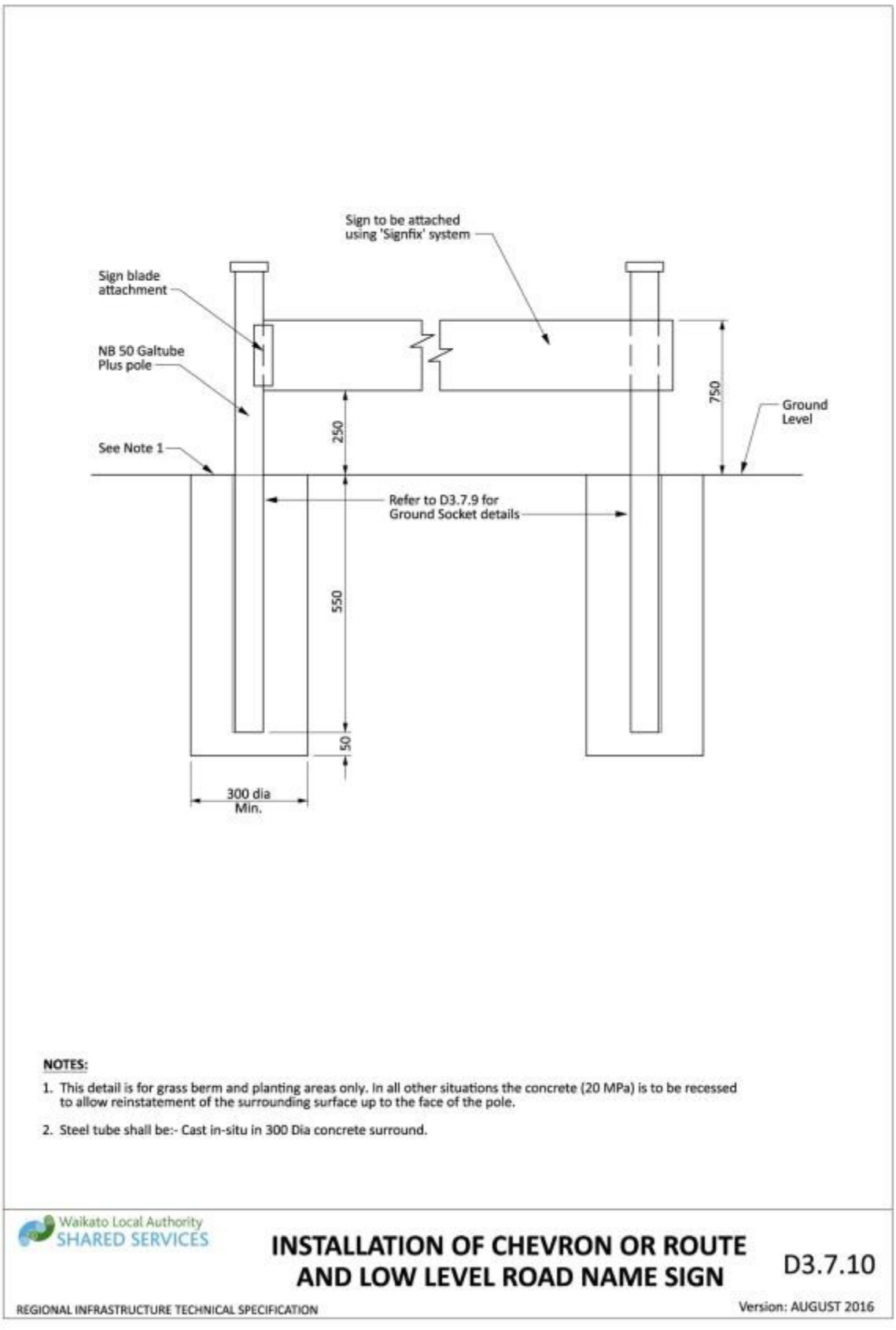

*Drawing 32: 3.7.5 Cycle signage for off road cycle paths*



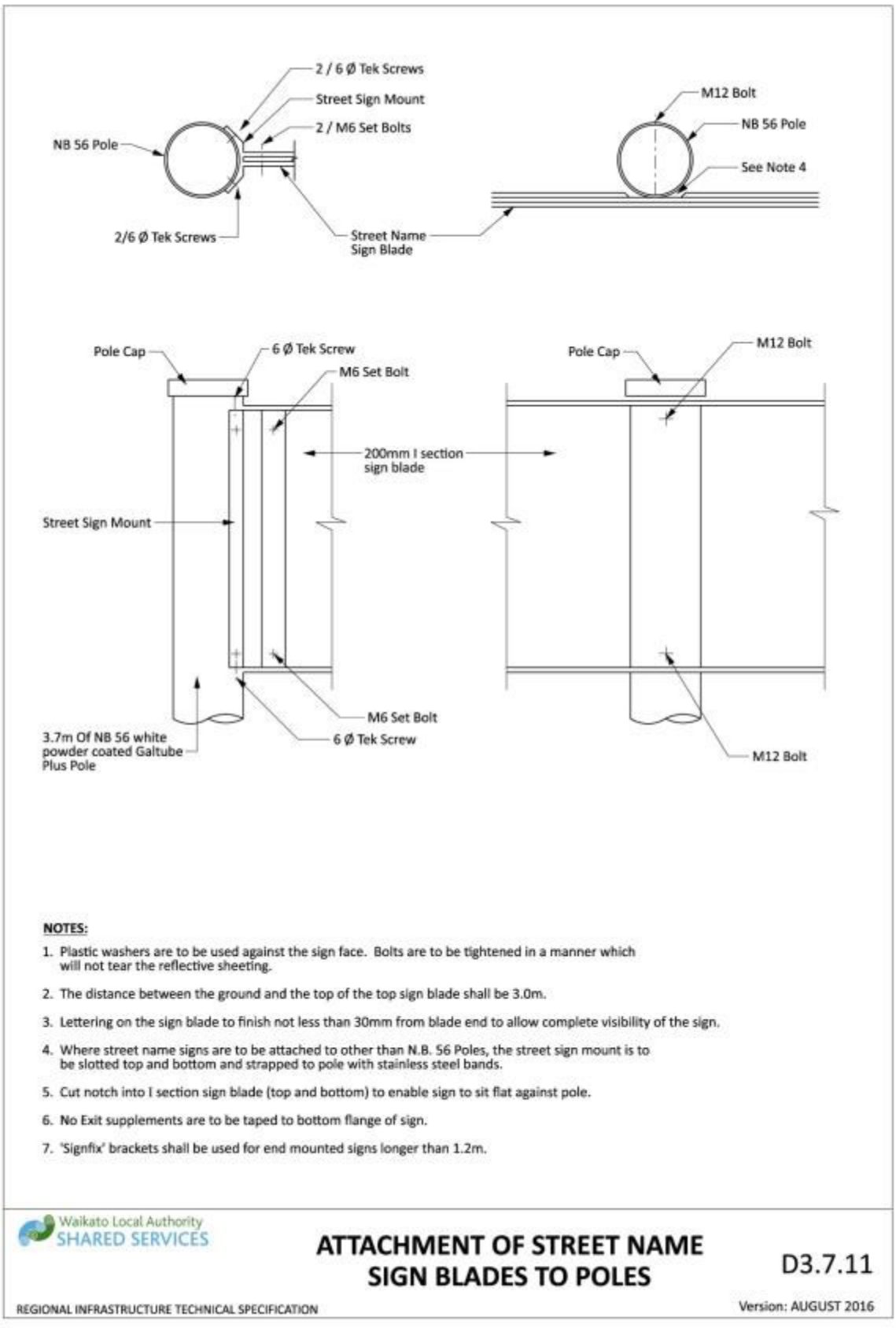

*Drawing 33 3.7.6: Neighbourhood watch signage*



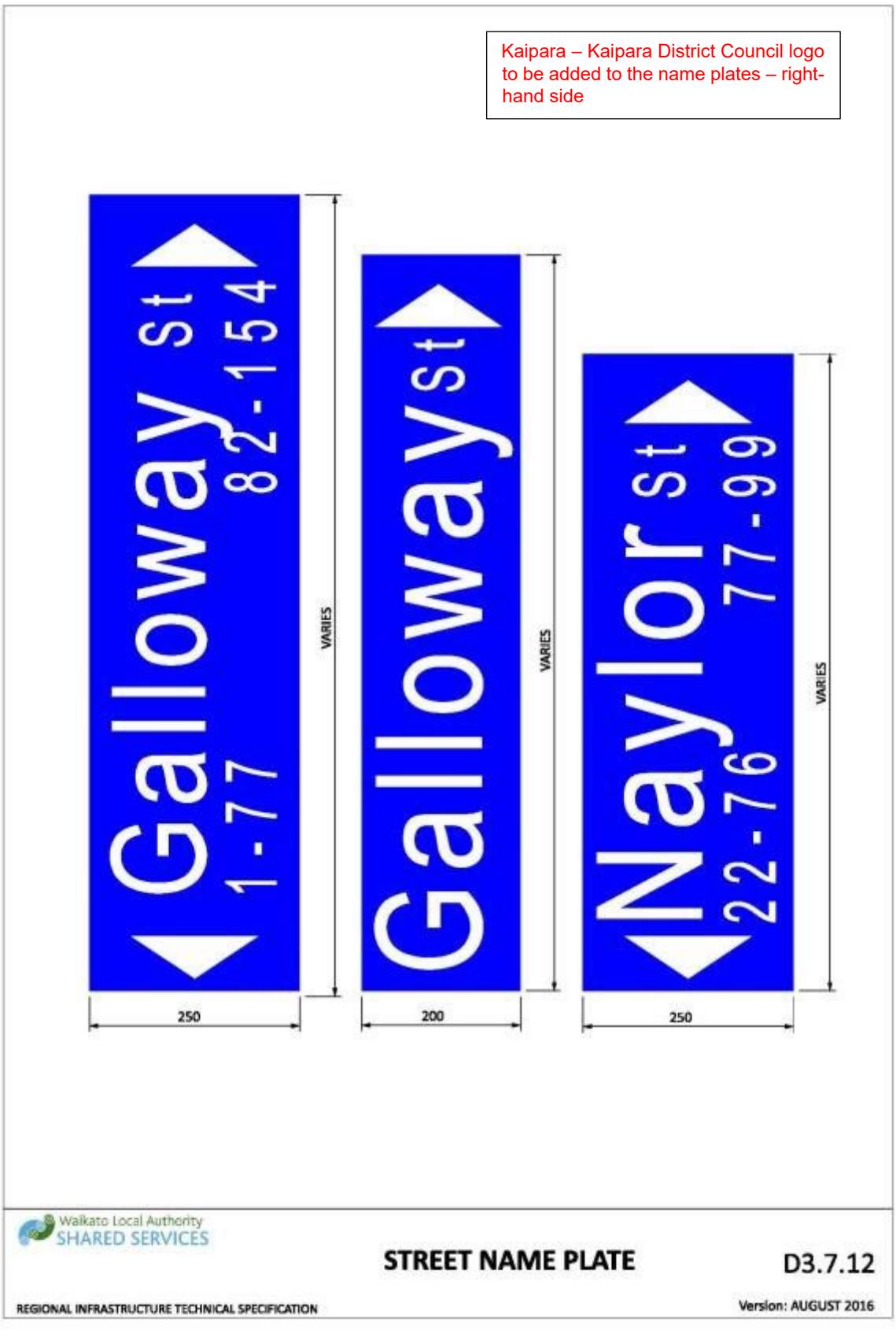

*Drawing 33:3.7.9: Ground sockets for removable poles*



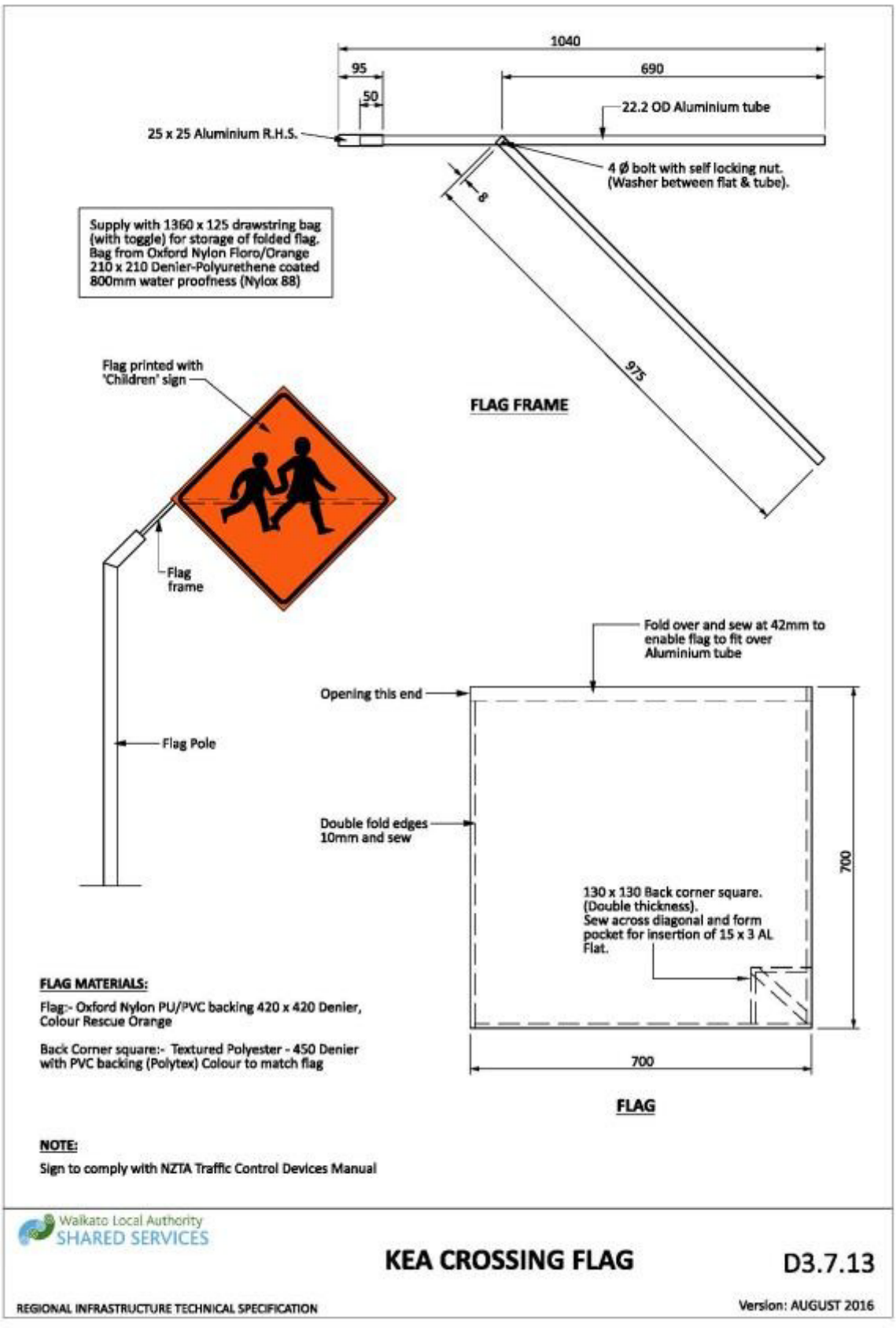

*Drawing 34: 3.7.10: Installation of chevron or route and low level road name signal*



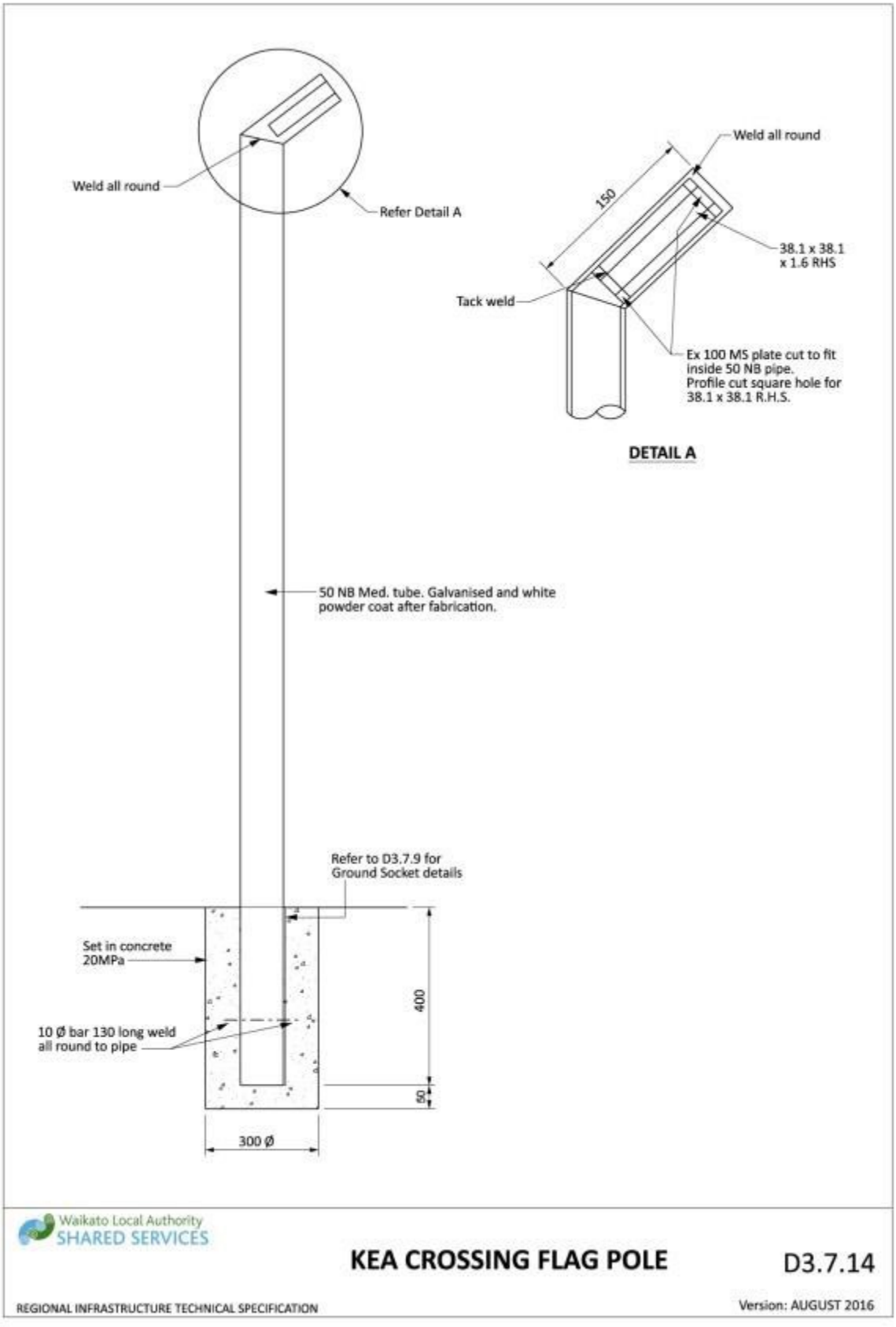

*Drawing 35: 3.7.11: Attachment of street name sign blades to poles*



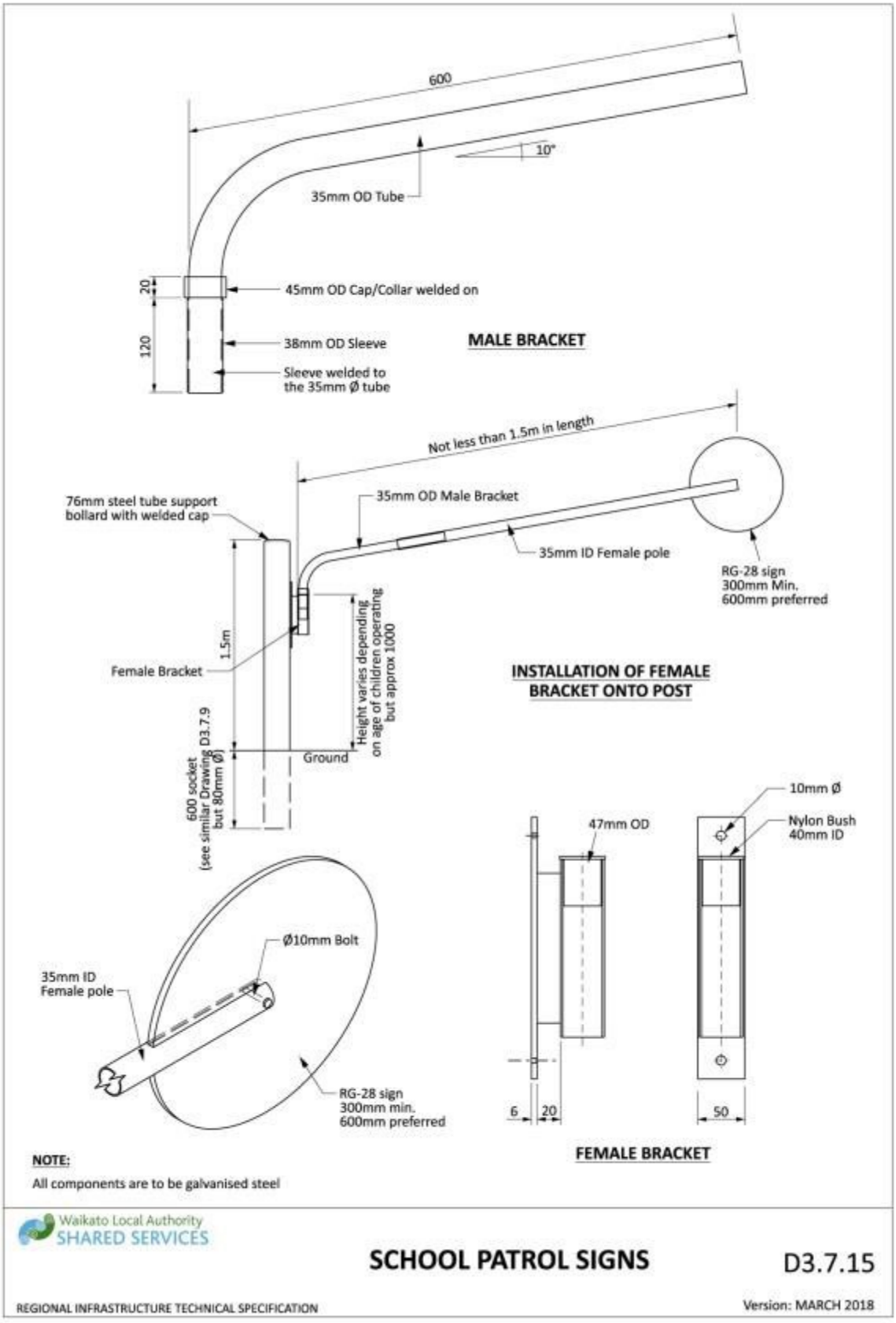

*Drawing 36: 3.7.12: Street name plate*




*Drawing 37: 3.7.13: Kea crossing flag*



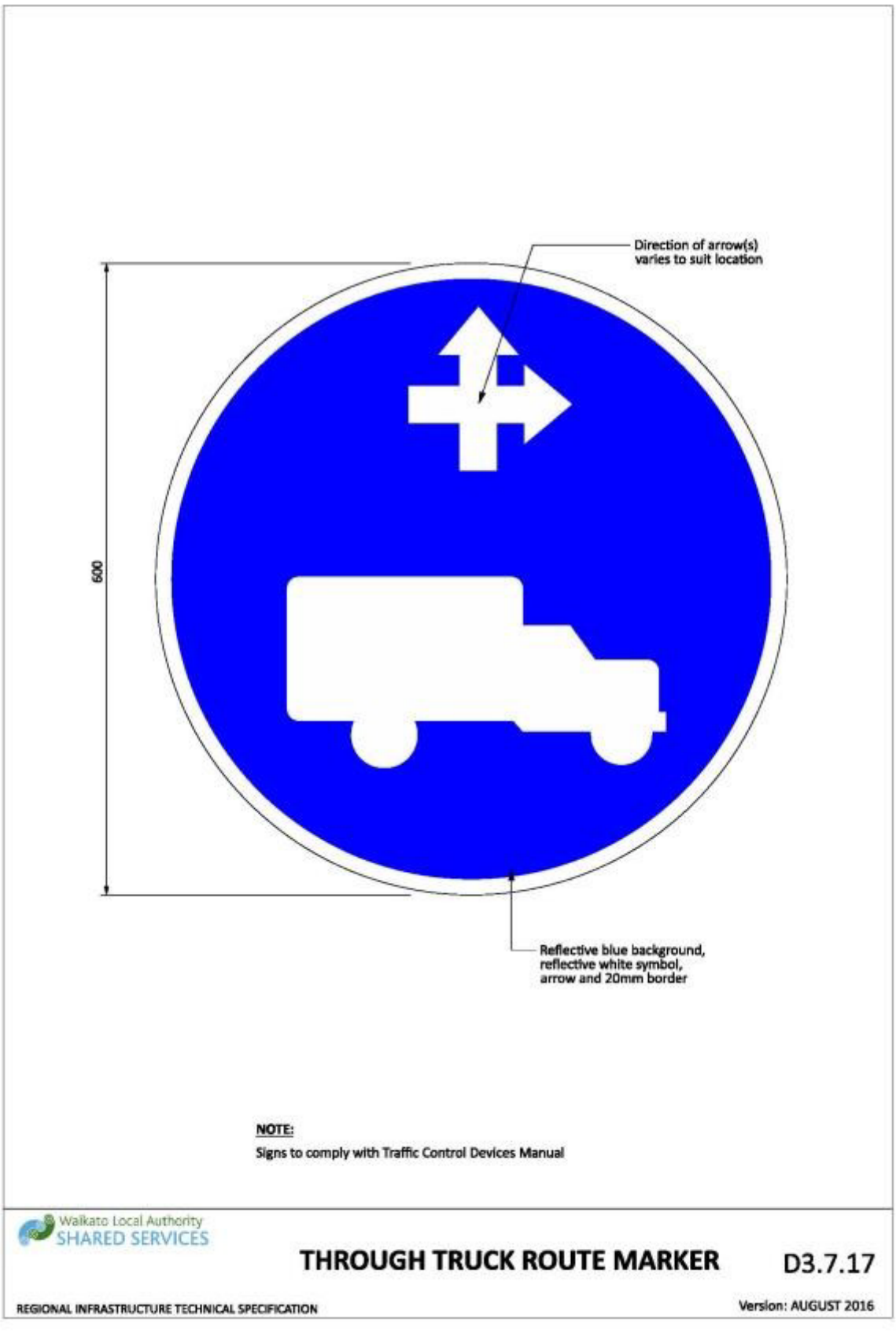

*Drawing 38: 3.7.14: Kea crossing flag pole*



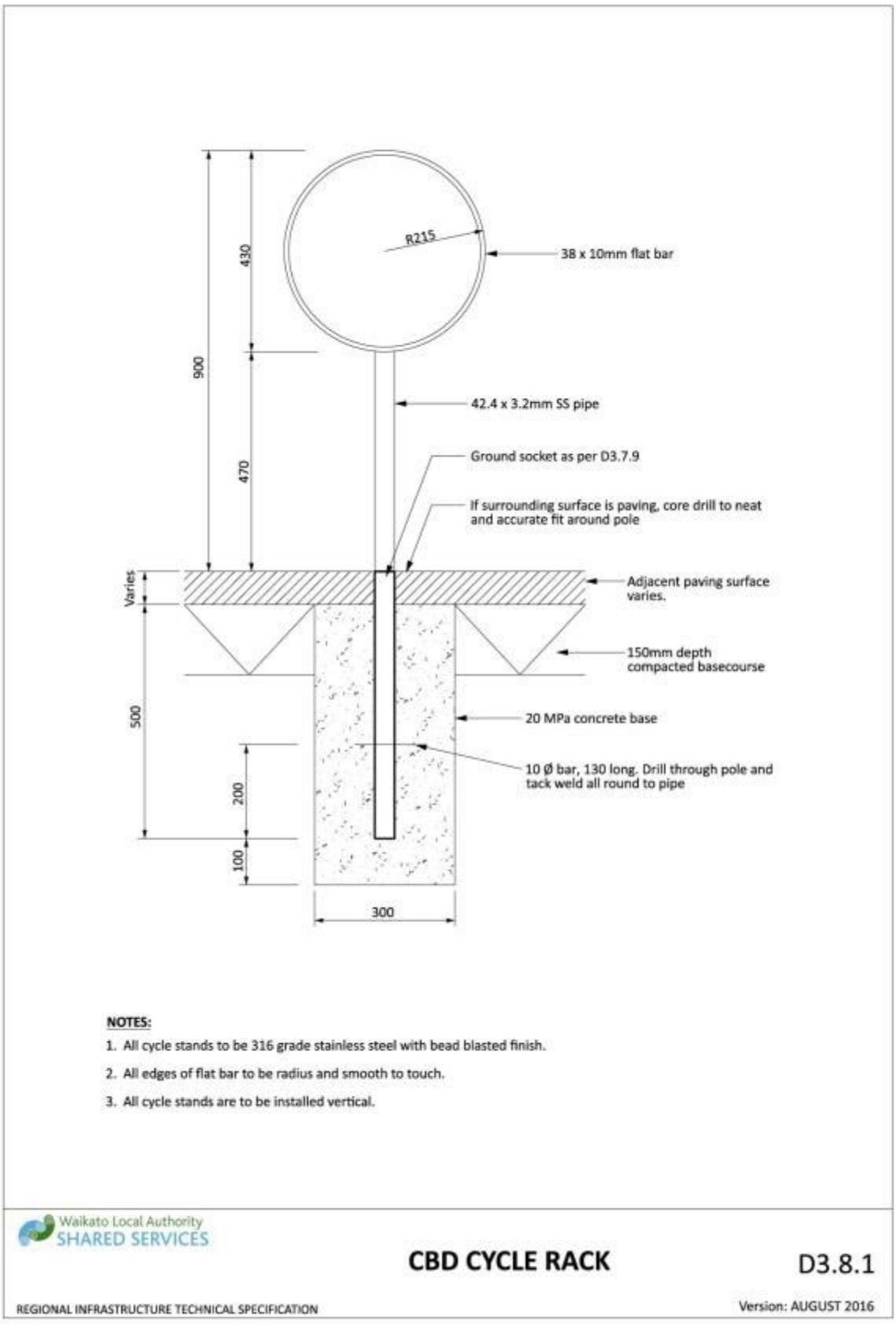

*Drawing 39:3.7.15: School patrol signs*



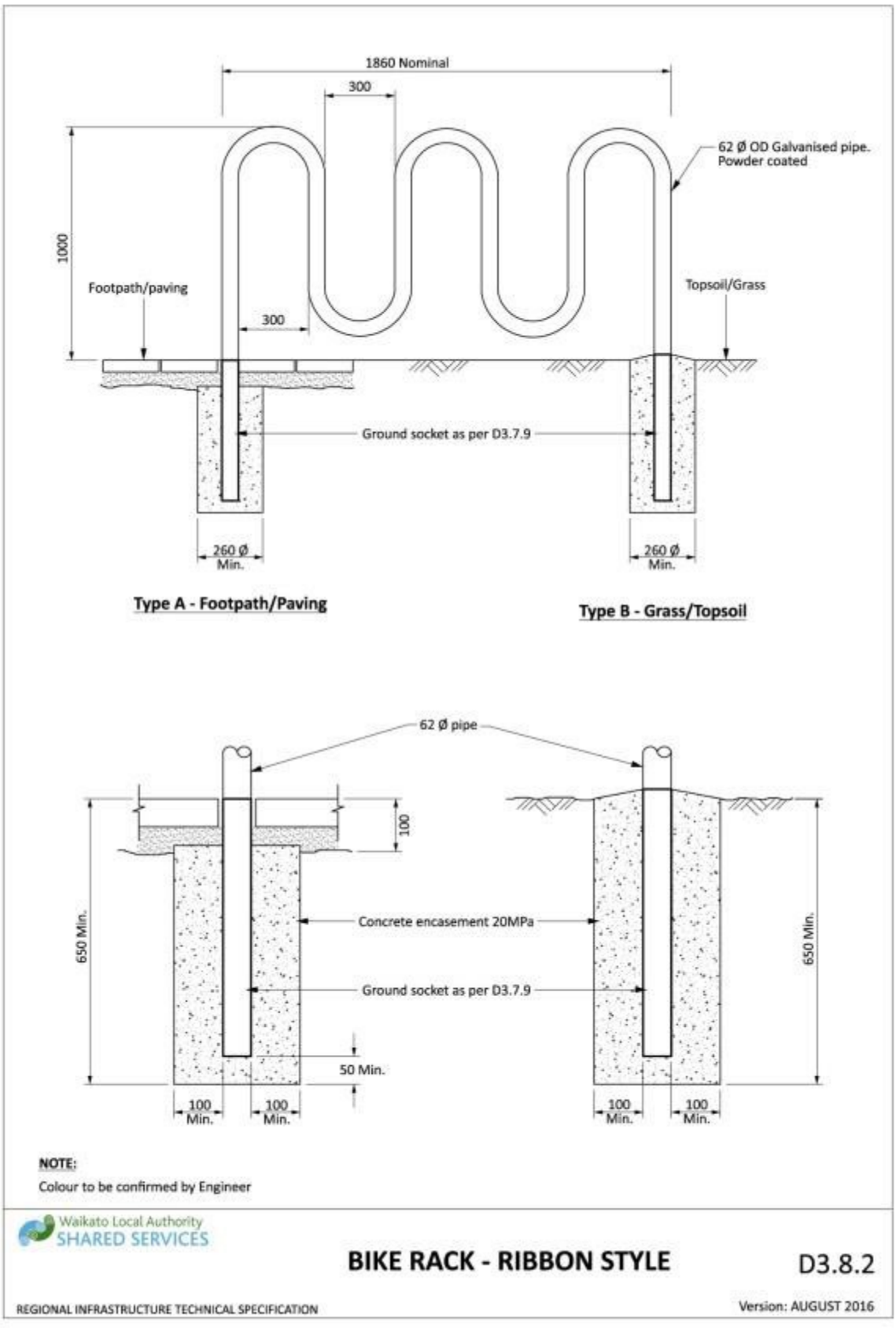

*Drawing 40: 3.7.16: Bus stop / taxi supplement*



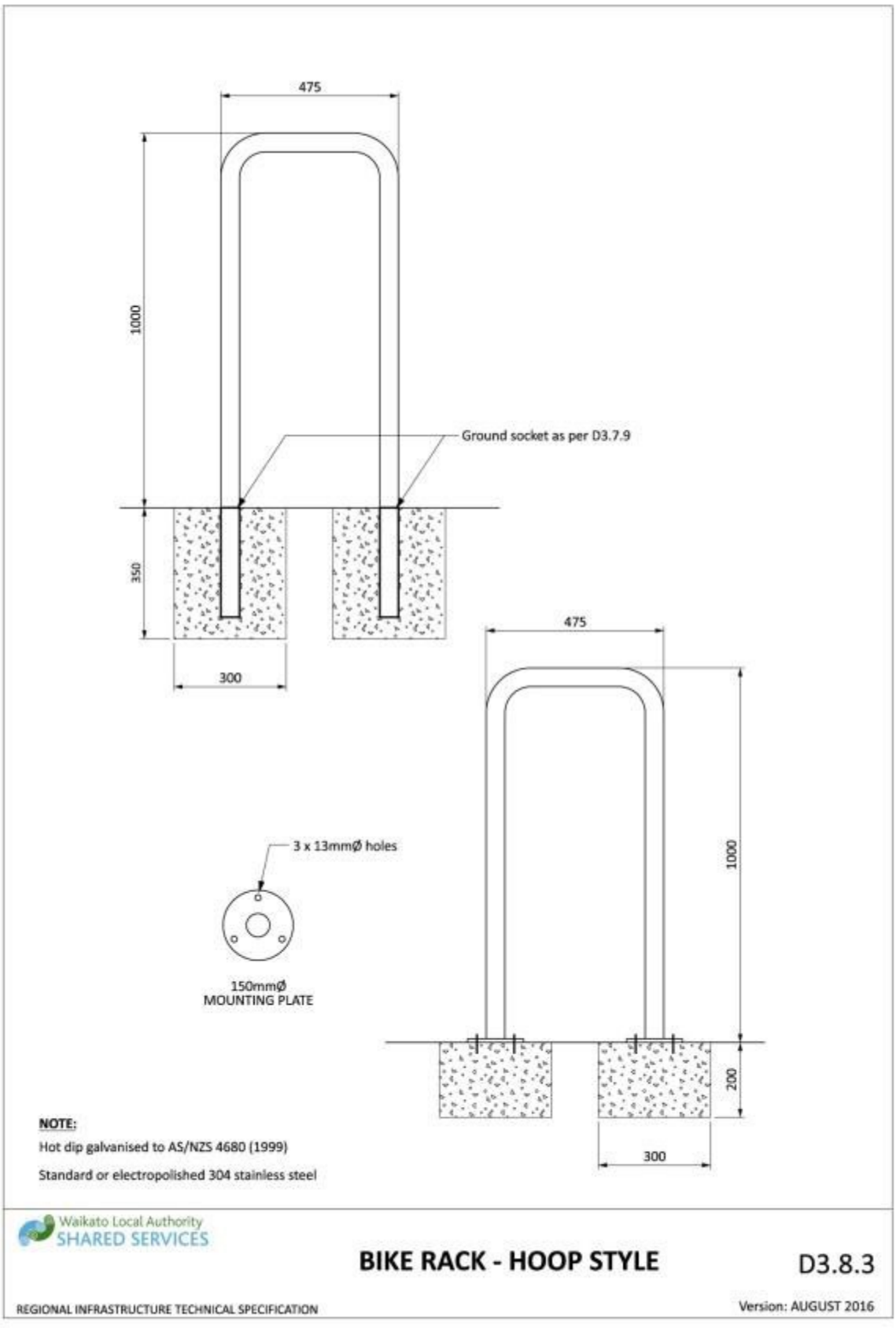

*Drawing 41: 3.7.17: Through truck route marker*



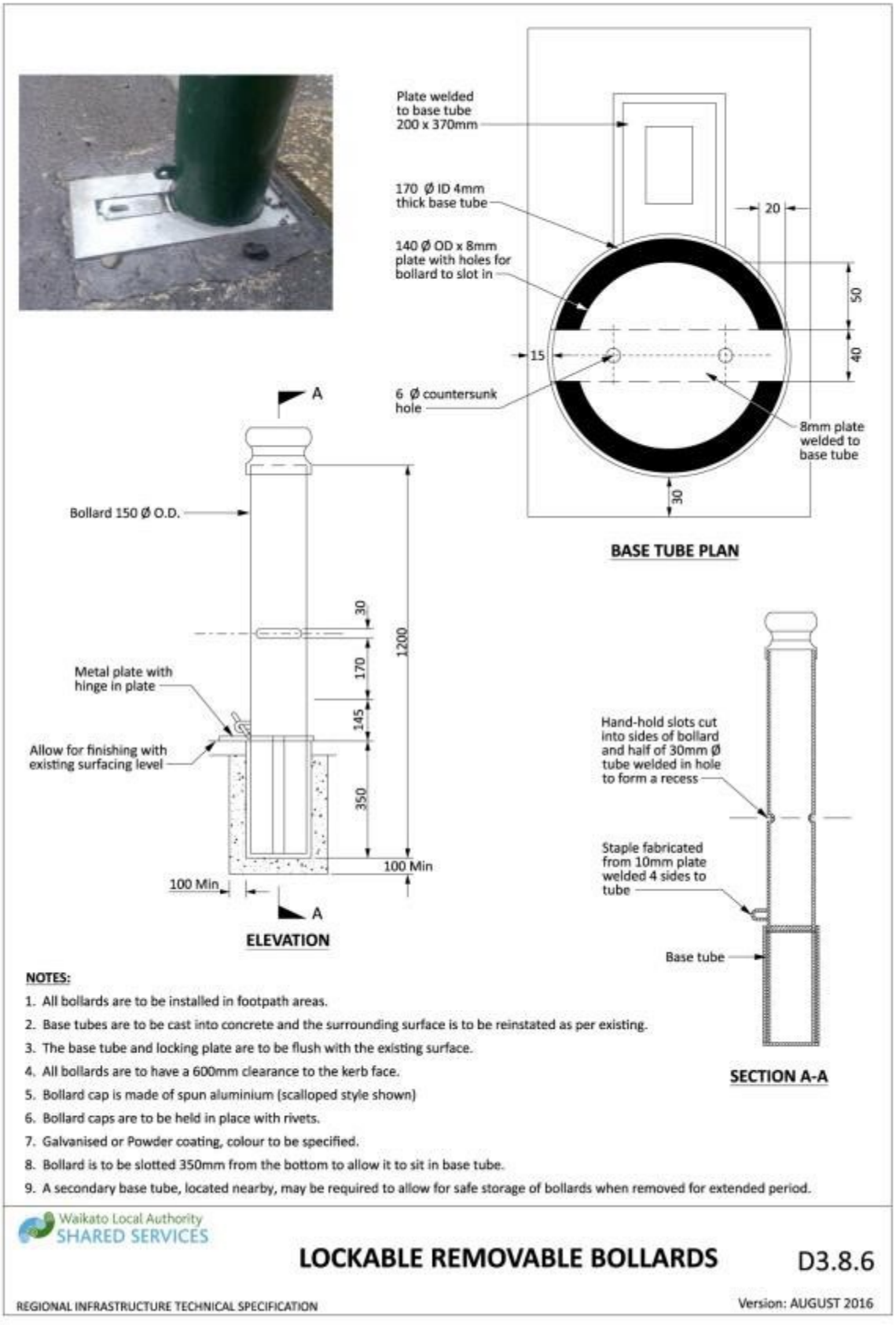

*Drawing 42: 3.8.1: CBD cycle track*



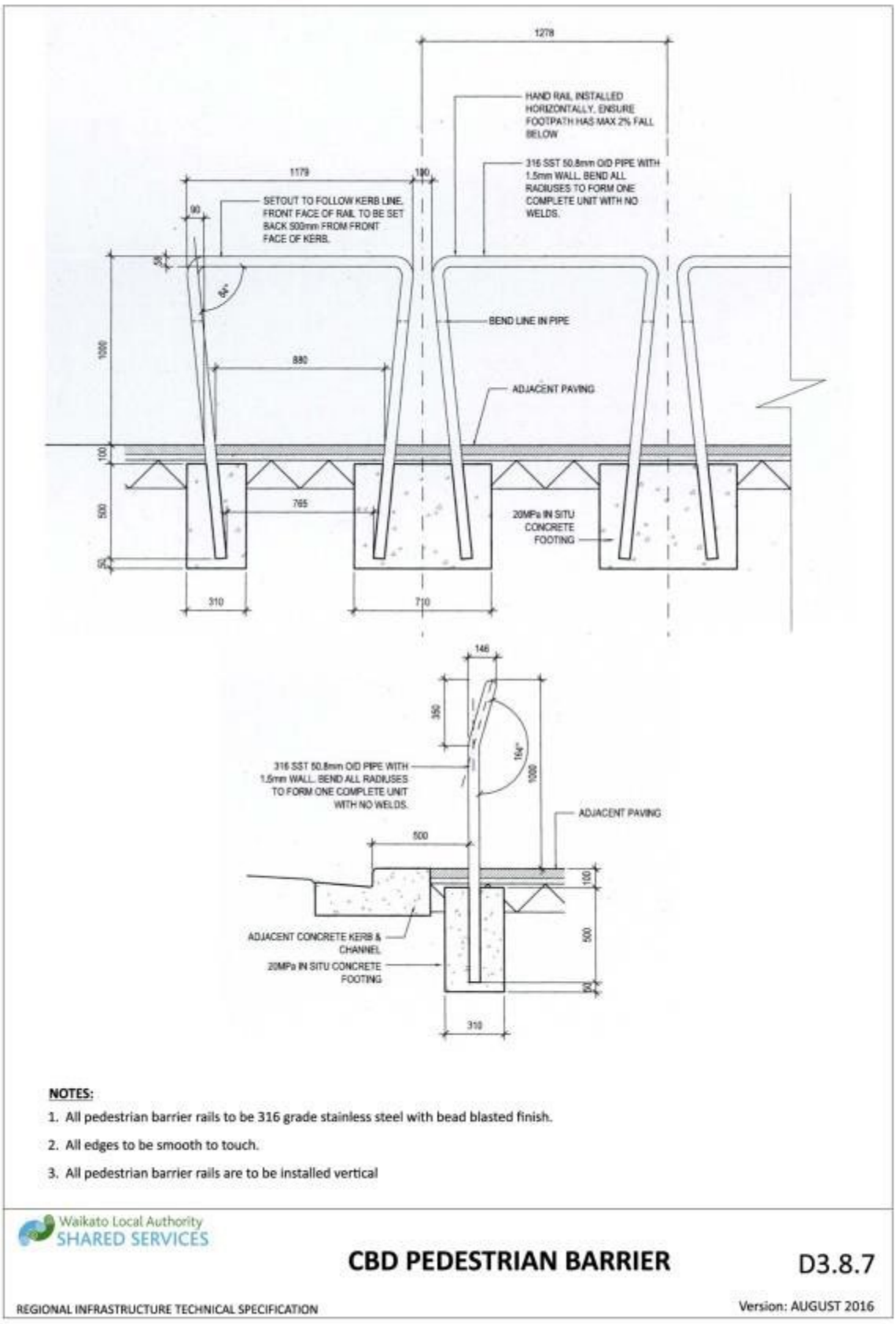

*Drawing 43: 3.8.2: Bike rack - ribbon style*



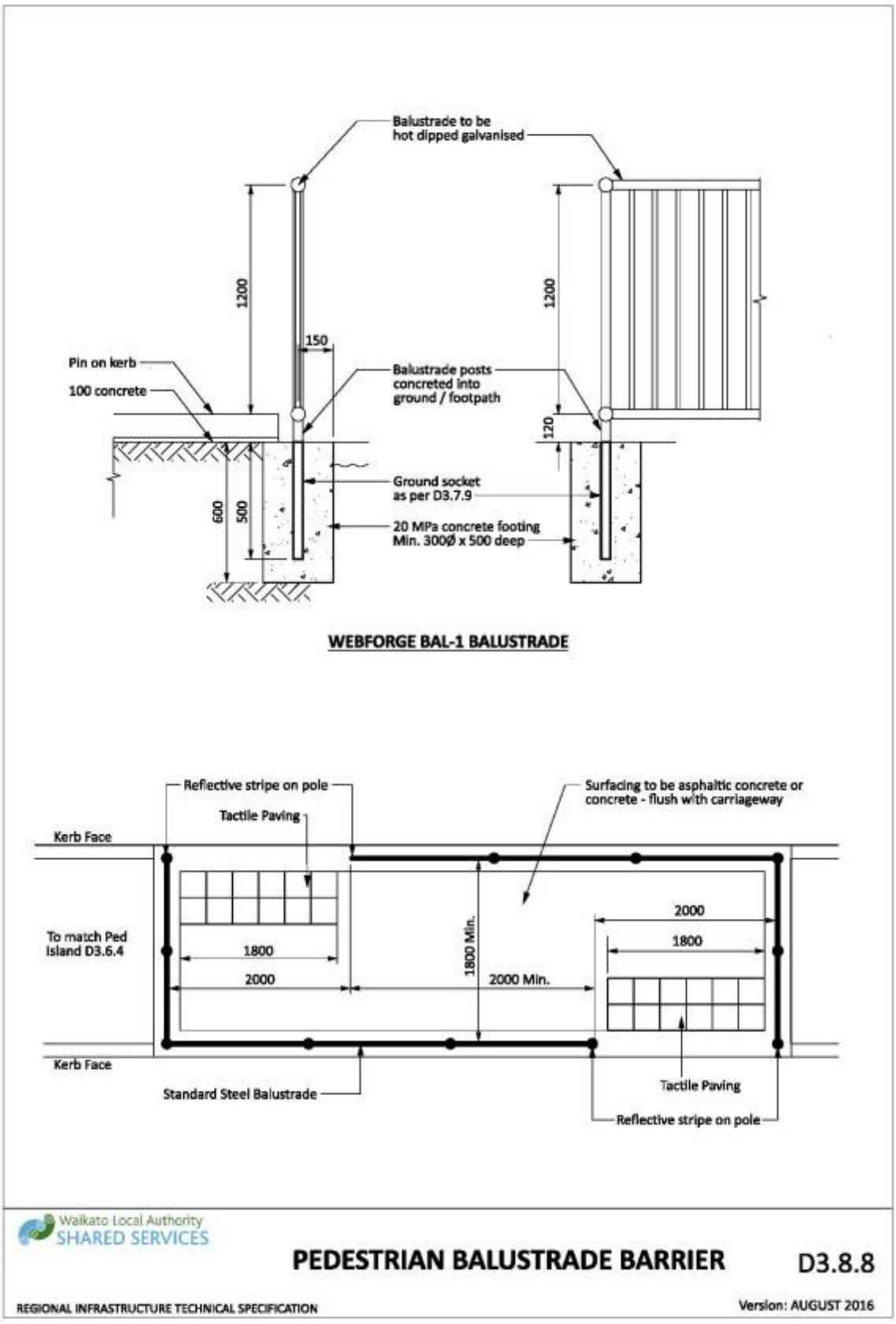

*Drawing 44: 3.8.3: Bike rack - hoop style*



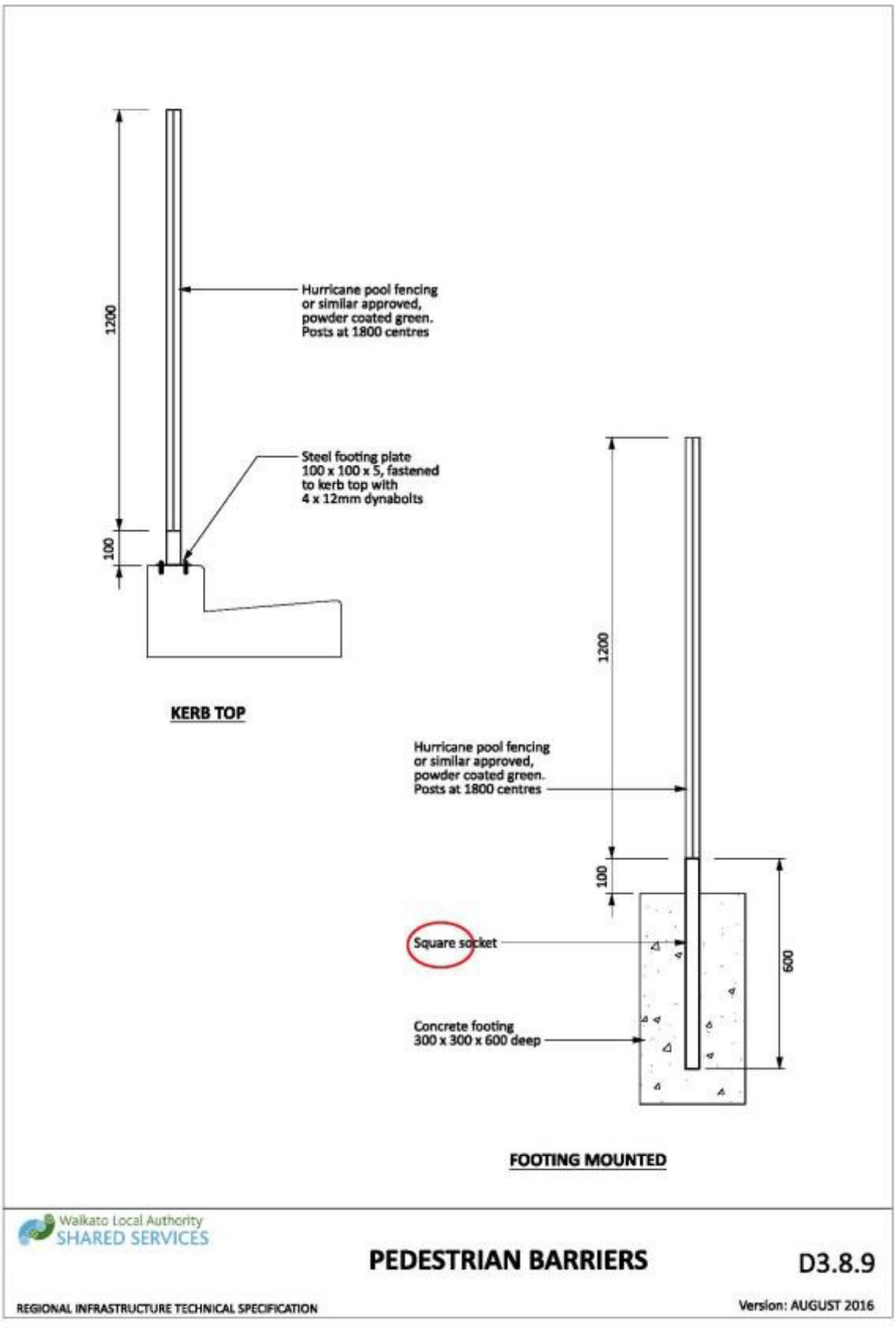

*Drawing 45: 3-46: Lockable removable bollards*



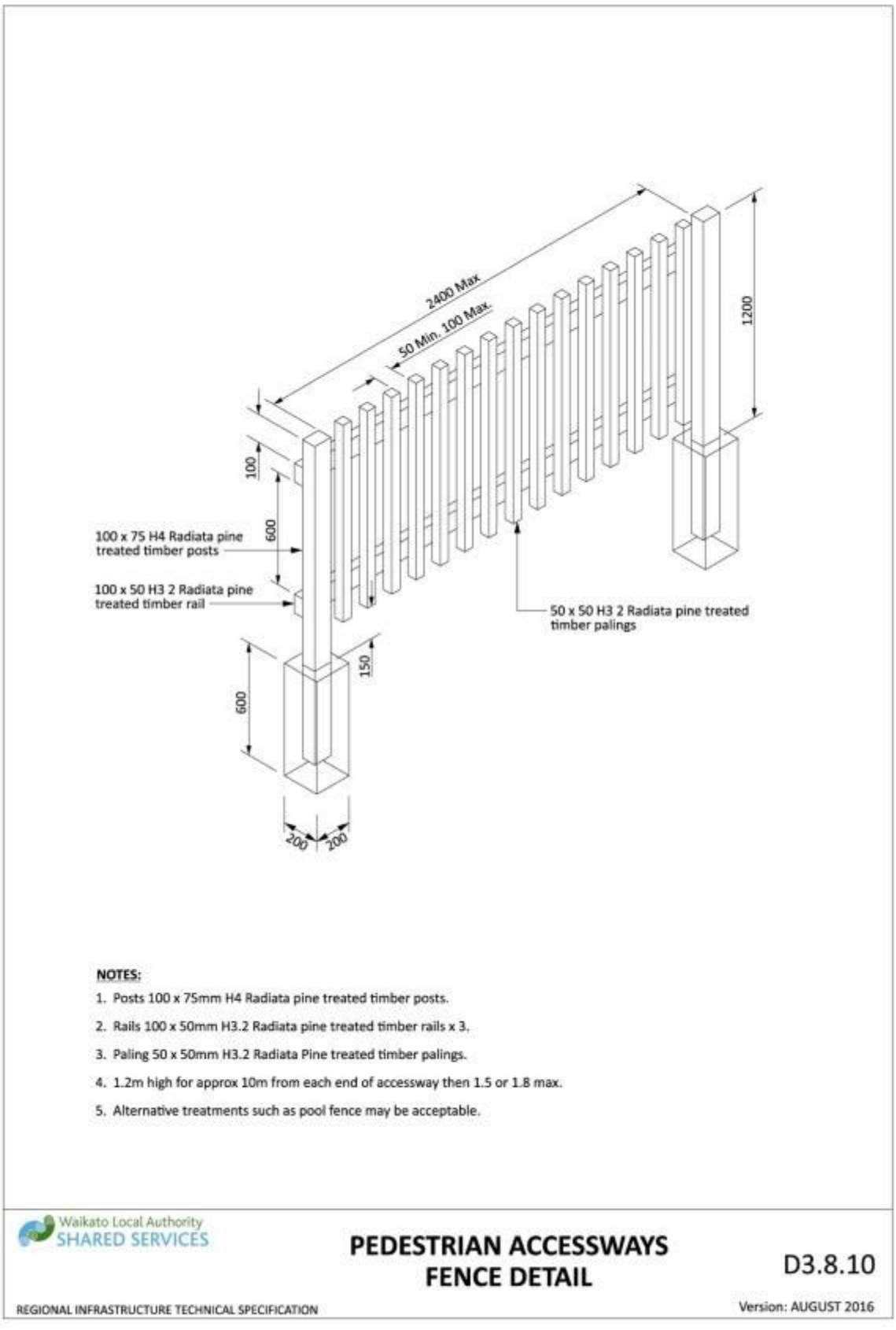

*Drawing 46: 3.8.7: CBD pedestrian barrier*



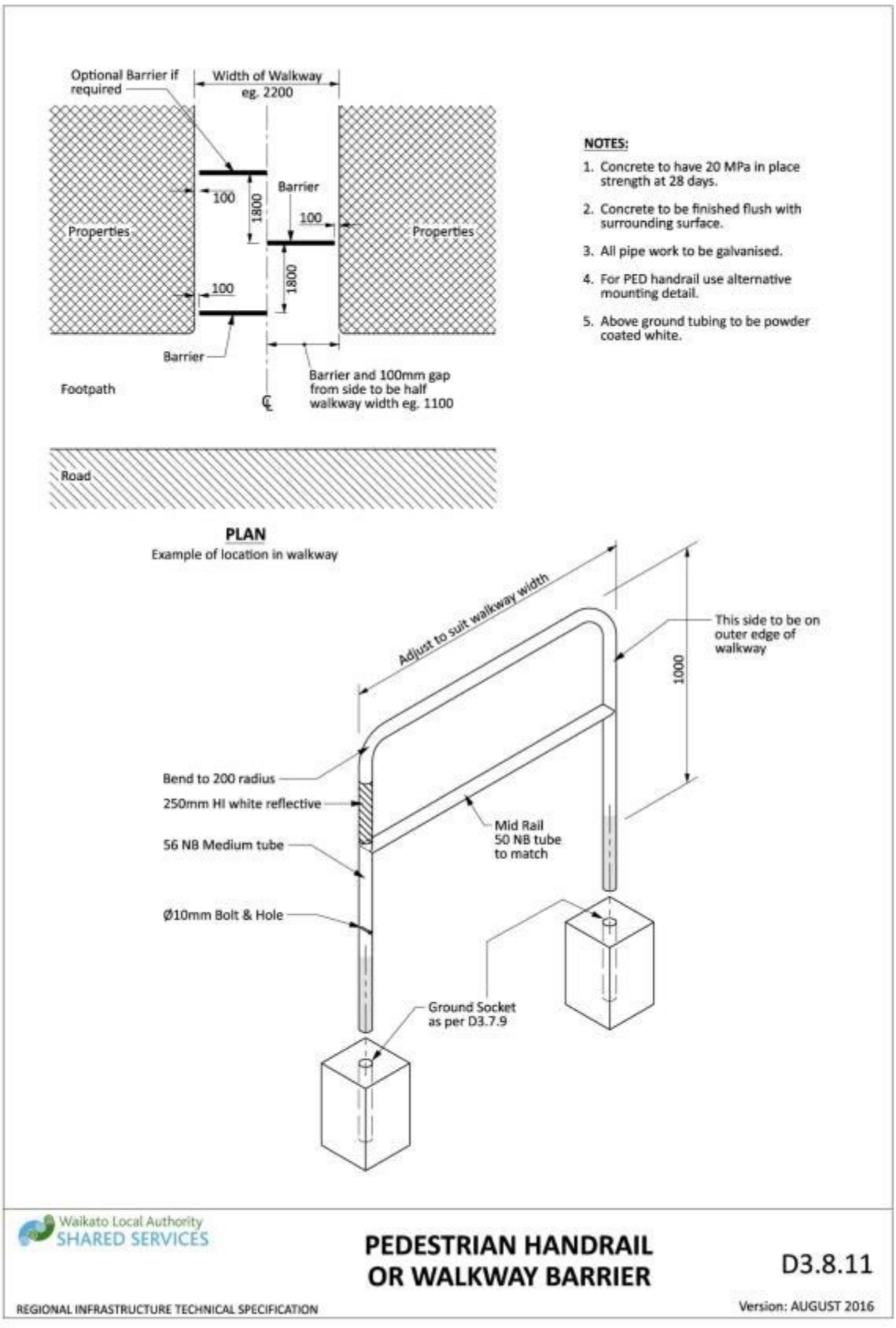

*Drawing 47: 3.8.8: Pedestrian balustrade barrier*



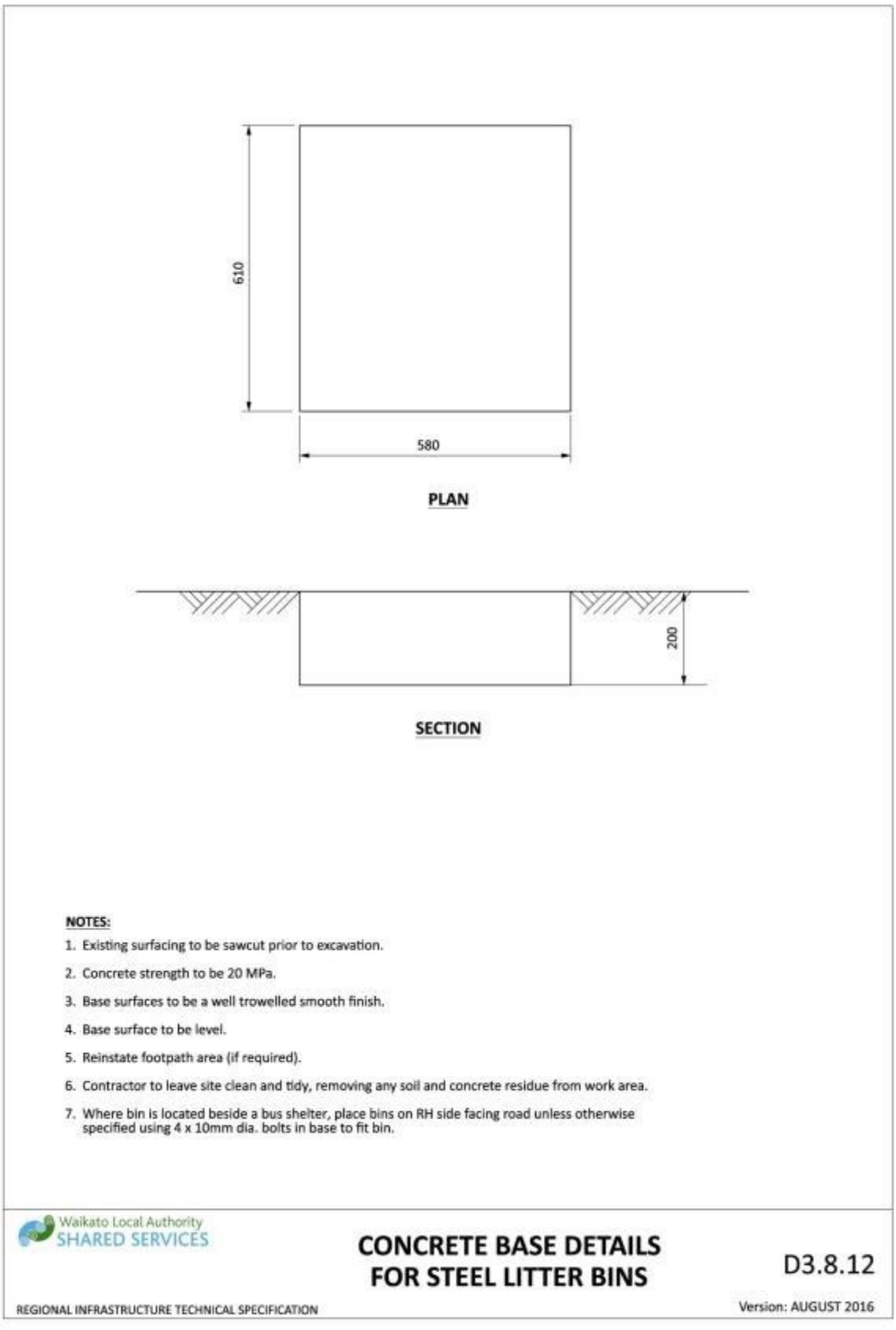

*Drawing 48: 3.8.9: Pedestrian barriers*



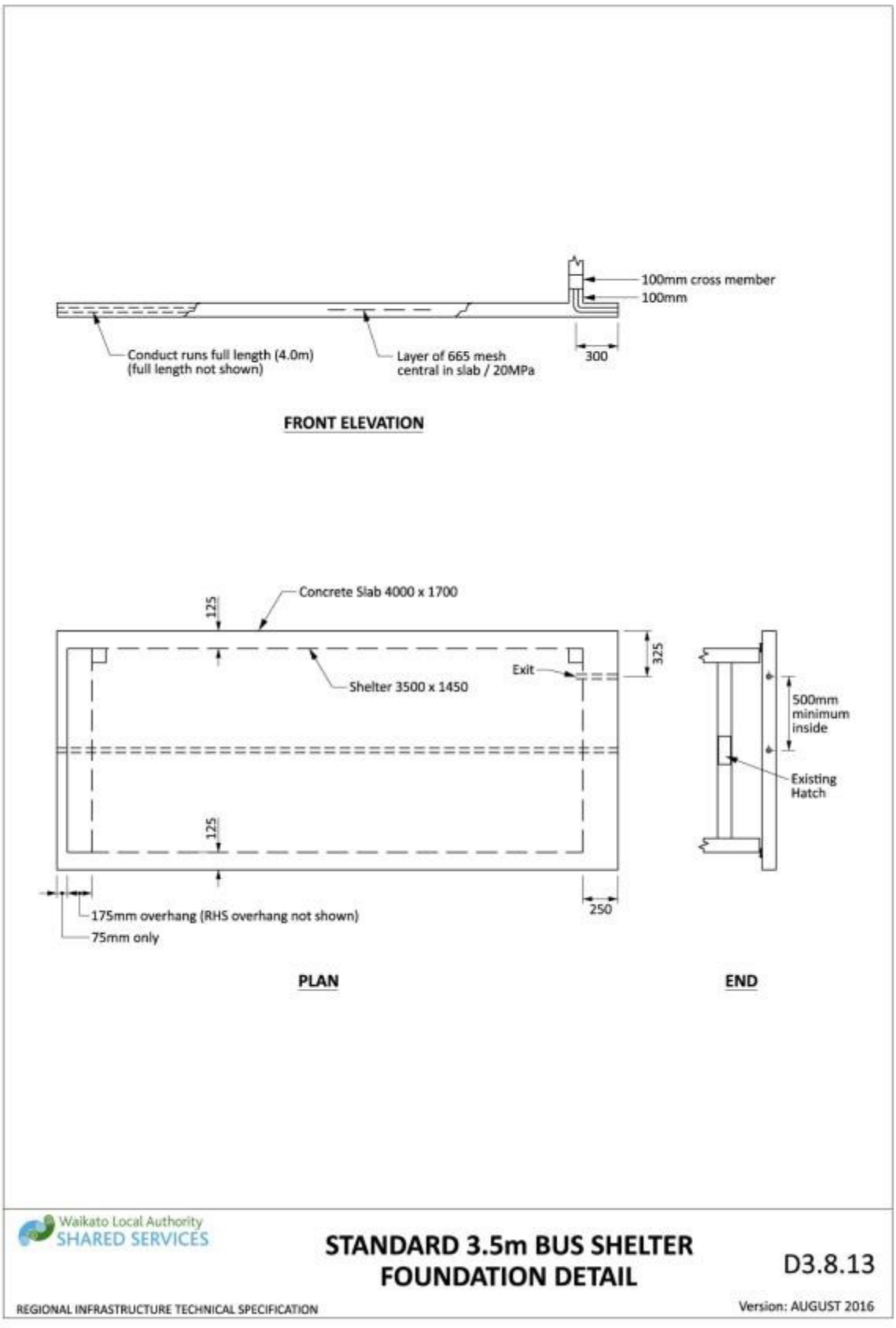

*Drawing 49: 3.8.10: Pedestrian accessways fence detail*



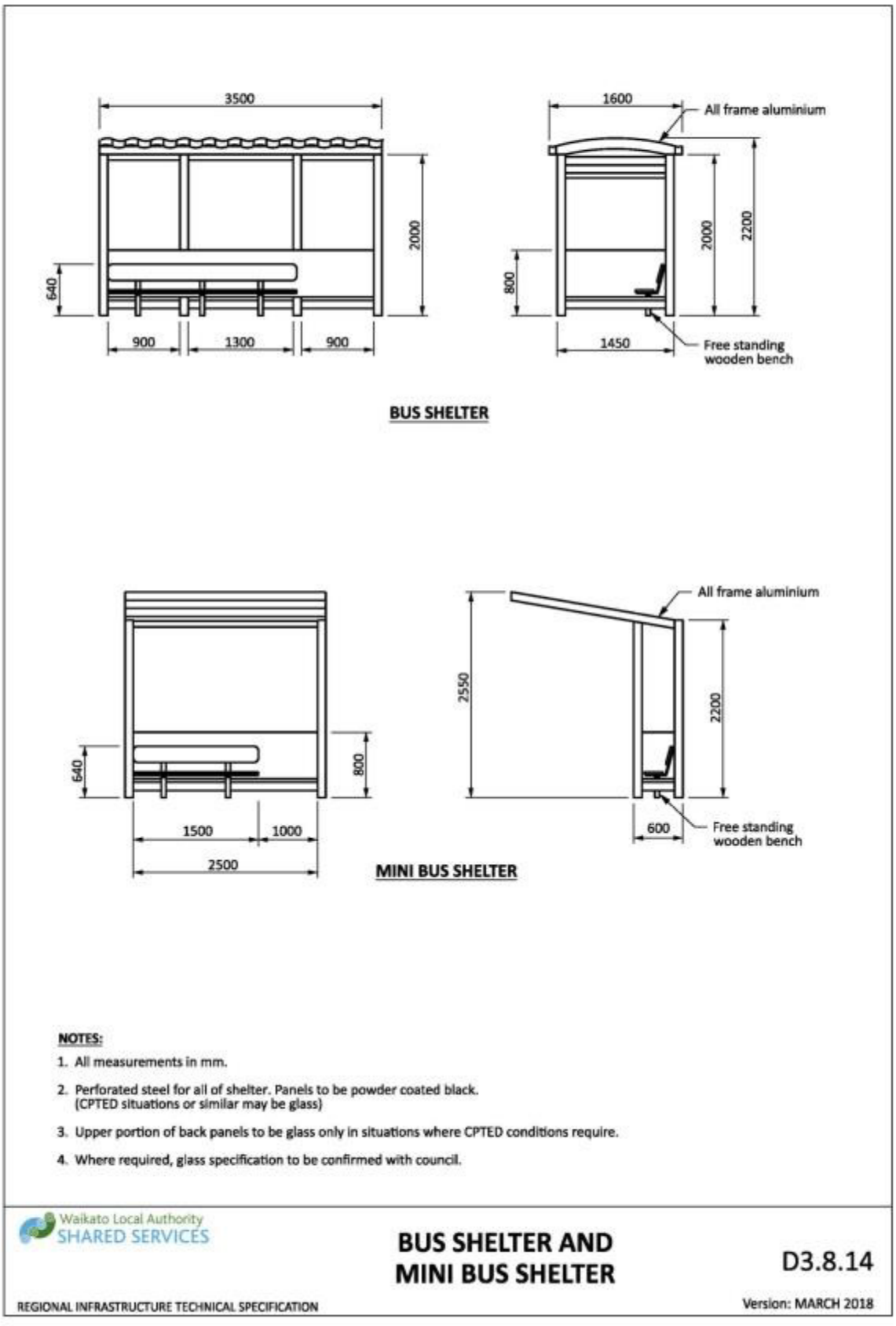

*Drawing 50: 3.8.11: Pedestrian handrail or walkway barrier*



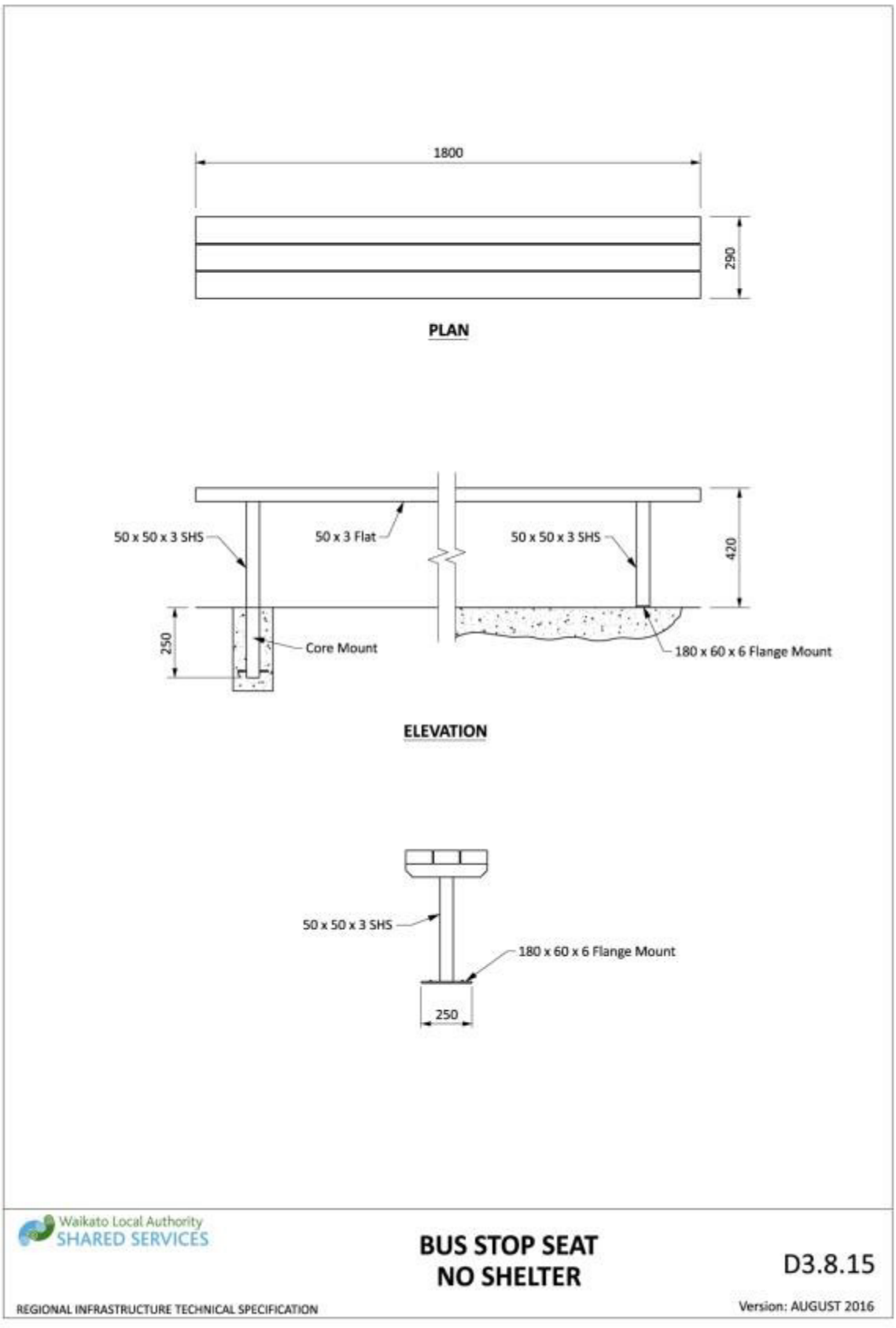

*Drawing 51: 3.8.12: Concrete base details for steel litter bin*



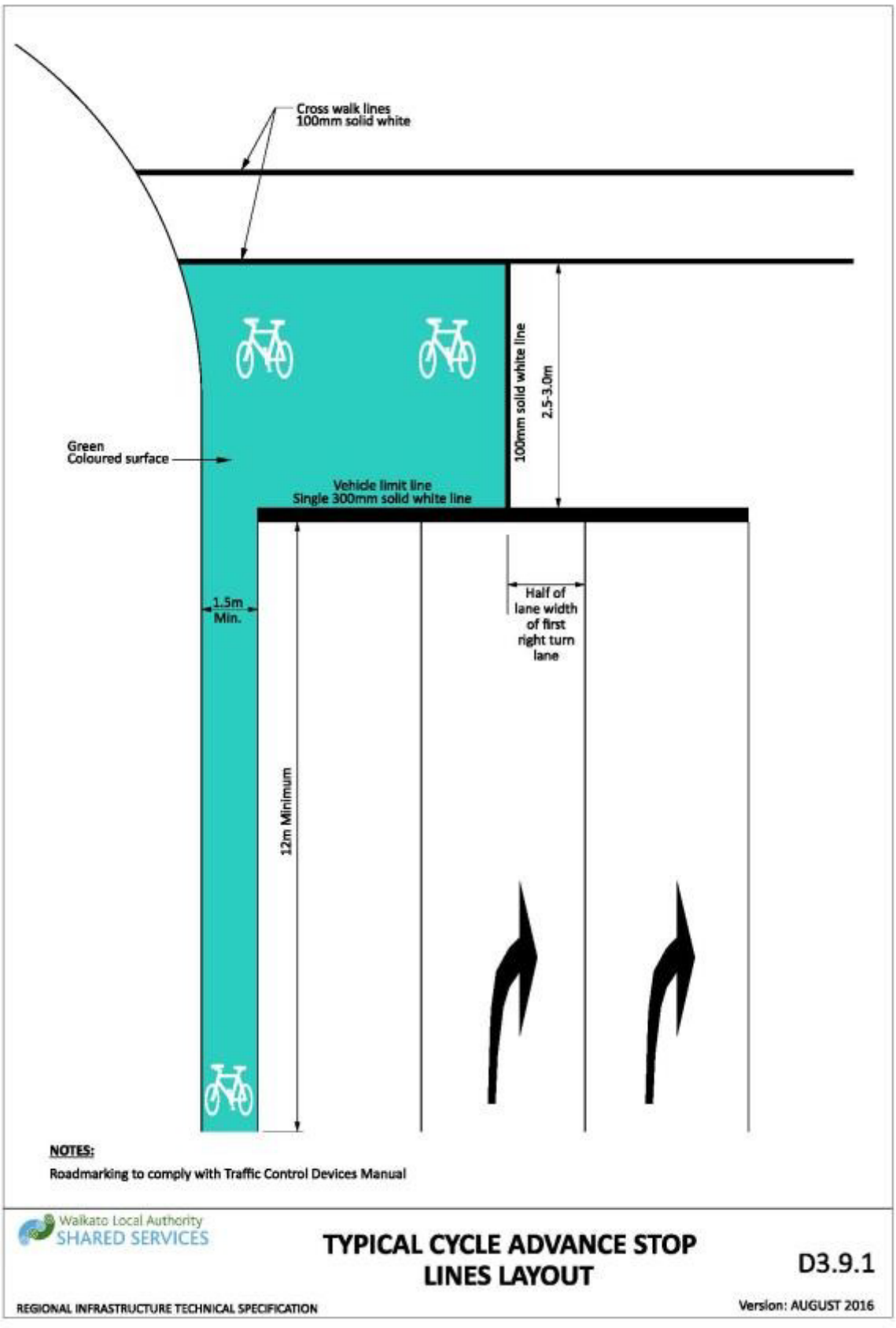

*Drawing 52: 3.8.13: Standard 3.5mm bus shelter foundation detail*



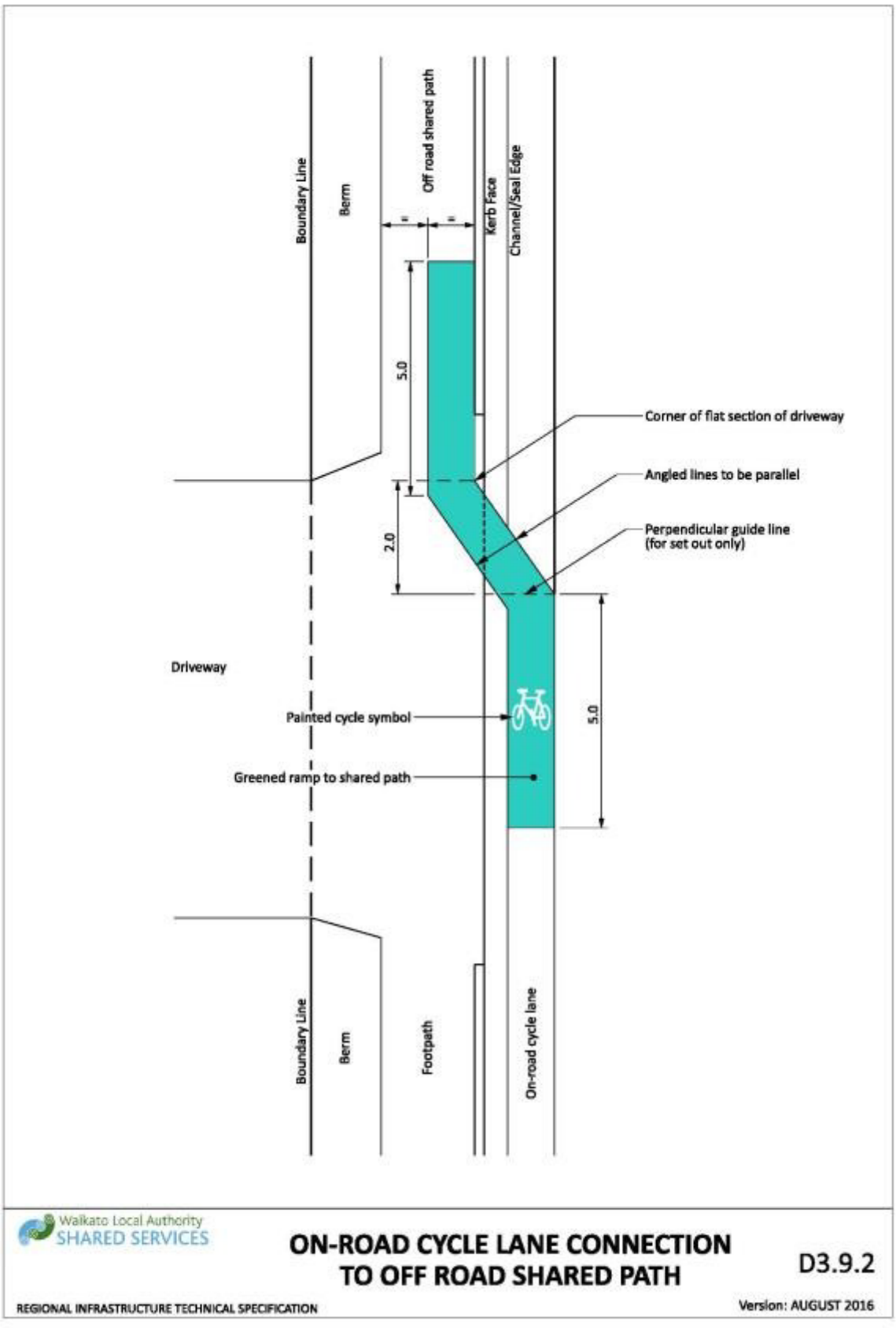

*Drawing 53: 3.8.14: Bus shelter and mini bus shelter*



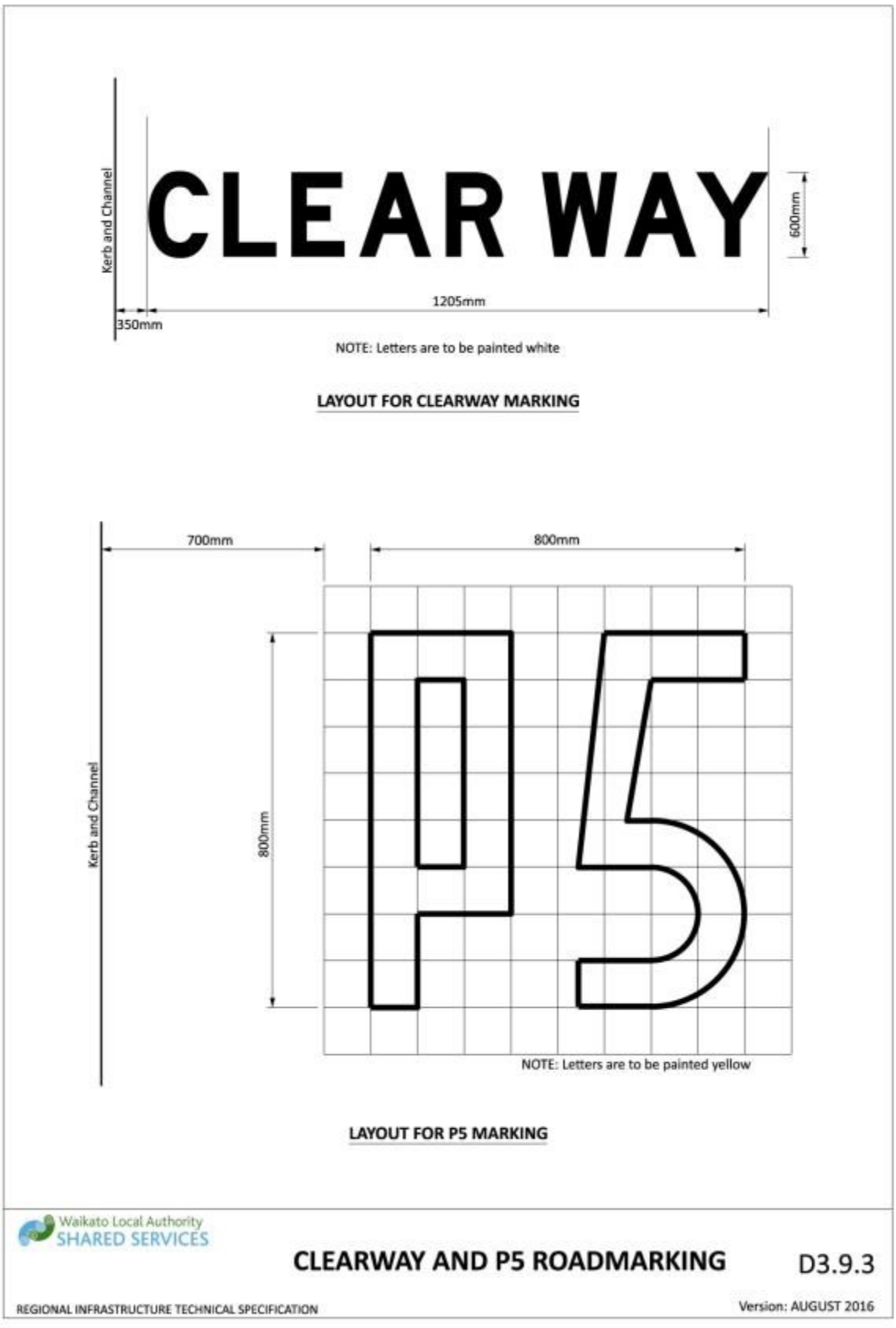

*Drawing 54: 3.8.15: Bus stop seat no shelter*



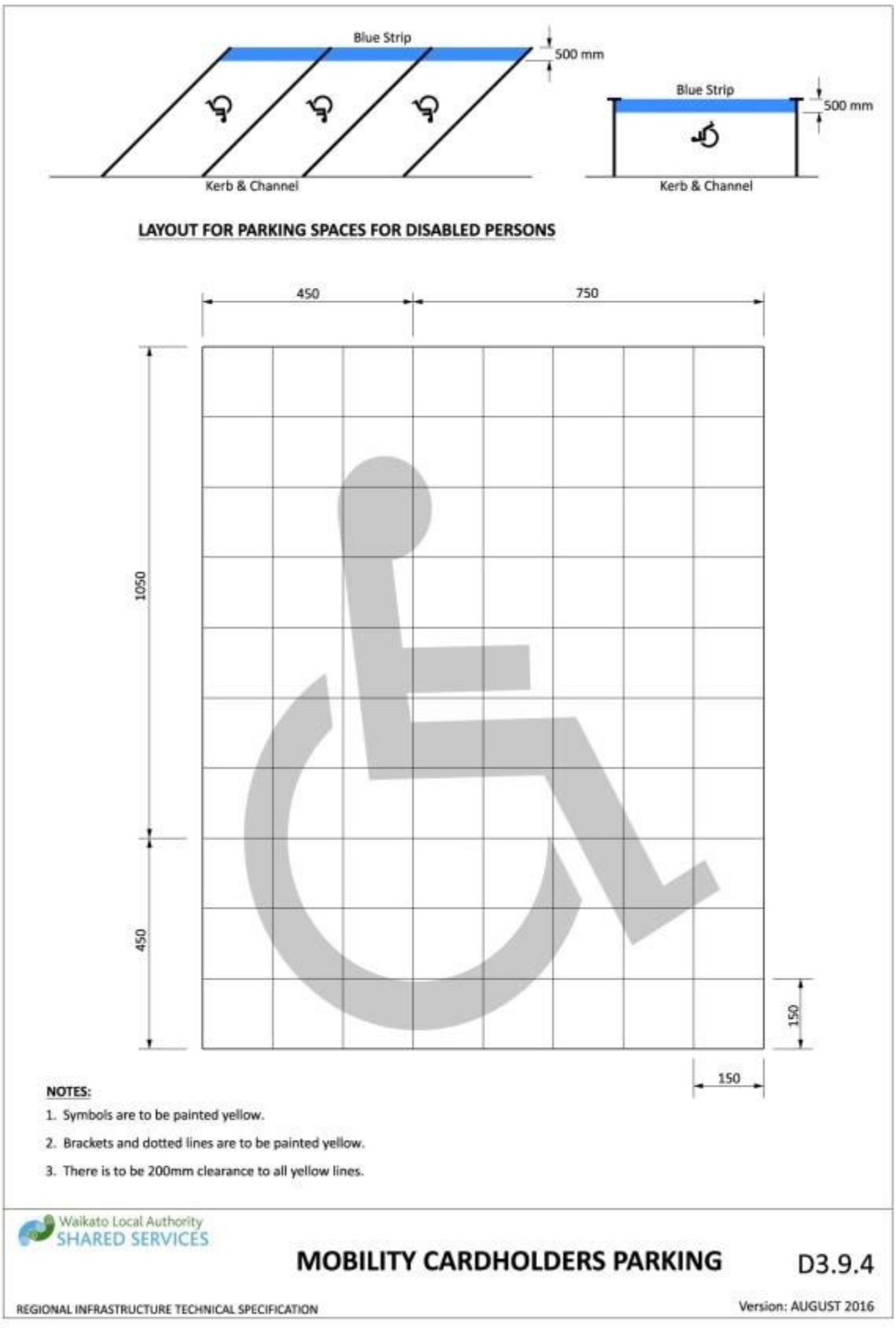

*Drawing 55: 3.9.1: Typical cycle advance stop lines layout*



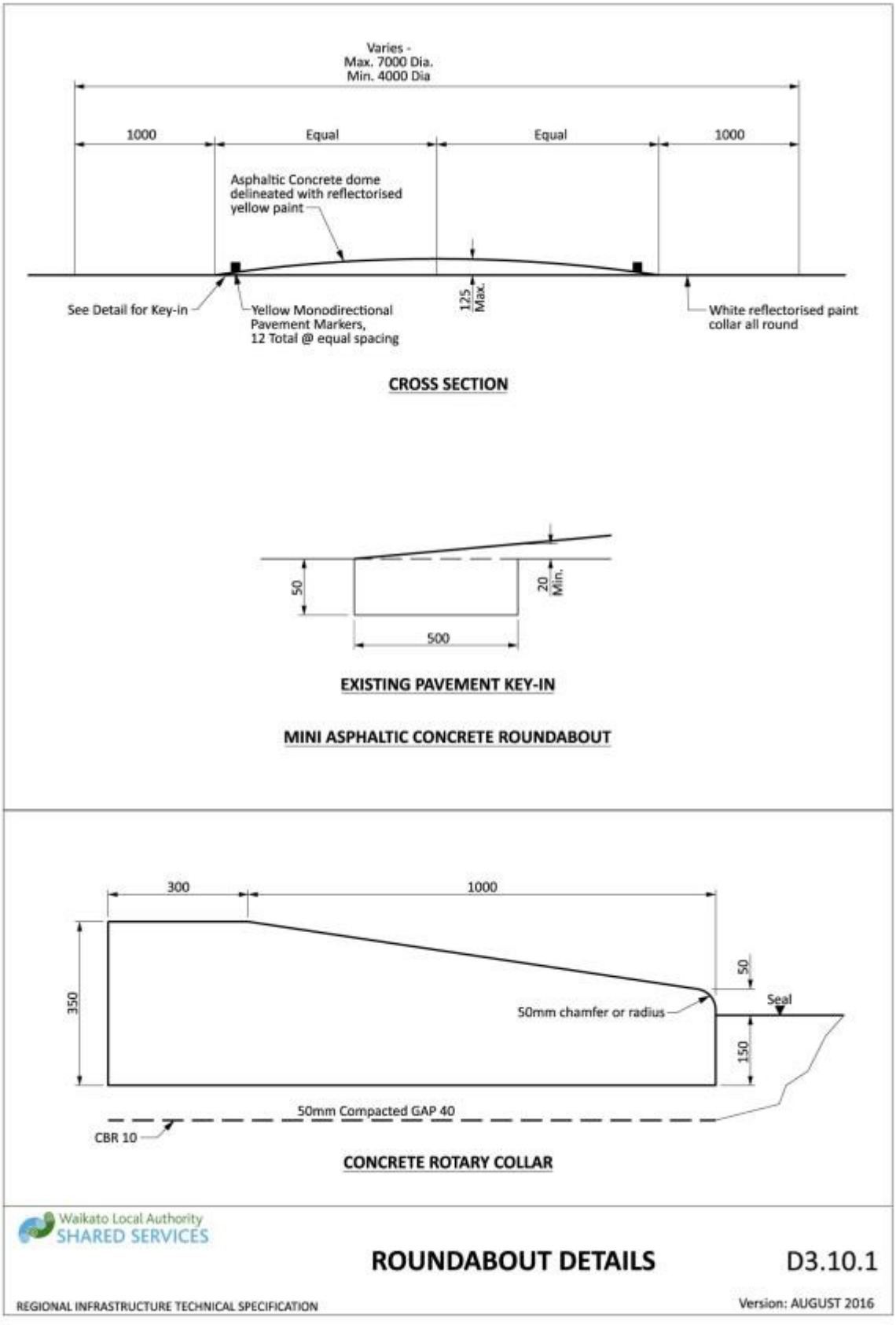

*Drawing 56: 3.9.2: On-road cycle lane connection to off road shared path*



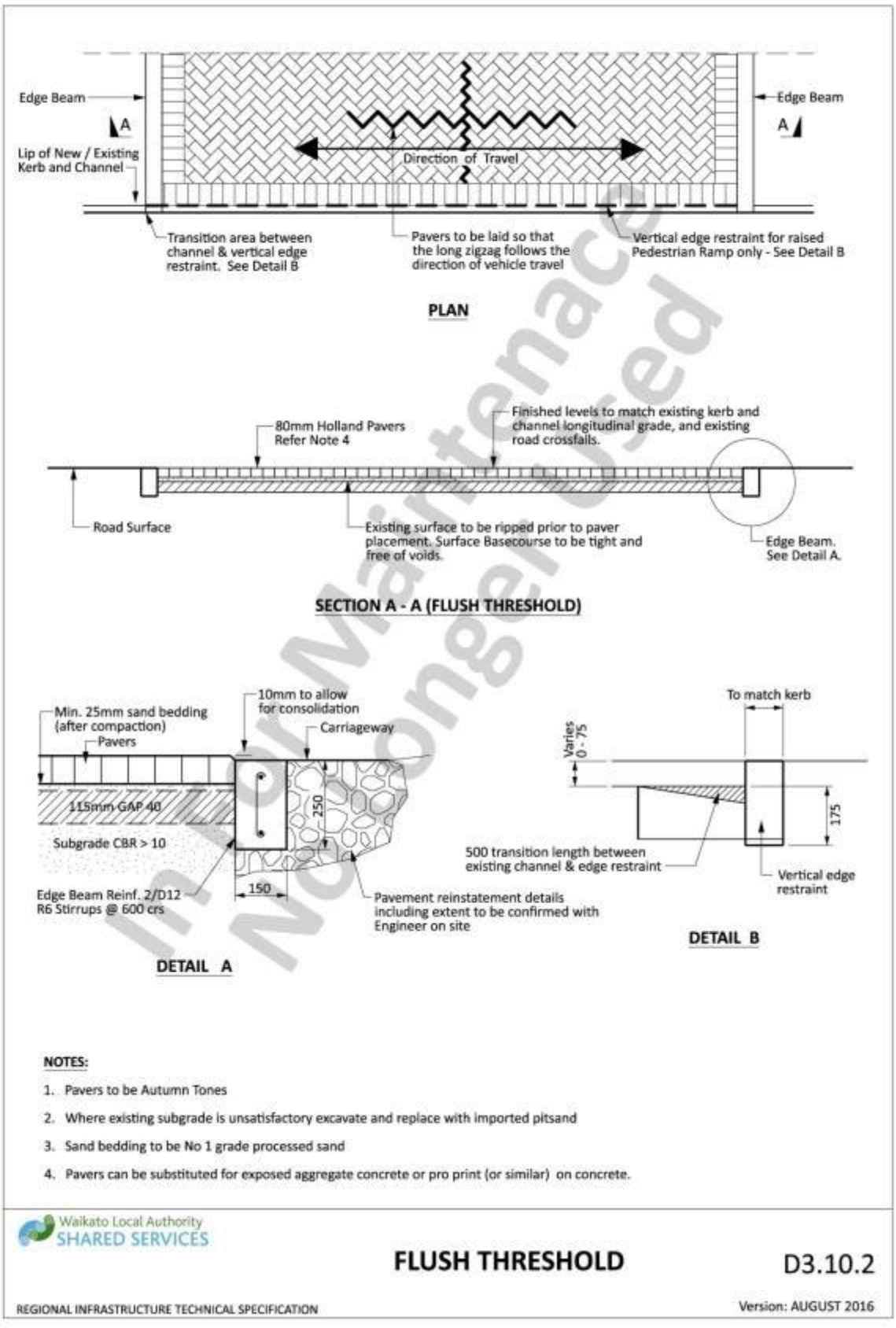

*Drawing 57: 3.9.3: Clearway and P5 roadmarking*



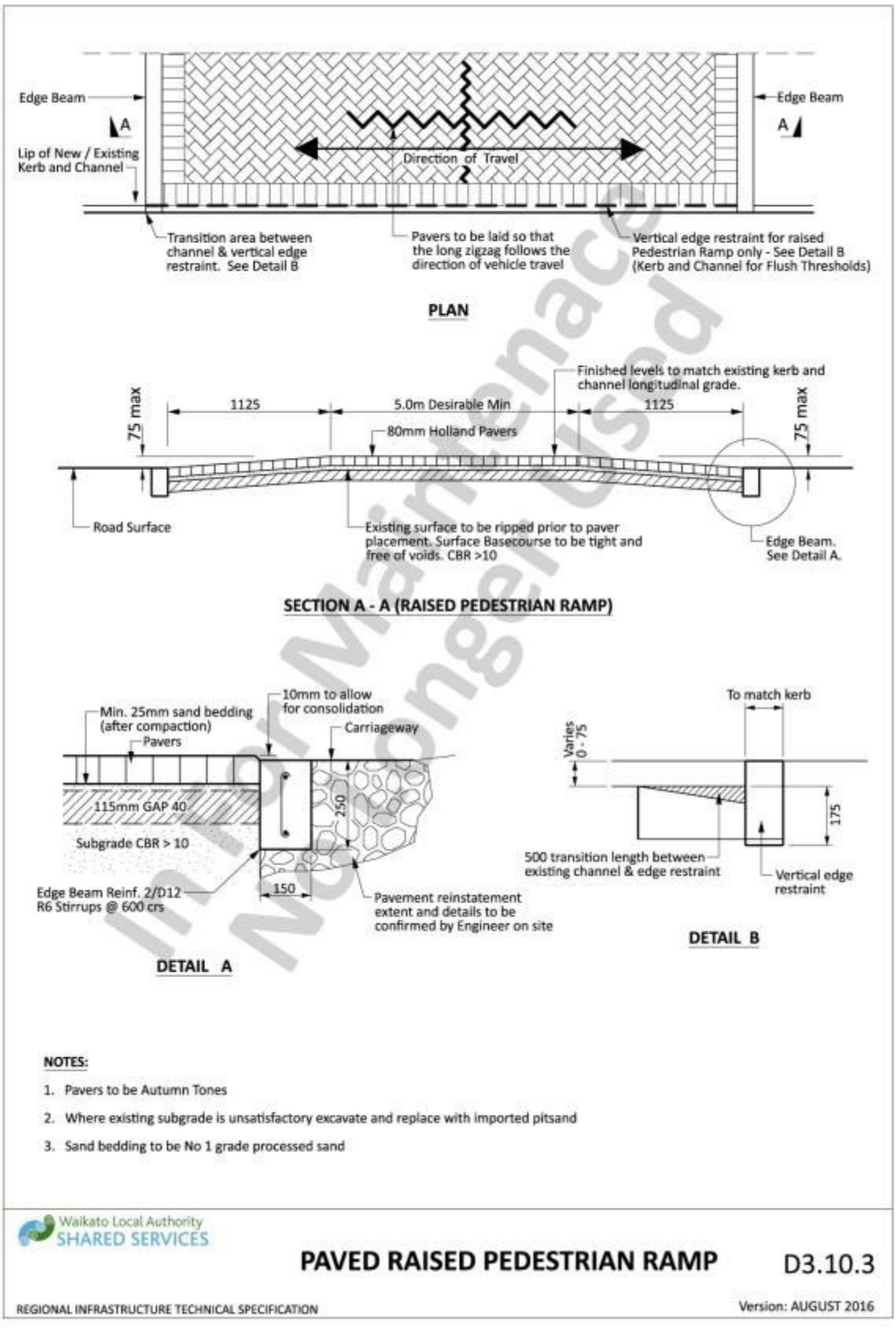

*Drawing 58: 3.9.4: Mobility cardholders parking*



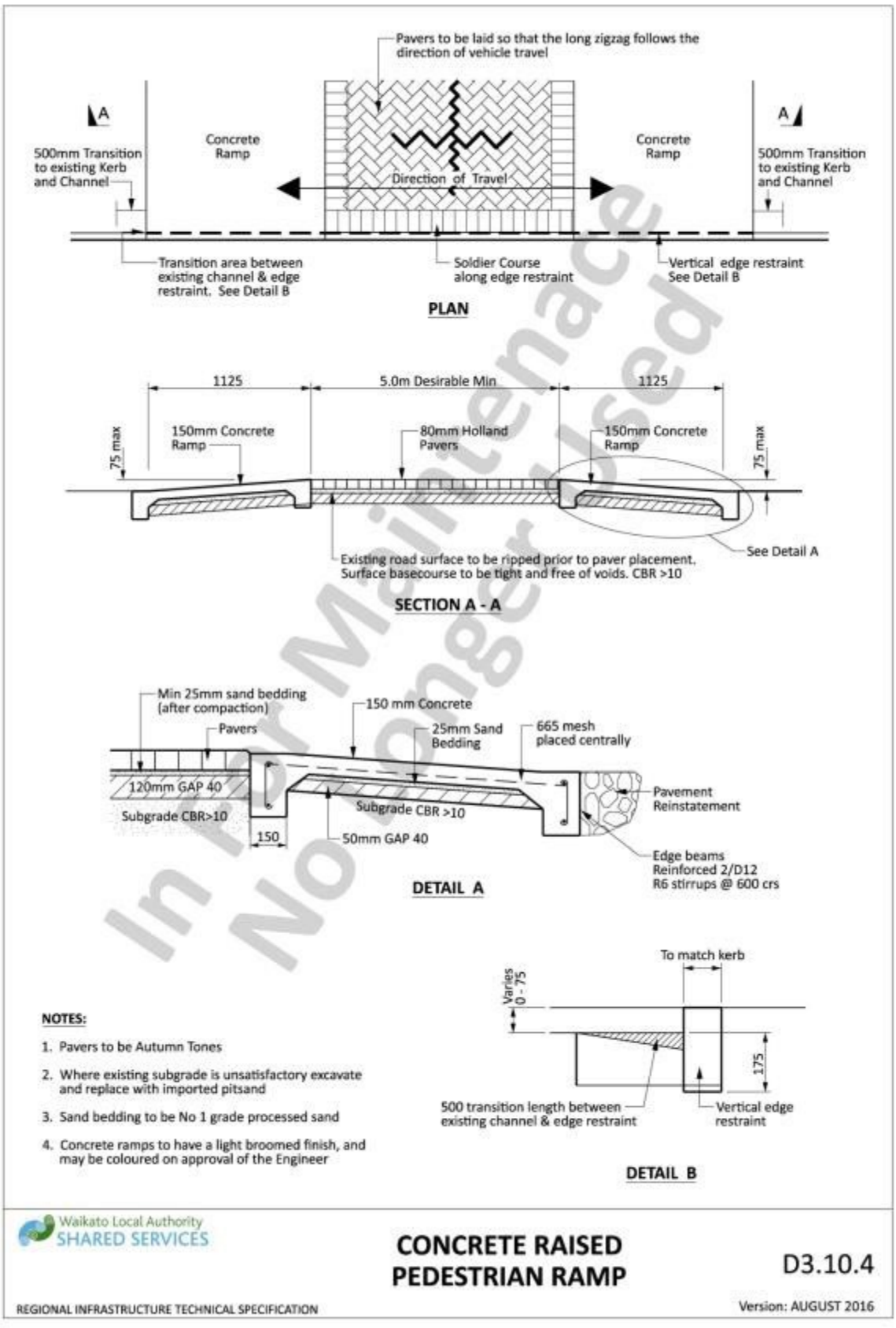

*Drawing 59: 3.10.1: Roundabout details*



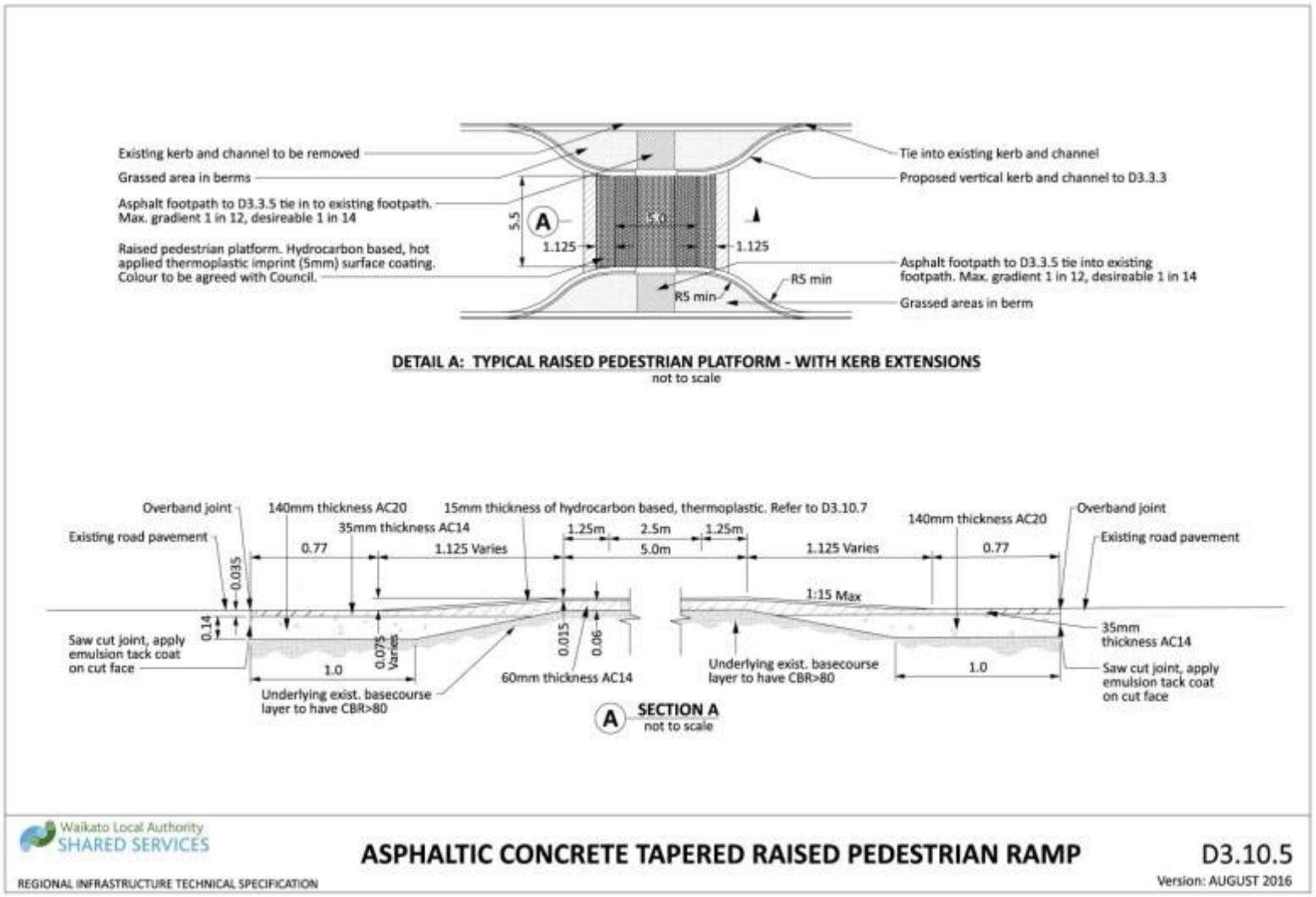

*Drawing 60: 3.10.2: Flush threshold*



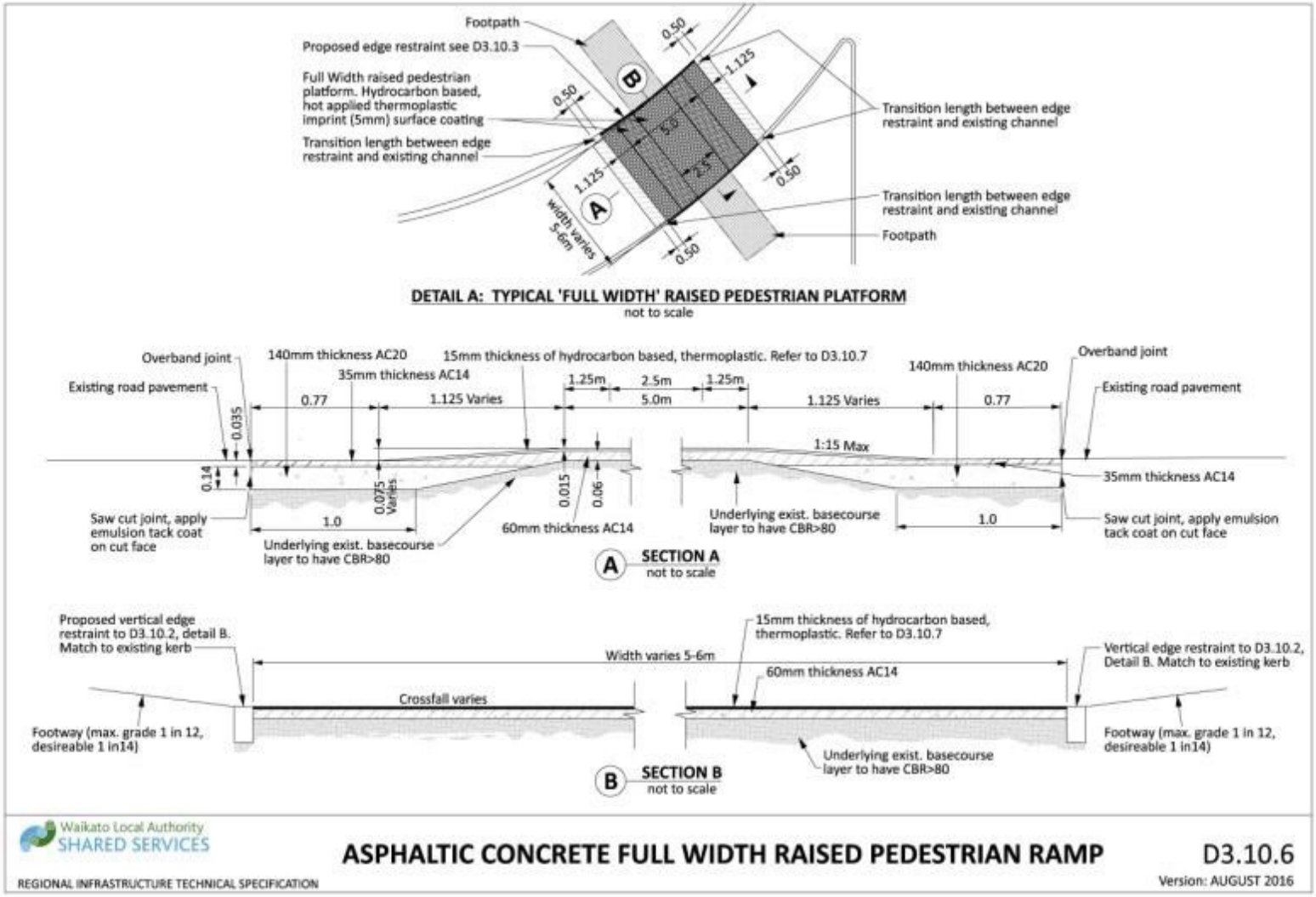

*Drawing 61: 3.10.3: Paved raised pedestrian ramp*



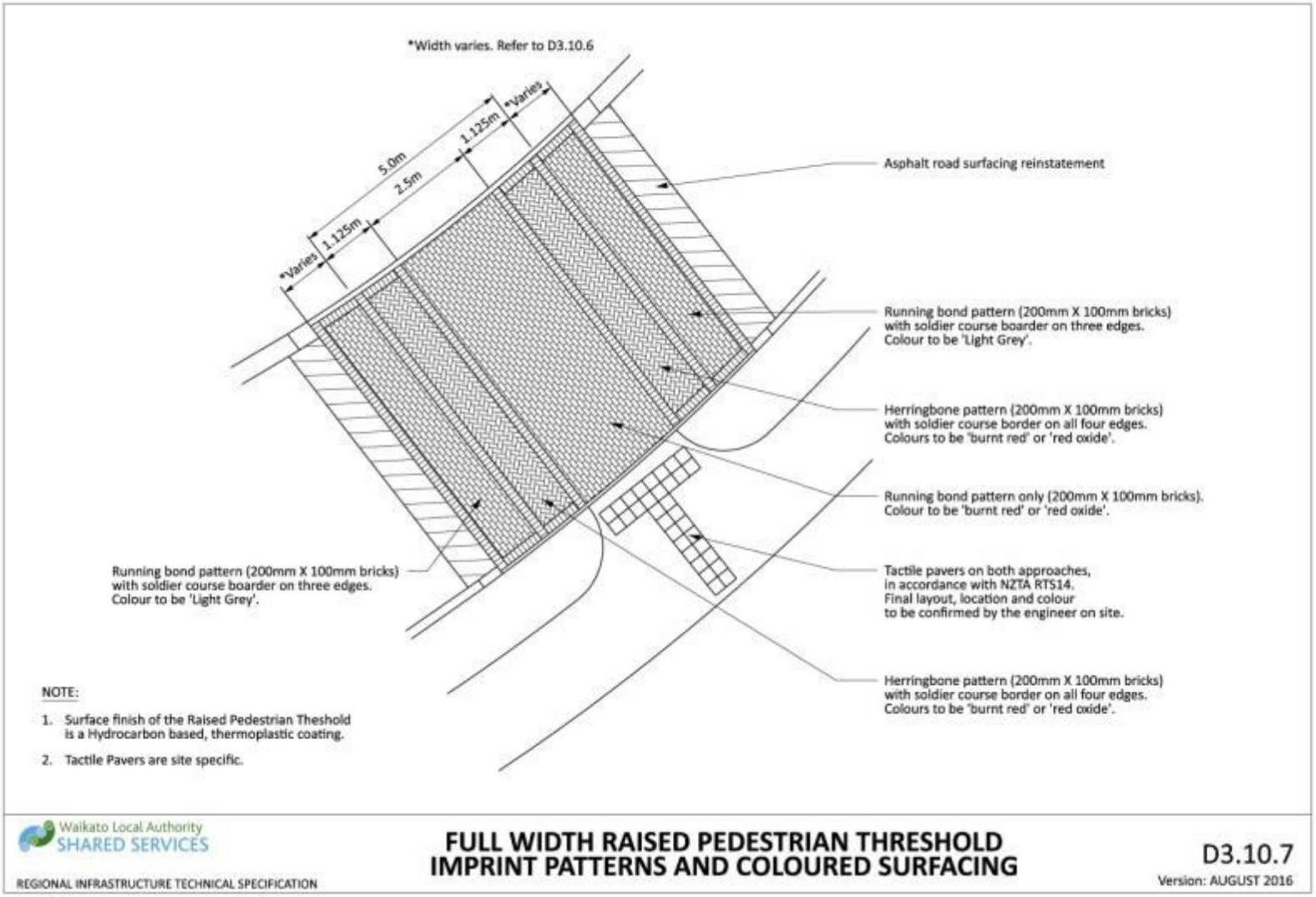

*Drawing 62: 3.10.4: Concrete raised pedestrian ramp*




*Drawing 63: 3.10.5: Asphaltic concrete tapered raised pedestrian ramp*

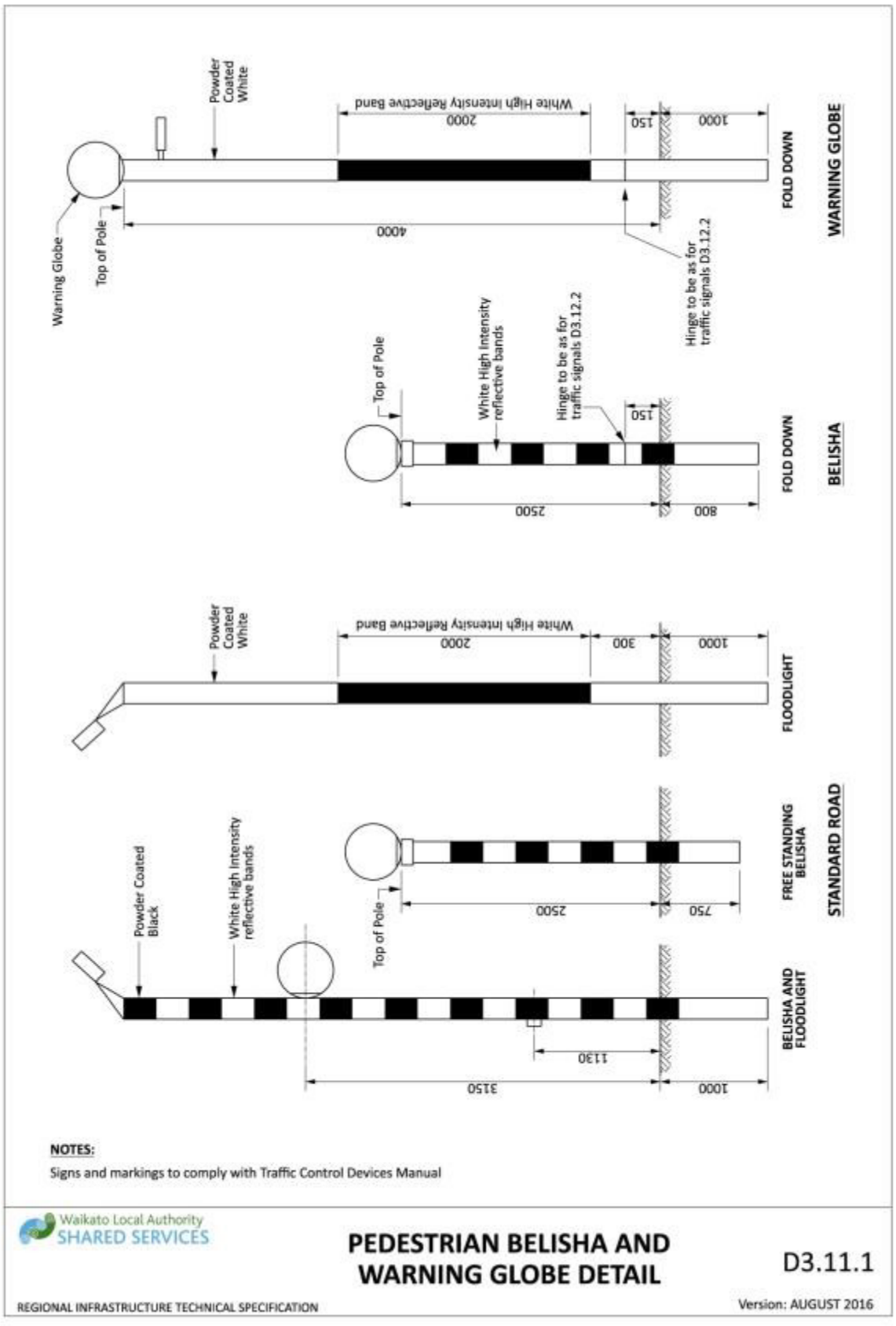



*Drawing 64: 3.10.6: Asphaltic concrete full width raised pedestrian ramp*

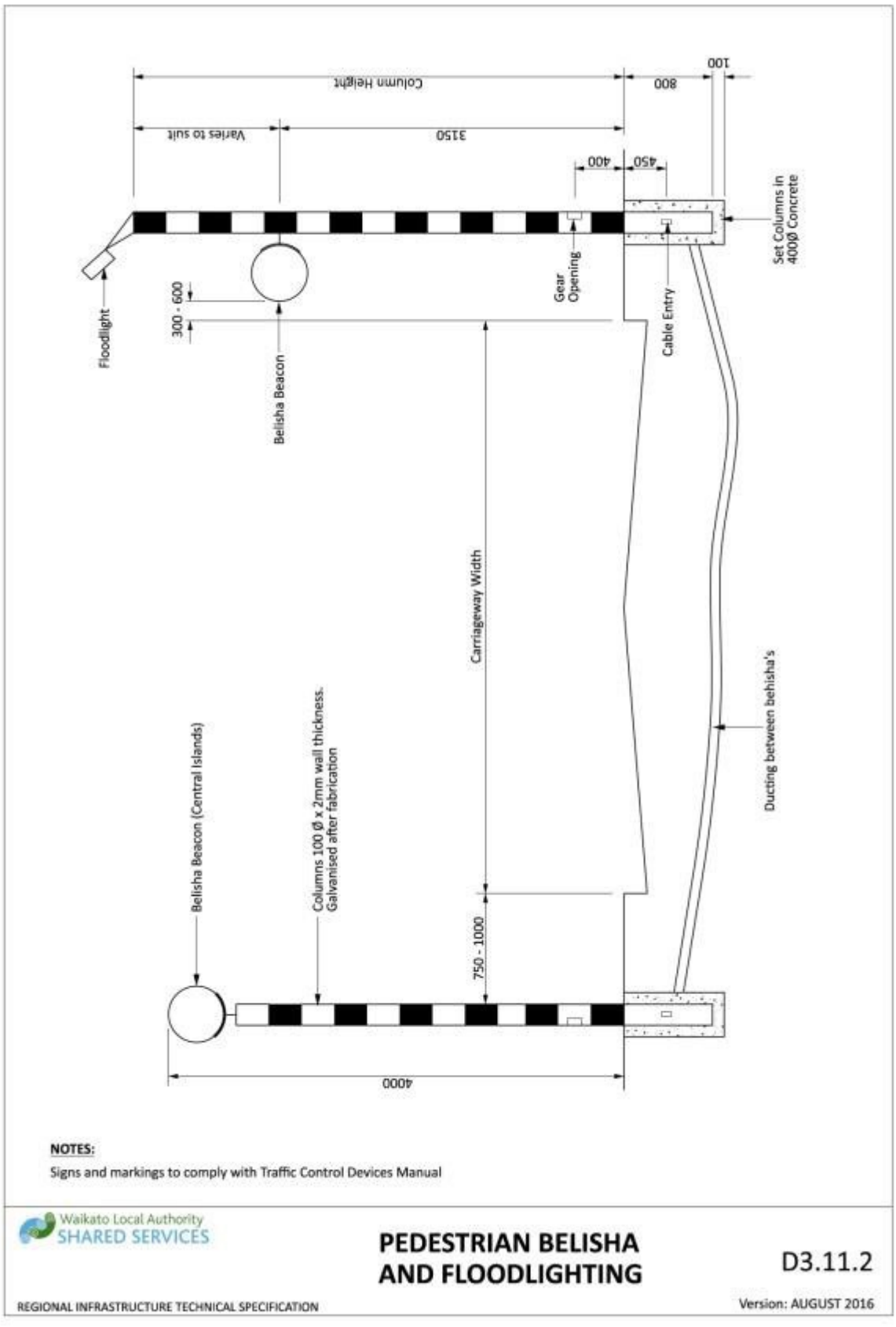



*Drawing 65: 3.10.7: Full width raised pedestrian threshold imprint patterns and coloured surfaces*

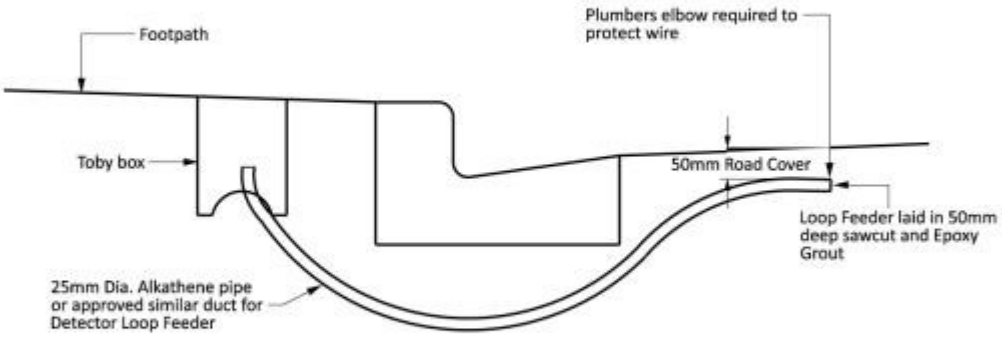
*Drawing 66: 3.11.1*



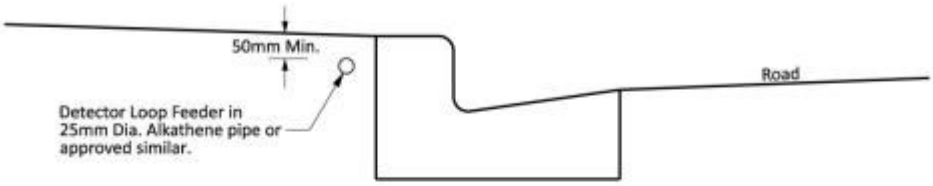

*Pedestrian belisha and warning globe detail*




*Drawing 67: 3.11.2: Pedestrian belisha and floodlighting*




**UNDER CHANNEL ACCESS DUCT DETAIL**




**DETECTOR LOOP FOOTPATH DUCTING DETAIL**

**NOTES:**

When installed after kerb a slot is to be cut with a concrete saw an sealed using a sealer as approved in P43 traffic signal specification.

Waikato Local Authority SHARED SERVICES

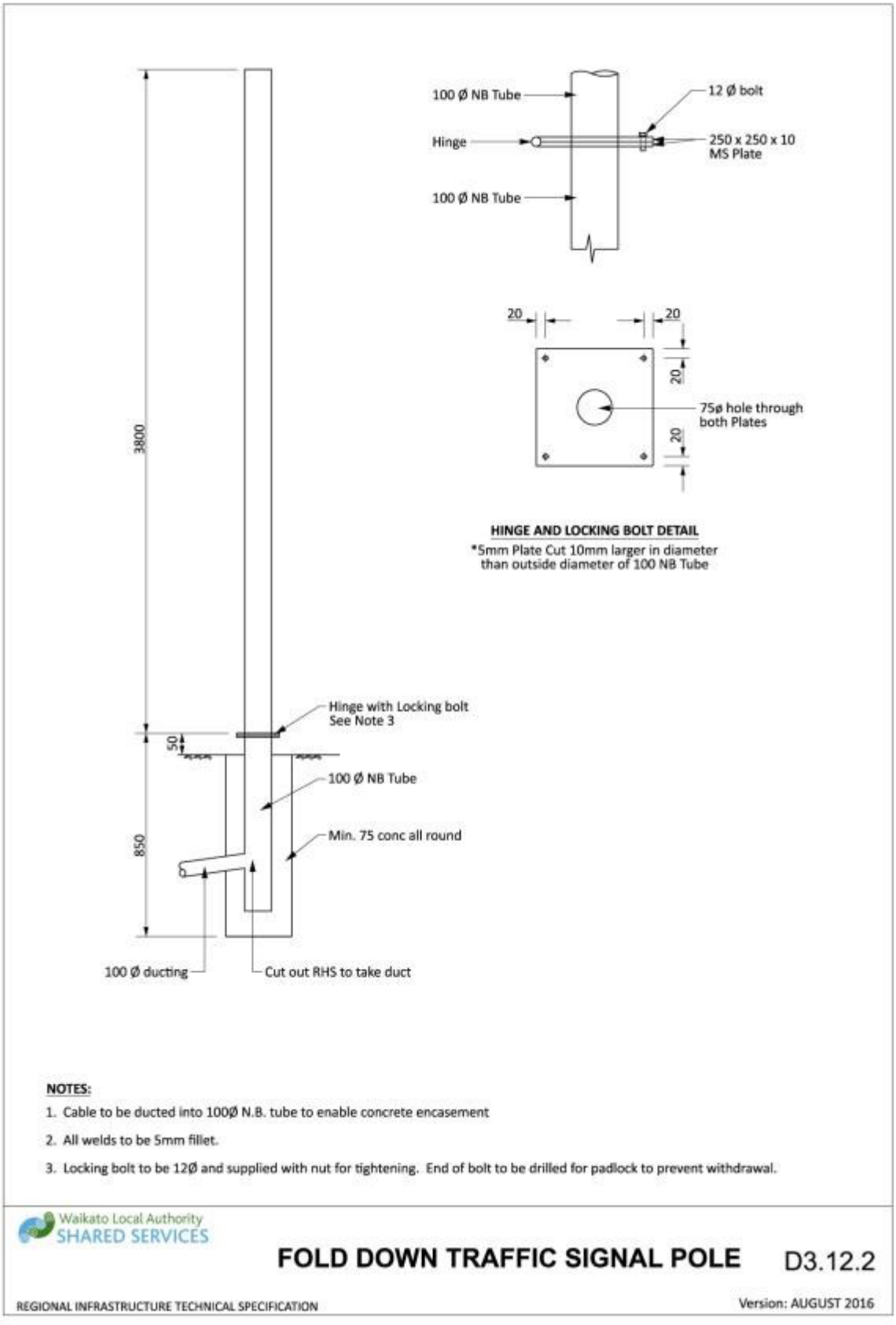
**TRAFFIC SIGNAL DUCTING UNDER KERB ACCESS DETAILS**

D3.12.1

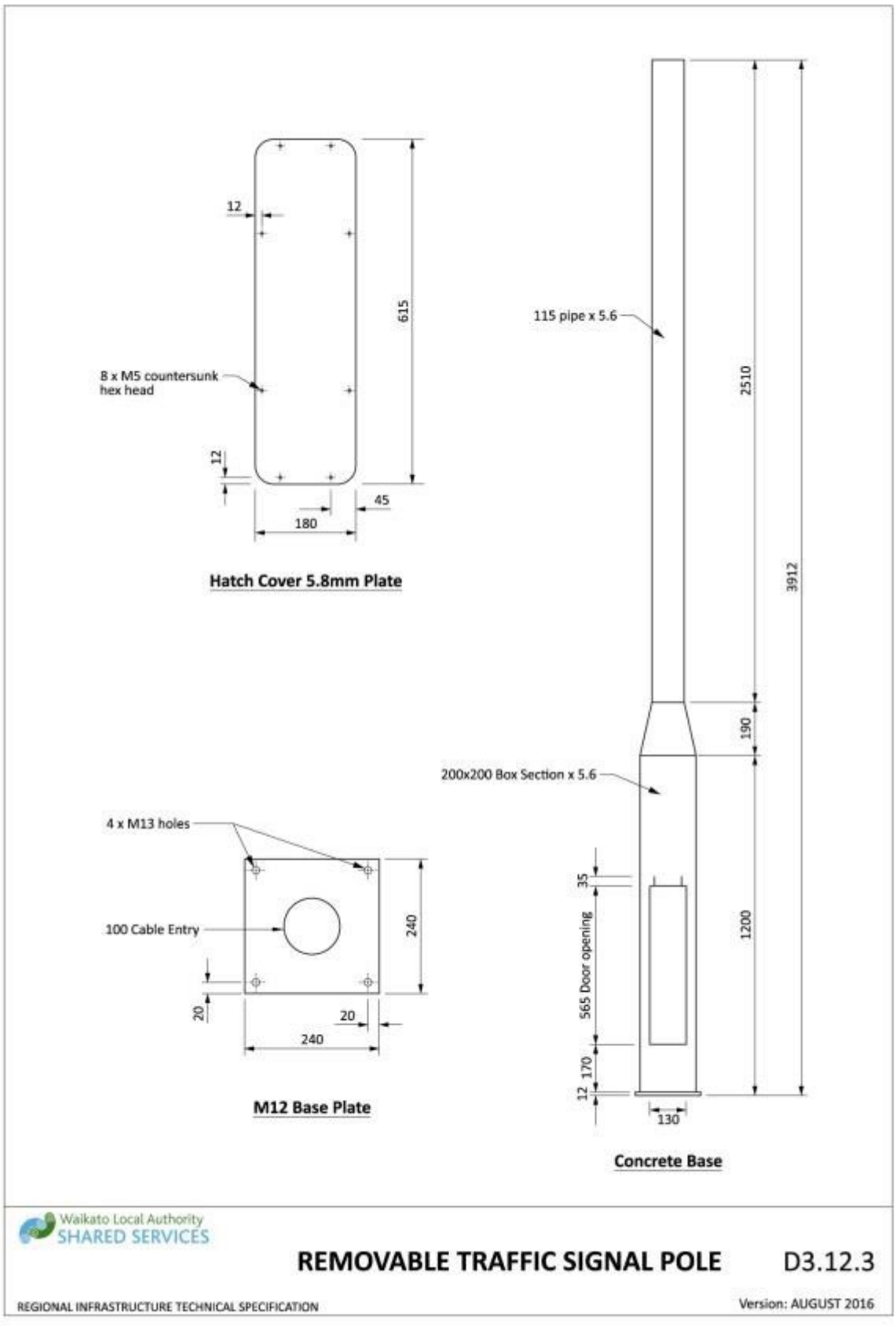
REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATION

Version: AUGUST 2016

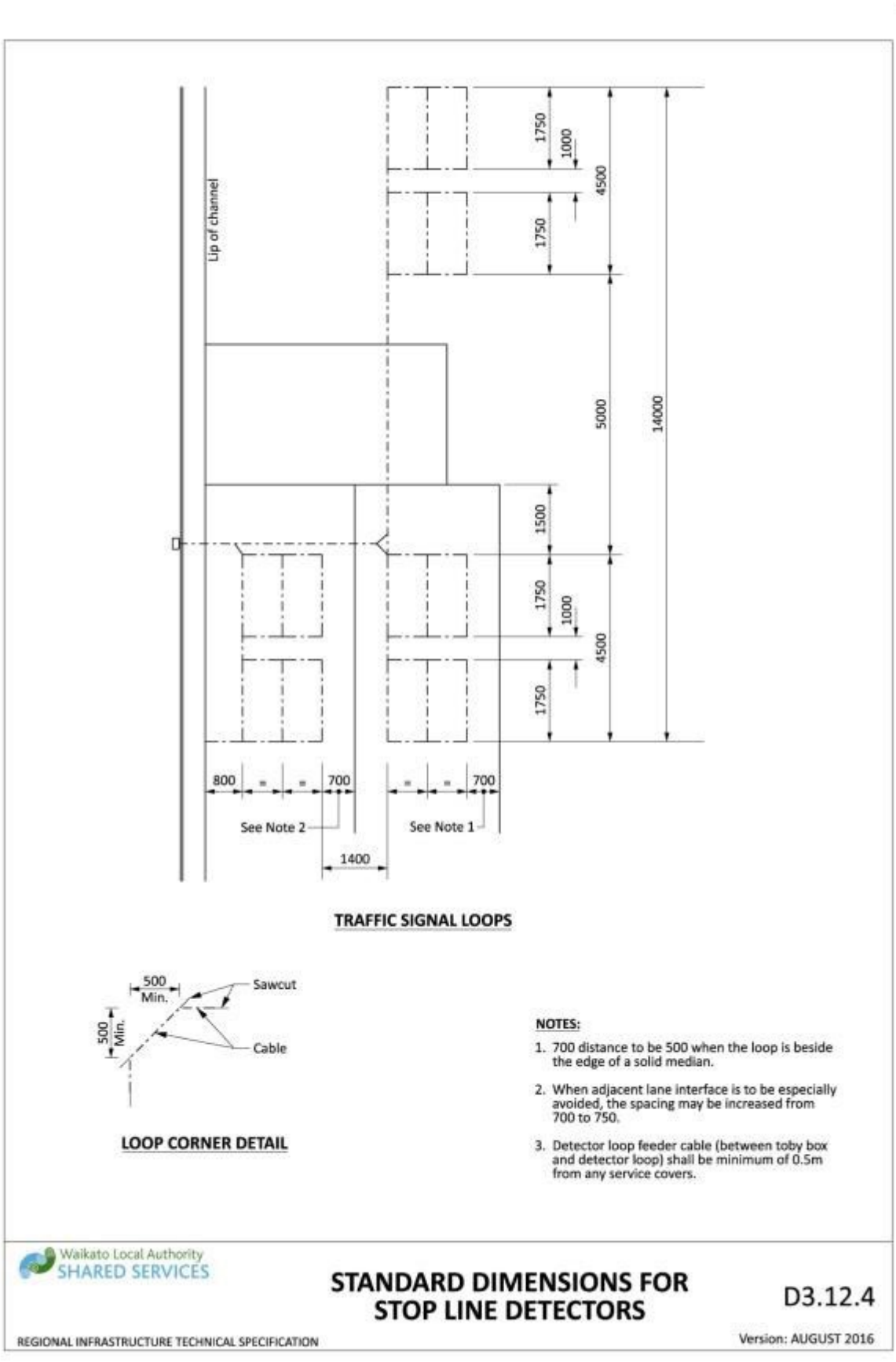
*Drawing 68: 3.12.1: Traffic signal ducting under kerb access details*



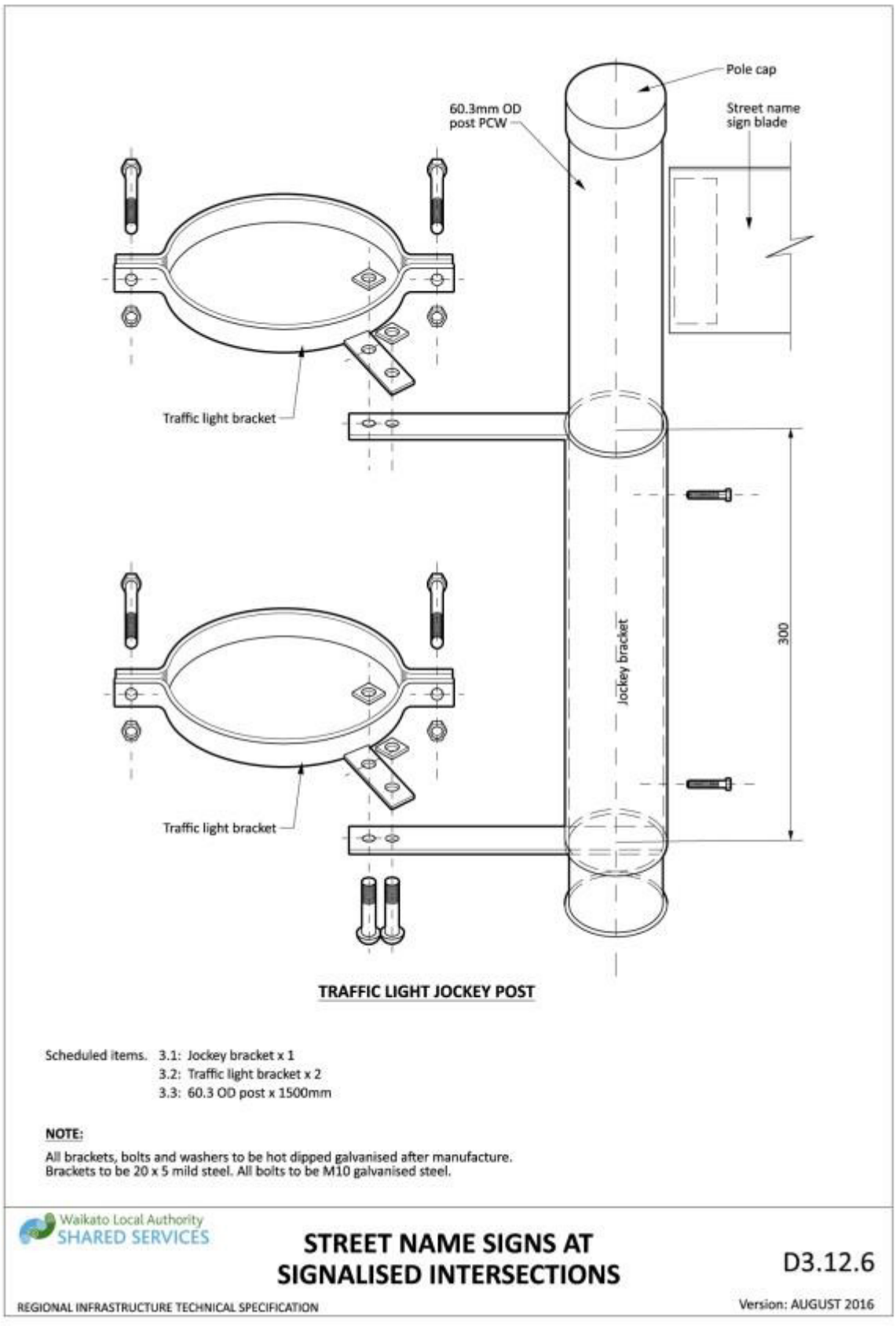

*Drawing 69: 3.12.2: Fold down signal pole*



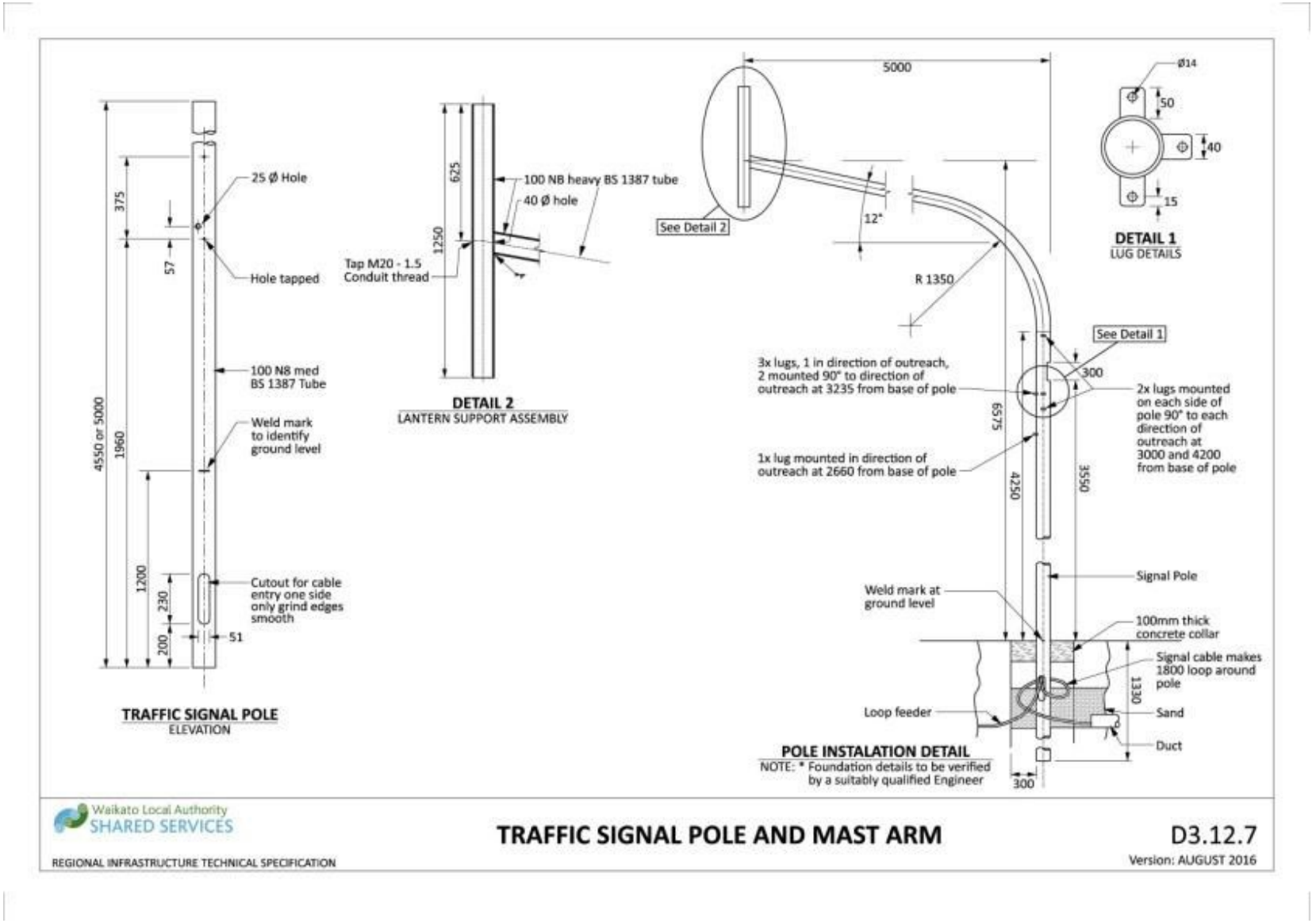

*Drawing 70: 3.12.3: Removable traffic signal pole*



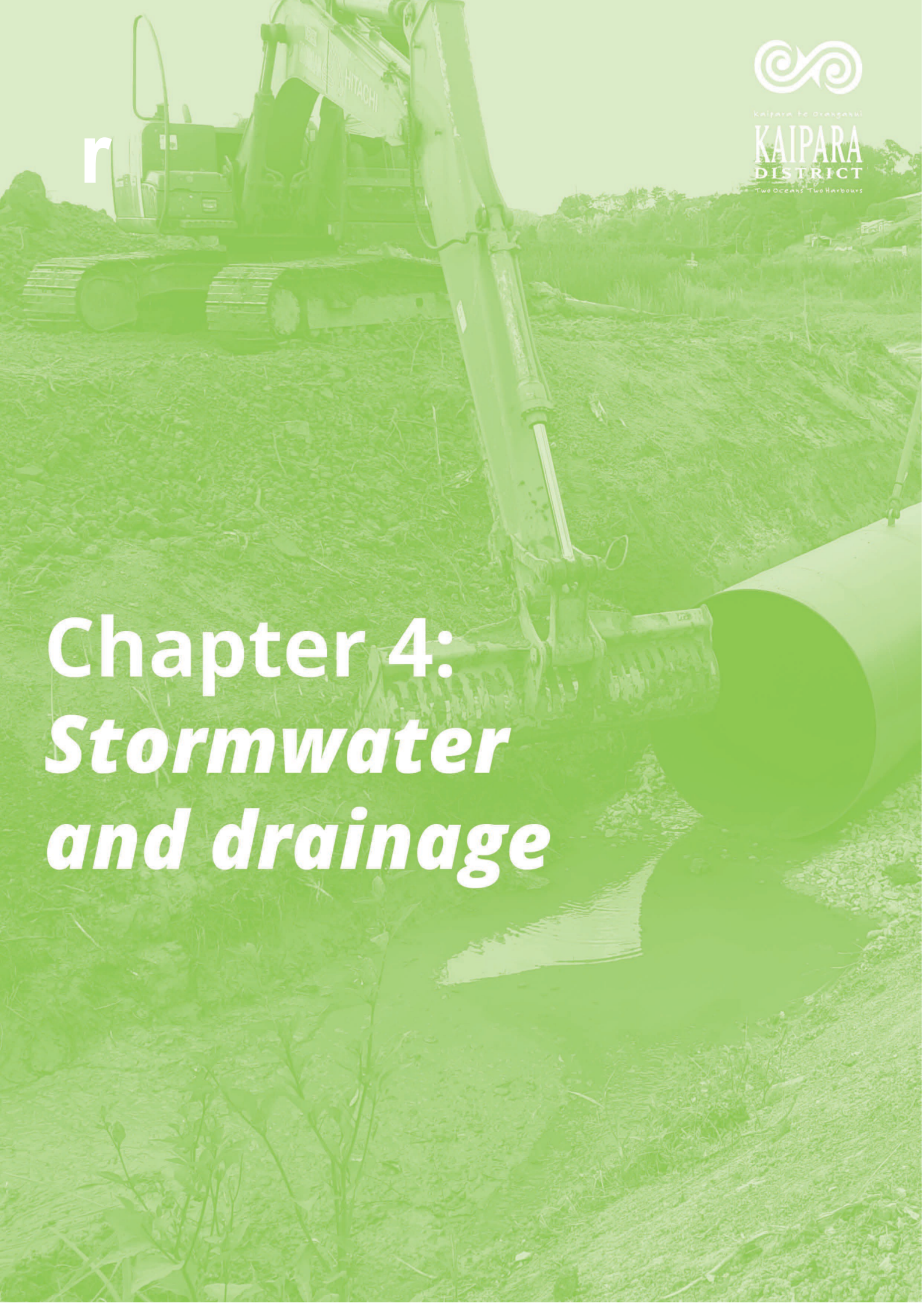

*Drawing 71: 3.12.4 Standard dimensions for stop line detectors*




*Drawing 72: 3.12.6 Street name signs at signalised intersections*




*Drawing 73: 3.12.7 Traffic signal pole and mast arm*



Kaipara te Oranganui
KAIPARA DISTRICT
Two Oceans Two Harbours

# Chapter 4: *Stormwater and drainage*

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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
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 KDC Standards
b. Design for resilience
c. Compliance with environmental and Network Discharge Consent requirements
d. Safety in Design
e. Minimising flood hazards to people and properties
f. Minimising adverse environmental impacts
g. Minimising health and safety risk(s) for public and maintenance workers
h. Ensuring Māori freshwater values are identified and provided for
i. Minimising operational, maintenance and asset decommissioning risk(s)
j. Extended service life of stormwater assets with application of whole-of-life cycle cost,
k. Practising and encouraging an integrated stormwater management approach
l. Delivering a public stormwater network that is fit for purpose and economical to operate and maintain
m. Maintain or improve water quality
n. Financial, environmental and community outcomes are achieved
o. Low impact design or WSUD 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 KDC 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
b. The KDC considers it is reasonable or practicable to require connection, or that it is a logical extension to the network required to provide connection
c. The KDC 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 recommended standards:

a. The stormwater system shall operate by gravity. Pumped public systems are not generally acceptable unless specific approval is obtained from the KDC Asset Management/Infrastructure Manager or delegate 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% AEP (without surcharge) and 20% AEP design storm events (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%) or using HIRDS RCP 8.5, 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 and design shall prioritize LID and WSUD (see 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 KDC Stormwater Catchment Management Plans
c. These standards, then
d. Auckland Council GD01 and GD04 (the adopted design guideline for stormwater treatment and low impact design)

***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 KDC 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 KDC.

### 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.*

#### 1.4.5.1 Statutory

Building Act 2004

Local Government Acts 2002 and 1974

National Policy Statement for Freshwater Management 2020

New Zealand Building Code

NRC Regional Plan 2026

KDC Operative District Plan 2013

Resource Management Act 1991

KDC Stormwater and Land Drainage Bylaw

#### 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. KDC Documents

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

WDC Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

Stormwater Catchment Management Plans and Discharge Consents (*to be provided by KDC 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

#### 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 DG007 - 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

### 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 water courses and the natural hydrological parameters of the system, 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 KDC, 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. KDC 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 Asset Management/Infrastructure Manager or delegate (refer to WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines).

Requirements of any applicable stormwater discharge consents will need consideration. This is especially applicable to sites that have potential to discharge contaminants to the network or store environmentally harmful chemicals.

### 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 KDC owned and / or maintained watercourse(s) located within approximately 500 metres require specific approval from the Asset Management/Infrastructure Manager or delegate before proceeding with design details and, if approved, KDC 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 KDC 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 KDC and the defects liability period is complete.

b. In the absence of an approved CMP the Developer shall contact KDC 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 KDC Owned Reserve

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

For private stormwater infrastructure within KDC owned Reserves refer to KDC ES Chapter 7 Public Spaces.

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

In situations where a property borders onto a KDC 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 KDC.

Stormwater discharge to a KDC public network within a KDC 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 KDC.

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 KDC to discuss a site-specific SMP and what measures are required
b. A site-specific SMP shall be submitted for approval by KDC
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 KDC
f. The receiving Reserve area shall be well vegetated or grassed, not susceptible to erosion and have no geotechnical constraints. Where requested by KDC, 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 KDC
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 KDC
l. All NRC requirements and any District Plan requirements or resource consent conditions for the discharge of stormwater to land and water shall also be met
m. Easements shall be provided over parts of private land, as necessary, for rights to drain and access to the assets for maintenance.

### 4.2.4. Discharge to the Road Kerb

Stormwater discharge from a private property to a road kerb outlet is an acceptable solution, only where alternatives are not available.

The use of kerbed roads for secondary (overland) flows is acceptable. All sites shall minimise discharges of stormwater flows onto roads.

### 4.2.5. Discharge to Land

Subject to the requirements of the NRC Regional Plans, discharge of stormwater from the development onto land is permitted provided that:

a. Flooding levels shall not be increased due to the development
b. New outlets to any low-lying areas shall be provided or existing outlets retained
c. 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 6m 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 KDC 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

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 KDC Asset Management/Infrastructure Manager or delegate

g. Where stormwater discharges to tidal waters, the design shall assume a tide level of Mean High-Water Spring (MHWS) plus a storm surge of 0.35m 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, KDC may require the Developer to take account of unmitigated MPD flows from the potential development of the upstream catchment.

KDC 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, KDC 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 KDC 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. KDC 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 KDC 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 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 KDC on the approach and obtain all necessary resource consents from NRC for the proposed site-specific SMP
b. The Developer shall consult with KDC to understand requirements regarding stormwater management (e.g. flood hazard, treatment and disposal), prior to submitting the NRC consent application
c. KDC's Asset Management/Infrastructure Manager or delegate shall review and accept NRC Resource Consent conditions before the consent being granted.

KDC will advise whether the area of a development is covered by a CMP/CDP, and conditions associated with it. KDC 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 KDC 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)
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-surcharge and freeboard requirements have been met
d. OLFP including 1% AEP flood level, flow path extent and easement requirements clearly shown on drawings, including floor level restrictions, if any
e. Minimum floor levels and flood hazard (depth, velocity) for residences and escape routes within 1% AEP flood inundation areas on the site are available and shown on the drawings
f. Scour protection designed for the range of events 1% AEP, 2% AEP, 20% AEP and 50% AEP and associated flows and velocities at outlets, watercourses and along OLFP's, (if parameters are outside those listed in Table 4-7: Maximum Velocities in Channel) 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 adequality 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
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 KDC shall have a design life expectancy of at least 100 years. Alternative Design Life values can be submitted for components of the system at the discretion of the Asset Management/Infrastructure Manager or delegate

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 Asset Management/Infrastructure Manager or delegate. 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 KDC and 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 TR-55 for catchment areas up to 8 ha (Rainfall intensity can be determined as a function of time concentration Tc).<br>For catchments greater than 8 ha refer to Section 4.3.10.2.1 Catchments Larger Than 8ha. | Always |
| Runoff coefficients | Pre-development runoff coefficients shall be based on existing imperviousness.<br>Post-development runoff coefficients shall be based on allowable imperviousness based on the MPD by the District Plan. Refer to Table 4-3. | Always |
| Design rainfall | Refer to Design Rainfall (Section 4.3.10.4 Design and Section 4.3.10.5 Design Storm). | Current rainfall (i.e. not climate change adjusted) shall be used for the following:<br>• Sizing temporary works where climate change is not relevant.<br>Climate change adjusted rainfall shall be used for the following:<br>• Determining pre- and post-development stormwater runoff flows and volumes for stormwater infrastructure design. |
| Time of concentration | Determined in accordance with Section 4.3.10.4 Design. | Always |
| 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.<br>Refer to Flood Hazard Areas in the District Plan and any known downstream restrictions causing flooding. |
| Flow attenuation (Attenuation of the 50% and 20% AEP events) | Pre- and post-development flows shall be calculated with climate change allowance.<br>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.<br>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 |

| Criteria | Design Parameter | When Required |
|---|---|---|
| | | assessment demonstrating no negative impacts would occur.<br>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).<br>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 or discharged via piped network to natural stream or man-made channel. |
| Stormwater quality treatment | Stormwater management hierarchy (Section 4.1.8 Stormwater Management Hierarchy)<br>• Provide treatment of the water quality flow or volume<br>• Managing at source where possible<br>• Designing for correct storm size.<br>• Use a suite of water sensitive design devices, including pre-treatment where practical.<br>Design parameters shall be based on a selected device's effectiveness to remove pollutants and in accordance with GD01. | Always |
| Water Quality Rainfall (WQR) | 90$^{th}$ percentile of a 24-hour storm event (approx. 25 mm). Equivalent to 1/3 2 year rainfall event. | Always<br>Refer to Auckland Council GD01 for details. |
| Water Quality Volume | Based on 90$^{th}$ percentile of a 24-hour storm event (approx. 25 mm). | When discharging directly into a natural stream or manmade channel or discharged via piped network to natural stream or manmade channel. Retention of the pre-development flows for the frequent low intensity rainfall events equivalent to 1/3 2 year rainfall event. |

| Criteria | Design Parameter | When Required |
|---|---|---|
| Primary and Secondary Network Level of Service Requirements | As per Table 4-2. Secondary overflow as per Section 4.1.8 Stormwater Management Hierarchy). | Always<br>The primary system shall be designed to ensure gravity flow with capacity to accommodate the peak flows, without surcharge.<br>The secondary system shall be designed for safe conveyance of 1% AEP. |
| Minimum Floor Levels | Freeboard requirements (Section 4.3.11.7 Freeboard Requirements). | Always |
| Whole-of-life | Shall demonstrate that the proposed system provides the most cost-effective whole-of-life outcome for KDC.<br>(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
f. Where applicable, location of service connections.

Where the primary network is in private property, an easement or otherwise record any limitations or public interests on the title shall be at the KDC's discretion. Sufficient width will be provided to allow for maintenance at KDC's discretion with a minimum width of 3m.

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. The Regional Infrastructure Technical Specification (RITS) 2018 (Waikato) 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 Asset Management/Infrastructure Manager or delegate.
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.
    i. uVPC pipe may be substituted for RC up to DN375 and must be a minimum of SN16 and installed as per AS/NZS2032 and AS/NZS2566.

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 KDC for drainage purposes at no costs to KDC (specific department ownership should be confirmed before vesting), or can be retained in private ownership, subject to a specific approval by the Asset Management/Infrastructure Manager or delegate
c. The ponds or wetlands shall not be included in Local Purpose Reserves without specific prior approval from the Parks and Recreation Manager
d. The ponds or wetlands shall be designed in accordance with Auckland Council GD01, or an alternative design can be submitted to KDC 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*

KDC 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. KDC 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 KDC 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. KDC 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 KDC 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 private 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 KDC or provide an easement or otherwise record any limitations or public interests on the title shall be at the KDC's discretion. Sufficient width will be provided to allow for maintenance at KDC'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. KDC Design Input

Notwithstanding the outcome of Specific Design, KDC 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 KDC Asset Management/Infrastructure Manager or delegate.

***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 surcharge 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 KDC 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 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

**C** Low permeability such as loam

**B** Medium permeability, coastal wind-blown 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 |
|---|---|---|---|---|
| **Open space (lawns, parks etc)** | | | | |
| Fair condition (grass cover 50-75%) | | 69 - 0.53 | 79 - 0.65 | 84 - 0.72 |
| Good condition (grass cover >75%) | | 61 - 0.44 | 74 - 0.59 | 80 - 0.67 |
| **Impervious areas** | | | | |
| Paved parking lots, roofs, driveways, curbs, channels etc (excluding right-of-way) | | 98 - 0.96 | 98 - 0.96 | 98 - 0.96 |
| **Roads and streets** | | | | |
| Paved: open ditches (incl. right- of-way) | | 89 - 0.80 | 92 - 0.85 | 93 - 0.87 |
| Unsealed/Gravel (incl. right-of- way, accessway and parking areas) | | 85 - 0.74 | 89 - 0.80 | 91 - 0.83 |

| Land Use | % impervious | Type B soils | Type C soils | Type D soils |
|---|---|---|---|---|
| **Urban development** | | | | |
| Commercial and business | 85 | 92 - 0.85 | 94 - 0.89 | 95 - 0.90 |
| Industrial | 72 | 88 - 0.79 | 91 - 0.83 | 93 - 0.87 |
| Landscaped | 0 | 70 | 75 | 80 |
| **Residential by average lot size** | | | | |
| 500m² or less | 65 | 85 - 0.74 | 90 - 0.82 | 92 - 0.85 |
| 1,000m² | 40 | 75 - 0.60 | 83 - 0.71 | 87 - 0.77 |
| 2,000m² | 25 | 70 - 0.54 | 80 - 0.67 | 85 - 0.74 |
| 4,000m² | 20 | 68 - 0.52 | 79 - 0.65 | 84 - 0.72 |
| 10,000m² (1 ha) | 10 | 65 - 0.48 | 77 - 0.63 | 82 - 0.69 |
| **Rural development** | | | | |
| Pasture, grassland (m²) | | 61 - 0.44 | 74 - 0.59 | 80 - 0.67 |
| Grass and bush | | 48 - 0.32 | 65 - 0.48 | 73 - 0.57 |
| Trees and grass combination (orchards) | | 58 - 0.41 | 72 - 0.56 | 79 - 0.65 |
| Forest | | 55 - 0.38 | 70 - 0.54 | 77 - 0.63 |

#### *4.3.10.2.1. 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 Asset Management/Infrastructure Manager or delegate.

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

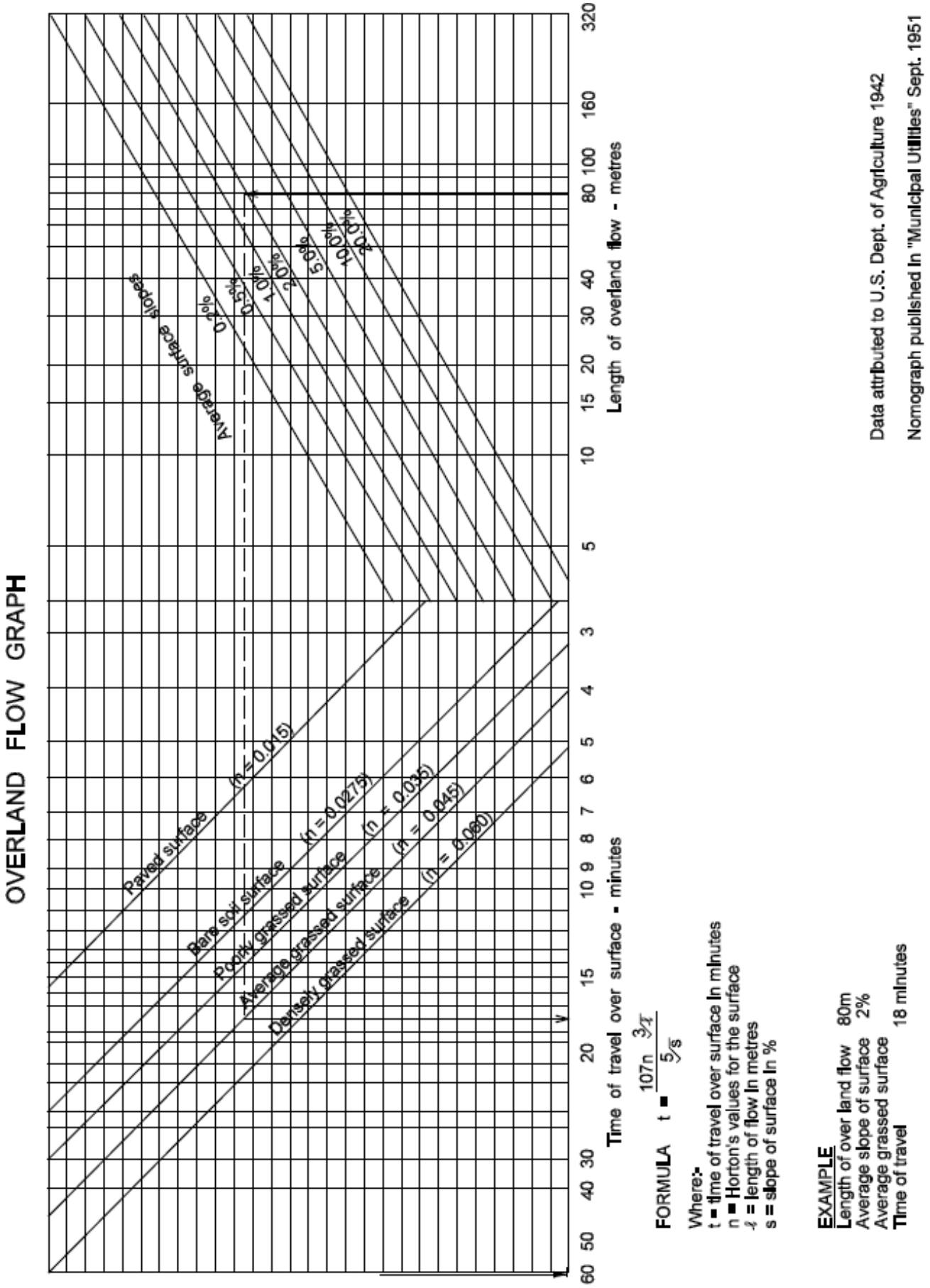
The time of concentration shall be determined as the 'time of entry' plus the 'time of flow' from the furthest point of the whole catchment to the point of discharge.

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***



#### 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. NIWA profile for the upper North Island is also acceptable.

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 Kaipara District is not acceptable.*

### 4.3.11. Hydraulic Design

#### 4.3.11.1. Energy Loss through Structure

Energy loss is expressed as velocity head: $He = kV^2/2g$ (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 (ke) |
|---|---|---|
| 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: 150mm

b. Main line: 225mm

c. Private / Lateral connection: 100mm

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 0.6 for design of both Reinforced Concrete and uPVC pipes.

Alternatively, the minimum Manning’s roughness coefficient shall be 0.013 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 Asset Management/Infrastructure Manager or delegate.

#### 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 are outlined in the KDC District Plan.

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
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 3.3m above One Tree Point datum on the east coast and 4.3m above One Tree Point Datum on the west coast.
- New non-habitable buildings will have a minimum floor level of 3.1m above One Tree Point datum on the east coast and 4.1m 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

KDC 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 + Climate Change.

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
m. Safety in Design considerations for the proposed works.

The piping of existing watercourses, constructed channels or open drains is not generally acceptable. Water courses 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 KDC 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 KDC 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 KDC
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 KDC 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 KDC acceptable 'n' values are set out in Table 4-6. Flow calculations should employ the best

practice method.

***Table 4-6: Manning's Values***

| Description | Manning's value 'n' |
|---|---|
| Open stream with straight uniform channel in earth and gravel in good condition | 0.0225 |
| Unlined channel in earth and gravel with some bends and in fair condition | 0.025 |
| Channel with rough stony bed or with weeds on earth bank and natural streams with clean straight banks | 0.030 |
| Winding natural streams with clean bed but with some pools and shoals | 0.035 |
| Winding natural streams with irregular cross sections and some obstruction with vegetation and debris | 0.045 |
| Irregular natural stream with obstruction from vegetation and debris | 0.060 |
| Very weedy irregular winding stream obstructed with significant overgrown vegetation and 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 |
| Sany loam, non-colloidal | 0.5 |
| Silt loam, non-colloidal | 0.6 |
| Alluvial silts, non-colloidal | 0.6 |
| Ordinary firm loam | 0.8 |
| Volcanic ash | 0.8 |
| Stiff clay, very colloidal | 1.1 |

| Description | Max velocity (m/s) |
|---|---|
| Alluvial silts, colloidal | 1.1 |
| Shales and hardpans | 1.8 |
| Fine gravel | 0.8 |
| Graded loam to cobbles, noncolloidal | 1.1 |
| Graded silts to cobbles, colloidal | 1.2 |
| Coarse gravel, noncolloidal | 1.2 |
| Cobbles and shingles | 1.5 |

#### 4.3.12.4. Drainage Reserves

Drainage Reserves include a land planned to be vested to KDC 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 4m 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
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.

   ***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 KDC.*
d. Safety in Design principles shall be applied.

Outlets' or inlets' surrounding area shall be designed to maintain and/or enhance in- stream values. Outlet and inlets structures shall be constructed to not restrict the flows in the watercourse and to not form a barrier to fish passage.

### 4.3.13.2. 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
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
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 4m
b. The total stored volume of fluid is more than 20,000m$^3$
c. The contributing upstream catchment is more than 20ha.

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 KDC
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 Drawings)
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 KDC 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 Drawings

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 KDC 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 KDC

r. All culverts transferring flow across the road reserve, roadside drains and water table are owned and maintained by KDC 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 and Large Culverts and Other Structures for culvert design requirements in respect of roading and accessways

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 3.3.27.1 Bridges and Large 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
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 accessway | 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 2m offset from the kerb except where the properties served are below road level. |
| Industrial | Within the Transport Corridor and within the berm, at 2m offset from the kerb or alternatively in the front yard area with specific approval from the KDC Stormwater Manager. |
| Business | Within the Transport Corridor and within the berm, at 2m offset from the kerb or alternatively in the rear service lane specific approval from the KDC Stormwater Manager. 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. |

| Area | Location |
|---|---|
| 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 1.5m 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 KDC mains with service connections to the property boundaries. |

The pipelines 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 Asset Management/Infrastructure Manager or delegate
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 Asset Management or Infrastructure Manager or delegate.
f. Pipes shall not be installed within the tree dripline
g. Where pipe joints lie within 5m of a tree with girth exceeding 0.5m (as measured 1.0m 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. 600mm in berms and any other areas not subjected to traffic loading
b. 1,000mm 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
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
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 Asset Management/Infrastructure Manager or delegate.

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 | 1,000 |
| 100 – 150 | 1,000 | 1,400 |
| 200 – 300 | 1,500 | 1,900 |
| 375 + | 1,500 + 2 x diameter | 1,900 + 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 450mm.

Bulkhead details shall be included in the drawings. Bulkhead spacing shall be as per Table 4-11.

***Table 4-11: Bulkhead Spacing***

| Grade % | Requirement | Spacing (S) (m) |
|---|---|---|
| 15 - 35 | Concrete Bulkhead | S = 100 / Grade (%) |
| > 35 | Special Design | 3.0 |

Where a pipeline shall be laid in soft ground (i.e. ground that is likely to settle, deflect and/or subside) KDC 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 KDC property or Transport Corridors whenever practicable. If located within the carriage way, manholes shall be located 2m 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 1.5m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist
d. Two metre 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
l. Permanent ends of a pipe.

For infill developments, manholes are not required at 150mm branch connections onto 150mm mains provided that:

a. a manhole exists on the main within 100m of the connection point

b. a manhole is provided on the branch upstream of the connection point
c. the manhole is immediately within the boundary of the property being served or within 20m 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 120m.

#### 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 50mm plus 5mm 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) +/- 5mm
b. Grading the channel shall be limited to falls through manholes of up to 150mm.

#### 4.3.17.5. Size of Manholes

Manholes shall be a minimum of 1,050mm diameter for depths of 1.2m or more.

Where two or more incoming pipes are connected to the manhole, larger diameters shall be used.

Non-access chambers of 600mm diameter are approved to be used for depths up to 1.2m 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 2.4m deep shall be constructed using a single riser with a pre-cast external flange base
c. Manholes in excess of 2.4m deep shall be constructed using a 2.4m 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 4.0m 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**
h. Access Chamber covers shall be painted blue

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 4.0m or
b. If affected by the high-water table
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 2.0m deep.
b. Where the cascade inlet pipe diameter will be a maximum of 300mm. Where the cascade will not discharge onto any steps or ladders.
c. Where the drop height will not exceed 1.0m (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 1.2m 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 300mm centres vertically (refer **Sheet 39**). The top step shall not be more than 450mm below the top of the top slab and the lowest step shall be no more than 375mm 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 1.0m clear of any vehicle crossing
c. The preferred depth at the boundary, of a stormwater connection to a piped network, is 1.2m (allowable range 0.9m - 1.5m) 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 0.5m the final design shall be to the satisfaction of KDC
e. Existing connections, if found on site, which may not be documented on KDC records, may be reused subject to confirmation of existing asset condition
f. A minimum connection diameter of 100mm is required for each residential allotment, or
g. A minimum connection diameter of 150mm 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, KDC 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:

a. 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**),
b. The distance between the pipeline connection and the closest inspection point is not greater than 25m.
c. 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 KDC 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 Asset Management / Infrastructure Manager or delegate 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 90m 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 225mm diameter for a single catch-pit, and minimum 375mm diameter for a double catch-pit
h. Catch-pit leads up to 225mm diameter and not more than 20m in length may be saddled on to pipes 600mm 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 accessways shall be capable of accepting the flow from a proprietary catchment area. The minimum grate size shall be 300 x 300mm. Where an access way is steep, or stormwater connections discharge onto the accessway, larger catch-pits or a cut off channel with a grate may be required. A minimum diameter for private catch-pit leads shall be 150mm. 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 KDC'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 150mm/hr, as determined using the NZ Building Code E1 Method (for single lot catchment area), and where other conditions (e.g. stability, groundwater) do not preclude their use.

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) for any devices that treat more than a single lot catchment area.

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. Maintenance responsibilities, schedules and procedures shall be clearly defined.

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 (safety factor of at least 2) 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 and calculated assuming 100% devices blockage
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 3.0m is required, but this can be reduced to 1.0m for porous paving or can be reduced to 1.5m where the neighbouring property is required to have a 1.5m setback to any new building. Setbacks to roadside boundaries shall be 0.5m (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 2.0m high, the clearance shall not be less than a horizontal distance that is equal to the retaining wall height plus 1.5m, unless a Specific Design is carried out. For walls higher than 2.0m, a Specific Design shall always be carried out
m. Soakage devices shall not be located within 2.0m of public sanitary sewers or 1.0m 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 KDC.

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

a. The lifecycle maintenance cost to the KDC
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 KDC.

Where proposed stormwater treatment and detention solutions may impact on the operation or maintenance of other KDC 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 KDC 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. The Regional Infrastructure Technical Specification (RITS) 2018 (Waikato)

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

The KDC encourages early consultation between the Developer and KDC to achieve mutually beneficial design outcomes. Of particular note KDC 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 ($m^2$) | Reduction of required Attenuation Volume (%) | | | | | |
|---|---|---|---|---|---|---|
| | Rainwater Tank Size (litres) | | | | | |
| | 200 | 1,000 | 3,000 | 4,500 | 9,000 | 25,000 |
| 150 | 20 | 35 | 45 | 45 | 50 | 50 |
| 200 | 20 | 25 | 35 | 35 | 35 | 40 |
| 250 | 10 | 20 | 30 | 30 | 35 | 35 |
| 300 | 10 | 15 | 20 | 20 | 25 | 25 |
| 500 | 5 | 10 | 10 | 10 | 15 | 20 |

***Note:*** *Reduction figures relate only to the roof portion of the attenuation and do not include other impervious surfaces.*

Where the rainwater tank attenuation shall be used to offset direct discharges from external impervious areas, once paved areas exceed 50-60% of the roof area, the incremental increase in roof runoff attenuation storage volume effectiveness becomes limited. Therefore, where the 'other' impervious areas exceed 120m², 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:

a. The proprietary system meets or exceeds the minimum treatment requirements of Auckland Council GD01, and
b. The proprietary system is on WDC Approved Materials List - Wastewater and Stormwater, and
c. The proprietary system is installed in accordance with the supplier's specifications and/or recommendations
d. When there are demonstratable site constraints precluding green infrastructure.

Use of a proprietary system that is not a KDC 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.

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 3.3.14.11 for use of swales within the Transport Corridor as road pavement drainage controls. Swales and roadside drains sized to 10% AEP plus Climate Change.

#### 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 GD01and GD04

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 3.3.14.11 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 |
|---|---|
| Land use | All land use types, all paved areas<br>It shall sustain traffic loads, which are anticipated over the subject area |
| Performance | Can provide retention (infiltration)and/or detention storage |

| Parameter | Application |
|---|---|
| Sizing | Provide to achieve requirements of Section 4.1.3 Performance Standards and Table 4-1 as required<br>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 |
|---|---|
| Land use | Heavy traffic paved areas, including shopping malls, schools, carparks, and roads |
| Catchment area | Less than 1 ha |
| Performance | Gross pollutant removal.<br>Some course sediment removal. Can be part of a treatment train. |
| Sizing | Installed into a curb inlet or catch-pit and can be customized to meet specifications.<br>High flows can bypass the filter.<br>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 GD04. Additionally, ponds and wetlands shall comply with the following minimum requirements:

a. Maximum permanent water depth is 1.5m
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 minimum width of 2.5m 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 KDC 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 KDC 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 1,000mm 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 and GD04:

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 4m, or
   - The total stored volume of fluid is more than 20,000m$^3$, or
   - The contributing upstream catchment is more than 20ha

   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 KDC

d. A safety bench shall be provided around the PWL perimeter where water depth is greater than 0.9m. The safety bench shall be between 0.3m and 0.5m below PLW and between 1.0 to 2m wide

e. The main safety measure for constructed wetlands is a 2m wide densely planted safety bench with a 1v:8h grade to a depth of 250mm form the PWL. The slope of the internal banks below the safety bench must be no steeper than 1v:3h, to allow easier access from the wetland should someone fall in. At PWL a safety bench 2m 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 0.9m or the ability to fall directly into standing water of depth greater than 0.9m 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 KDC.*

### 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 KDC 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
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
h. Minimise ongoing maintenance
i. Improve stormwater water quality discharge
j. Retain existing bush areas and tree stands where practicable
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 KDC.

***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 1.5m 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 5.0m of watercourses.

Where trees, shrubs and groundcovers shall be planted within a Transport Corridor, reference shall be made to Section 3.2.26 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 50mm and 150mm, depending on engineering design parameters.

Where engineering requirements permit, *Carex virata* or *Carex geminata* may be planted in the Wet and Marginal Zones. No other groundcover, shrub or tree species are permitted in these Zones. These shall be planted with mulch rounds.

***Table 4-16: Swale Planting - Velocity/Grade Matrix***

| Type | Grade | Velocity |
|---|---|---|
| Swale – Roll on Turfing | Less than 2% | Less than 1.5 m/s at 20% AEP flow |
| Swale – Vegetated (Carex grasses) | 2-5% | Less than 2.0 m/s at 20% AEP flow |
| Swale – Rocks | Greater than 5% | 2.0 m/s or greater at 20% AEP flow |

Turfed swales shall be prepared, established and maintained as per the Section 7.3.7 Grassing, Sowing and Turfing Both during and post-establishment, the height of the turf shall be consistently maintained at least fortnightly to the designed stormwater engineering requirements. Turf shall be of a drought- resistant hard-wearing rye grass-based variety.

Swales planted with Carex species shall be planted according to Section 7.3 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 KDC 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 4.0m 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 2.0m above the base of the clean out area
e. If the access path is greater than 50m 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 KDC 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 15m 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 600mm.

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 1.5m 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, KDC 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 KDC 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 300mm 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 50m of trench or 50m³ 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 KDC 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 KDC.

### 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 25m
d. Saddling of catch-pit leads into primary lines is permitted provided that the connection is made at 45º or less to the direction of primary flow
e. Saddling of double catch-pits is not permitted
f. Connections shall be sealed with removable caps until required
g. Connection/cap and locations, and depths to invert shall be accurately measured and shown on As-Built Plans in accordance with the requirements of Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals
h. The cap position shall be marked with a wooden stake (100 x 50 mm) with green 'SW' painted/fixed onto the stake and extending from the invert of the connection to a minimum of 600 mm above ground level
i. Connections shall be constructed as per **Sheet 37**
j. All connections to KDC piped network or work on KDC 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 KDC.

### 4.4.10. Stormwater Treatment and Detention Devices

Planting, protection, site preparation, spacing, and mulching shall be in accordance with the KDC 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 KDC 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 50mm.

#### 4.5.1.2. Inspections

The Developer/Contractor shall ensure that any progress inspections and associated approvals are granted before continuing with the installation. Failure to follow this process may result in the Developer/Contractor removing items or excavating a competed work to allow inspection. The progress inspections include:

a. Set out
b. Excavation and bedding
c. Backfill
d. Pre-pour form and reinforcing
e. Pre-cover installation
f. Water tightness

### 4.5.2. Manholes

Manholes shall be visually inspected to ensure the standard of construction and finishing is acceptable.

### 4.5.3. CCTV Inspections

#### 4.5.3.1. General Requirements

CCTV inspection shall be carried out on every new system to vest in Council. The timing of CCTV inspection shall be determined by KDC.

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 KDC. 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 KDC to flush the pipe with water prior to the CCTV being completed.

The CCTV camera shall travel upstream.

CCTV maps with log sheets (showing the pipe GIS identification references, still images of critical locations with distances form the stat node, and indication of defects types and severity) shall be submitted to the KDC.

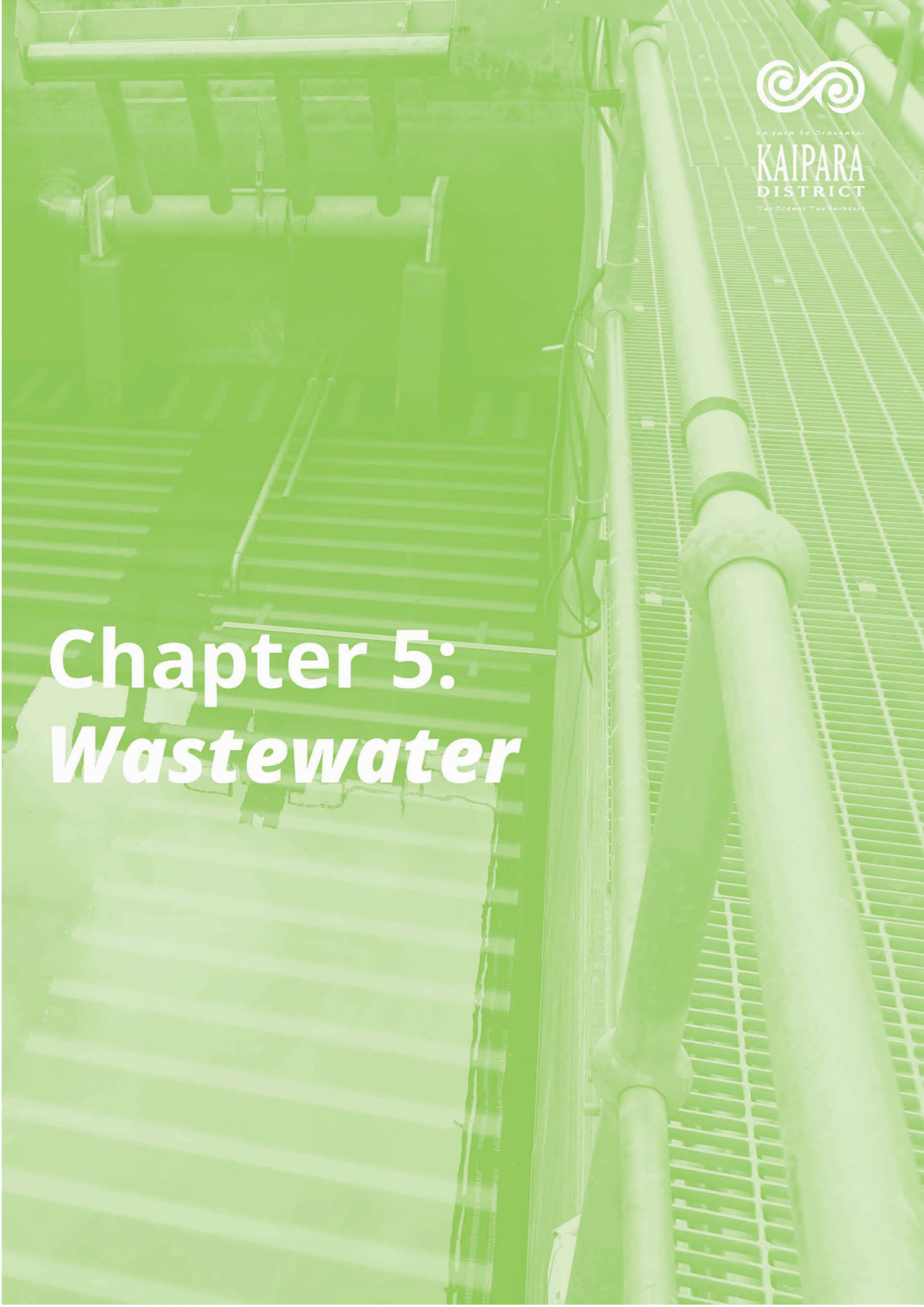
#### 4.5.3.2. Deliverables

The following deliverables are required:

a. As-built plans and/or KDC 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 KDC 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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# Chapter 5: *Wastewater*

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

KDC 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
b. KDC considers that it is reasonable or practicable to require connection
c. KDC 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 Asset Management/Infrastructure Manager or delegate.

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 KDC.

## 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 KDC'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 recommended 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 KDC for the purpose of balancing flows in the existing network. Storage, if approved by KDC, 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
KDC Wastewater Drainage Bylaw

#### 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 1124-42013)
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. KDC Documents

WDC Approved Materials List - Wastewater and Stormwater *(to be provided by KDC on request)*
Briefing Document – EES 1: Wastewater Pump Stations Electrical Engineering Standards *(to be provided by KDC on request)*

WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines (2015)
Policy #0056 - Pressure Sewer Policy (2012)
KDC form Application for Connection to Services
WDC Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

#### 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 KDC owned and operated, public wastewater system shall be provided with either:

a. Reticulation, and a communal treatment and disposal system
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 KDC 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 KDC.

The SSA shall reference the following:

a. The KDC Hazard Plans, e.g. and,
b. KDC'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 KDC 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)
e. All necessary NRC consents have been obtained and shall be transferred to the KDC.

Existing private systems will not be accepted to vest in KDC 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 2,000m$^2$,
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 KDC during the consenting phase of a development application.*

#### 5.4.5.4. 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 landowners 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 KDC.

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

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

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

Early consultation with KDC 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 1.5.3.2.5 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 KDC 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 KDC will provide (on request) for design purposes, details held by KDC of the existing wastewater reticulation. Where necessary, and at the Developer's expense, KDC 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 KDC.

***Note**: Design flow requirements in this section are for reticulated sewers – for onsite systems, design flows are based on AS/NZS 1547.*

### 5.2.2.2. Residential Flows

Table 5-1 shows the minimum inflows to be provided for (depending on the source of the water supply) for various uses related to people-based activities. The flows are average daily dry weather flows (ADWF).

***Table 5-1: Design Inflows for Residential Type Activities (Reticulated Sewers only)***

| Source | | Wastewater Flow Allowances(litres / person / day) | |
|---|---|---|---|
| | | Tank Supply | Reticulated / Bore Supply |
| **Household** | | 140 | 200 |
| **Hotels / Motels** | Guests and resident staff | 140 | 200 |
| | Other Non-resident | 30 | 40 |
| **Community Halls** | Banqueting | 20 | 30 |
| | Meetings | 10 | 15 |
| **Marae** | Day only | 40 | 40 |
| | Day / Sleep over | 140 | 140 |
| **Restaurant / Bar / Café** | Dinner | 30 | 30 |
| | Lunch | 25 | 25 |
| | Bar patron | 20 | 20 |
| **Schools** | Pupils plus staff | 30 | 40 |
| **Camping Grounds** | Fully serviced | 100 | 130 |
| | Recreation areas | 50 | 65 |
| **Retirement Home** | Residents | 200 | 220 |
| | Day staff | 40 | 50 |
| **Hospital/Rest Home** | | 220 | 250 |

Where a particular activity is known (such as development in a holiday area), figures specific to the activity shall be used.

Where particular activities are not known or are not being specifically designed for in accordance with Table 5-1, then a default flow of 200 litres/person/day shall be used.

***Table 5-2: Peaking Factors to be applied to ADWF Flows***

| Factor | Gravity Sewer Reticulation |
|---|---|
| Dry weather peak daily flow | 2.5 x ADWF |
| Peak wet weather flow (PWWF) | 5 x ADWF |

Additionally:

a. Number of people per Household Unit = 4.0

b. Number of Household Units per gross hectare = 15

These factors are the default figures where there is no additional information available and shall be applied to the default flow figure. The KDC 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 KDC Asset Management/Infrastructure Manager or delegate 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 KDC Asset Management/Infrastructure Manager or delegate.

Provision for liquid trade waste and 'wet' industries shall be considered and provided for by the design.

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, 150mm diameter gravity pipes laid within the limits of Table 5-5 (Minimum Grades for Wastewater Pipes) will be adequate without specific hydraulic design.

Where a catchment does not comply with the above criteria, a specific hydraulic design shall be carried out.

Hydraulic design shall be based on either the Colebrook-White formula or the Manning formula. Material coefficients for pipes up to DN 300 are given in Table 5-4. These values take into account joints, slime, debris etc. and apply for pipes up to DN 300.

Pipes exceeding DN 300 require Specific Design by a SQEP.

***Table 5-4: Coefficients for Gravity Lines***

| Material | Colebrook-White K *(mm)* | Manning |
|---|---|---|
| PVC | 0.6 | 0.011 |
| PE | 0.6 | 0.011 |
| Cement lining (DI & steel, concrete) | 1.5 | 0.012 |
| PP | 0.6 | 0.011 |

### 5.2.2.5. Minimum Grades for Self-cleaning

The minimum allowable self-cleansing velocity in pipelines is 0.6 m/s and shall be calculated using peak dry weather flow.

Minimum pipeline gradients are specified in Table 5-5 below. The Developer shall demonstrate that the design can achieve self-cleansing velocities regardless of the selected pipeline gradient.

***Table 5-5: Minimum Grades for Gravity Wastewater Pipes***

| Pipe Size | Location | Minimum Grade (%) | Minimum Grade (Ratio) |
|---|---|---|---|
| **Connections and Permanent Ends of Reticulation** | | | |
| DN 100 | Property connection | 1.65 | 1:60 |
| DN 150 | Property connection | 1.20 | 1:83 |
| DN 150, 225 & 300 | Permanent upstream ends of reticulation with 10 or less residential lots connected | 1.00 | 1:100 |
| **Wastewater Pipes – Reticulation with more than 10 Residential Lots (except PE pipelines and pipes installed by trenchless methods)** | | | |
| DN 150 | Recommended minimum grade | 0.67 | 1:150 |
| | Absolute minimum grade | 0.55 | 1:180 |
| DN 225 | | 0.33 | 1:300 |
| DN 300 | | 0.25 | 1:400 |
| **PE Pipes and Pipes Installed by Trenchless Methods** | | | |
| All sizes | To suit installation method, but not less than | 1.65 | 1:60 |

### 5.2.2.6. Steep Pipeline Grades

Where the pipeline grades are greater than 1:3, and pipes do not exceed 450mm 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 450mm.

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 2.5m/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 KDC'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. Con*crete 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 KDC 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 KDC'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 KDC'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 KDC owned reticulation within private property, or down right of ways or private roads, requires specific approval from the Asset Management/Infrastructure Manager or delegate.

Approval of public reticulation located in private property or right of ways will depend upon:

a. The number and length of connections required

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 1.5m from the boundary

b. An easement in favour of KDC over the private property, right of way or private access is required

c. Pressure sewer mains shall be laid in a duct

d. The required minimum clearances from other services (refer Sheet 30) and future buildings shall apply.

The KDC may require the legal width of an access to be greater than the minimum specified in Chapter 3 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. 600mm in berms and areas not subjected to traffic loading
b. 900mm 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
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
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 Asset Management/Infrastructure Manager or delegate.

Sufficient clearance (a minimum offset of 2m 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 Asset Management/Infrastructure Manager or delegate.

If approved by KDC, 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 KDC
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 Asset Management /Infrastructure Manager or delegate.

Approval shall be subject to the following design criteria being met:

a. Size the pipes to ensure peak daily velocities of at least 0.6m/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 KDC shall have a design life expectancy of at least 100 years. Alternative Design Life values can be submitted for components of the system at the discretion of the Asset Manager.

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 Asset Management/Infrastructure Manager or delegate. 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 KDC.

### 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
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 KDC 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 600mm)
c. Rodding eye.

Maintenance structures shall be located:

a. On KDC property or Transport Corridors whenever practicable. If located within the carriage way, manholes shall be located 2m 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 2m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist
d. Two metres 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 prefabricated vertical bend | No |
| Change of pipe grade at different invert level<br>Changes of pipe invert level | Yes | No | No |
| Changes of pipe size | Yes | No | No |
| Changes in horizontal direction | Yes | Use prefabricated | No |

| Maintenance Structure Locations | Acceptable Option | | |
|---|---|---|---|
| | Manhole | Inspection Chamber (IC) | Rodding Eye (RE) |
| Combined changes of pipe direction and grade, except where compound curves are permitted | | units or bends, max 33° deflection | |
| 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 150mm branch connections onto 150mm mains provided that:

a. a manhole exists on the main within 100m of the connection point
b. an 'off-line' manhole is provided on the branch upstream of the connection point
c. the 'off-line' manhole is immediately within the boundary of the property being served or within 20m of the connection point, whichever is the lesser.

Where public manholes are located on private property, the provisions of Section 5.2.3.2 Reticulation on Private Property shall apply.

Manholes are the only option where personnel entry is required.

Inspection chambers 600mm diameter are only permitted for depths not exceeding 1.2m to invert.

#### *5.2.7.1.3. Additional Requirements for Rodding Eyes*

Rodding eyes shall be provided at the end of 100mm diameter laterals of lengths up to 25m. For lateral lengths exceeding 25m, 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 120m

b. Where a combination of manholes and inspection chambers are used on the same pipeline, the maximum spacing between consecutive manholes shall not exceed 400m 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 1.5m for DN 150 and DN 225 pipes
c. The minimum depth to invert of the manhole shall be 2.0m 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
g. Benching shall be taken to 150mm 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 150mm.

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 1050mm diameter for depths of 1.2m 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 2.4m deep shall be constructed using a single riser with a pre-cast external flange base.
c. Manholes in excess of 2.4m deep shall be constructed using a 2.4m 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 4.0m 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 4.0m
b. If affected by the high-water table
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 1200mm or greater diameter manhole
c. External drops will not be approved
d. The minimum height for drop connections shall be 600mm
e. Only one drop connection per manhole is permitted.

### 5.2.7.9. Covers

Watertight manhole covers with a minimum clear opening of 600mm 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 1.2m 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 300mm centres vertically. The top step shall not be more than 450mm below the top of the top slab, and the lowest step shall be not more than 375mm 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 KDC's Public Utility connection process as per Public Utility Connection/Disconnection application form shall be completed by the Developer and the KDC'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 KDC Waste and Drainage Bylaw 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 1.2m (range 0.9 - 1.5m)
d. Where the depth of a connection at the boundary is deeper than 1.2m, 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 1.2m

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 KDC requires a larger size connection to be provided.<br>Connection to in-fill development, serving up to 3 household units, via an inspection chamber (subject to KDC 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 KDC 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 KDC. No individual lot connections are permitted into an interceptor.

### 5.2.6.4. Connections to Deep Lines

Where an existing or proposed wastewater pipe is more than 5.0m 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 5m 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 KDC'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 2m outside of the pipe
b. Building within the zone of influence of the pipe
c. Building within 2m horizontally of the outside of any maintenance structure (manholes, lampholes, maintenance shafts and sewer dead ends)
d. Driven piles shall not be installed closer than 5m from any pipe unless documentation is provided to the KDC's satisfaction showing that the proposed works will not damage the asset.

### 5.2.10. Pump Stations

#### 5.2.0.1. General Requirements

The design of public pump stations and components require Specific Design and KDC'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 KDC 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 KDC, 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 KDC.*

### 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 150mm 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 300mm above the estimated 1% AEP flood level
f. The bottom of the control cabinet shall be provided with a minimum freeboard of 450mm 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 900mm x 900mm
h. All lifting chains, guide rails, fittings, connections, nuts, bolts etc. in the pump station shall be 304 stainless steel
i. Pump chamber pipe work shall be stainless steel (316) or fiberglass
j. Concrete in pump stations shall be suitable for sewer pump stations, and shall be lined with an epoxy or similar lining. The concrete strength, admixtures and lining specification shall be supplied in the design submission
k. Pump impellors shall be hard iron. Impellor types shall be:
    i. For rising main diameters of 90mm or greater - an Open Self Cleansing channel impeller. Shredded single or multichannel impellers shall be capable of passing a 75mm diameter solid
    ii. For rising main diameters of less than 90mm - 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 900mm x 900mm, 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 5kW.
u. All pump stations shall be reviewed for the potential for odours in accordance with Section 5.2.6 Ventilation and Odour Control.
v. The electrical supply shall be underground.
w. Lighting shall be provided to illuminate the control cabinet. A 10A single phase power socket shall be provided in the cabinet with RCD protection.
x. Suitable low maintenance landscaping may be required on the pump station site around the wet well area.
y. Fencing may be required where the pump station is exposed to traffic etc.
z. An Operating and Maintenance Manual shall be provided that covers all aspects of the design and operation of the stations including:
    i. Design calculations, including pipe and fitting head-loss assumptions and pump curves
    ii. A plan of the design catchment
    iii. As-Built Plans including circuit diagrams and switch locations

iv. Pump details, pump duty information, float switch levels
v. Contingency measures for emergency overflows
vi. Operation and maintenance procedures
vii. Other relevant data and information
viii. Guarantees and warrantees

aa. Pump stations shall be tested and commissioned in the presence of a KDC 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 KDC'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 KDC'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 1050mm manhole with 400mm 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 3.5m, and have provision for parking and manoeuvring of maintenance vehicles. The centre line of the parking space shall be no greater than 4.0m in plan from the distal pump and no greater than a 0.5m difference in elevation between the parking area and lid elevation.

Where the access way is longer than 30m, 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 2.5m to any well or valve chamber lids and no further than 5.0m. 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 5.0m x 5.0m 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 1.8m 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 100mm 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 400mm
d. The design stop level is 50mm 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 KDC.

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 2.0m, 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 four 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 KDC 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 KDC's telemetry system. KDC 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 KDC reticulated water supply is available, fresh water shall be supplied from a standard 25mm. ID connection at a minimum static pressure of 250kPa. A standard hose connection shall be fitted.

If the water supply is taken from KDC'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 KDC 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 KDC 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 1.5m and 0.5mm 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 15m, 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 15m 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 30m 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 KDC. 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 KDC 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: 50mm, 100mm, 150mm, 200mm, and 300mm nominal bore (internal diameter)
g. KDC's specific approval is required for pipe sizes exceeding 150mm.

***Note**: KDC 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, KDC may:

a. Provide details of the working pressure of the existing network, or of pressures at the approved connection point
b. Provide details of the capacity of existing network.

Where this information is not available from KDC records, or further information is required for the design, the Developer shall consult with KDC 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. 400kPa (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 two 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 and 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 0.75m/s, and a maximum velocity of 2.5m/s.

The preferred velocity range is 0.8m/s to 1.2m/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 KDC'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 polymetric 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 Asset Management/Infrastructure Manager or delegate.

### 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 150mm 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 2m 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 800m.

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 Kaipara 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 KDC.

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
    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
   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 and regional plans.

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

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

The KDC 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 2m 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 KDC 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 KDC 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 KDC).

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 (50mm OD).

Property discharge line for a standard house connection is usually DN40 (40mm 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 KDC 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 15m 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 600mm.

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 1.5m 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 250mm 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 2.5mm 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 3.0m 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, KDC 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 KDC 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 3.4.2.4 Basecourse Layer .

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 $m^3$ of trench backfill, whichever is greater.

Compaction testing of fill material shall be in accordance with NZS 4402:1988/1986.The Contractor shall undertake tests to demonstrate that the specified compaction standards have been achieved throughout.

## 5.3.4. Trenchless Construction

### 5.3.4.1. General

Trenchless technology may be preferable or required as appropriate for alignments passing through or under

a. Environmentally sensitive areas
b. Built-up or congested areas to minimise disruption and reinstatement
c. Railway and major road crossings
d. Significant vegetation
e. Vehicle crossings.

Trenchless construction shall only be used for applications in which the specified tolerance can be achieved.

Pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints.

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient.

### 5.3.4.2. Installation Methods

Trenchless installation methods for new pipes include

a. Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE):
b. Uncased auger boring/pilot bore micro-tunnelling/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 and 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 10mm
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 KDC'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 KDC approved contractor using calibrated and data logging butt fusion or electrofusion machines. Only employees of an approved contractor who have successfully completed a Water New Zealand approved butt fusion or electrofusion jointing course for polyethylene pipe, or re- fresher in the past two years, shall be permitted to physically undertake welding.

Prior to commencing work, the following shall be provided:

a. Copy of current calibration certificate(s) of the butt fusion or electrofusion machine (not more than 12 months old)
b. Registration number of the fusion technician, and current certification (not more than 24 months old).

All jointing of PE pipe shall be data logged.

Fusion jointing shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion joints, including tapping saddles, a mechanical scraper with winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with prior permission from the Distribution Engineer. Electrofusion joints shall be undertaken using clamps and the equipment correctly calibrated.

##### *5.3.5.3.2. 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 450mm.

#### 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 20.0MPa at 28 days, unless otherwise specified or detailed by KDC.

### 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 25m
d. Saddling of catch-pit leads into primary lines is permitted provided that the connection is made at 45º or less to the direction of primary flow
e. Saddling of double catch-pits is not permitted
f. Connections shall be sealed with removable caps until required
g. Connection locations and depths to invert shall be accurately measured and shown on As-Built Plans in accordance with the requirements of Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals
h. The connection position shall be marked with a wooden stake (100mm x 50mm) with 'WW' painted/fixed onto the stake and extending from the invert of the connection to a minimum of 600mm above ground level.

Connections shall be constructed as per Sheet 37.

All connections to KDC piped network or work on KDC 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 Stormwater 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 KDC 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 KDC 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 1.5mm 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 2.0m.

### 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.

### 5.3.8.3. 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

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 3.0m, additional support brackets shall be installed at 2.0m 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 200mm 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 KDC.

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 20mm 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 100mm 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 15mm BSP threaded socket welded to the centre line of the pipe with a stainless steel plug no closer than 50mm 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 200mm below the invert of the overflow pipe to 150mm 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 42.

#### 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 0.6m below ground on a 50mm thick bed of clean sand. The trench shall be backfilled with a 75mm

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 200mm 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 100mm dia. shall be installed from the base of the electrical control cabinet concrete plinth to the pump station chamber
b. One 100mm duct shall be installed in the plinth for the mains cable
c. A 50mm duct shall be installed from the electrical control cabinet concrete plinth to the flow meter
d. A further 50mm 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 KDC, this final test shall be carried out in the presence of a KDC 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 KDC representative

New sewer reticulation shall be completely and permanently isolated from the KDC's 'live' sewer reticulation until such time as all tests are passed, and written authority from KDC to connect to the live sewer is obtained. Connection shall only be carried out by a Registered contractor or contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate, and the connection shall be inspected by a KDC

representative before the connection is backfilled.

A minimum of 24 hours' notice is required to be given to KDC before any tests are carried out, so that arrangements for a representative can be made. The Developer/Contractor shall provide all fittings and materials to carry out any tests.

#### 5.4.1.1. Inspections

The Developer/Contractor shall ensure that inspection and subsequent approval is granted before continuing with the installation. Failure to follow this process may result in the Developer/Contractor removing items or excavating a competed work to allow inspection. The progress inspections include:

a. Set out
b. Excavation and bedding
c. Backfill:
d. Pre-pour Form and Reinforcing
e. Pre-Cover Installation
f. Water Tightness
g. Rising Main Pressure Test
h. Electrical Inspection.

#### 5.4.1.2. Low Pressure Air Test

The materials and workmanship used shall pass a low-pressure air test.

a. Introduce air to the pipeline till a pressure of 300mm 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 50mm.

***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 5mm 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 KDC. 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 KDC. 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 KDC to flush the pipe with water prior to the CCTV being completed.

The CCTV camera shall travel upstream.

CCTV maps with log sheets (showing the pipe GIS identification references, still images of critical locations with distances form the stat node, and indication of defects types and severity) shall be submitted to the KDC.

The following deliverables are required:

#### 5.4.2.2. Deliverables

The following deliverables are required.

a. As-built plans and/or KDC 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 KDC GIS maps

e. Still images shall be in a source file and a PDF format

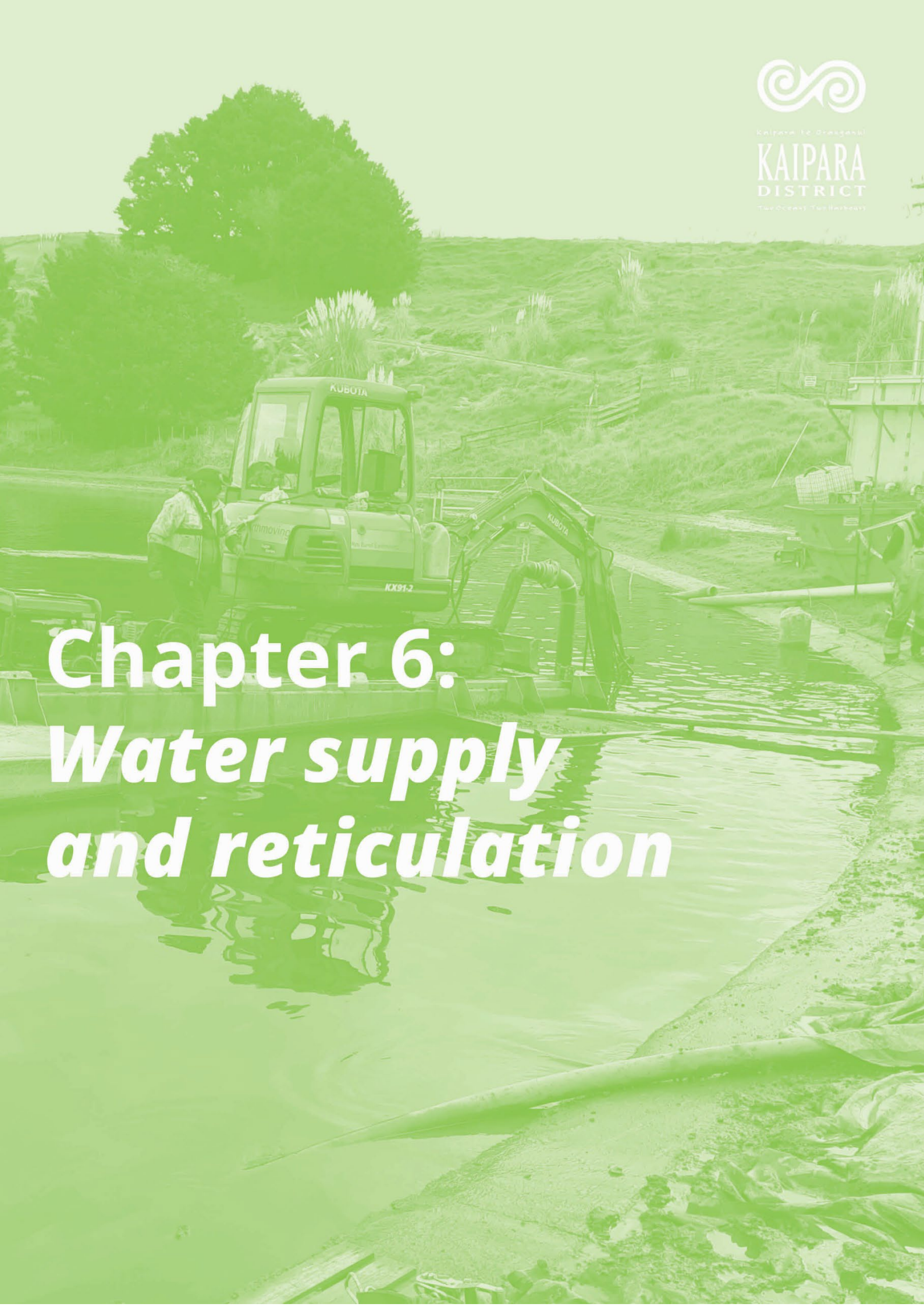
f. CCTV inspection summary sheets in a PDF digital format.

#### 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.




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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 KDC's water reticulation system. A connection to KDC system shall be provided to all lots within Living and Business Zones unless KDC 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 KDC may however require that a water supply be provided to a development, regardless of the Zone, if KDC 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 KDC'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 KDC'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 recommended 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 KDC.
f. All pipelines and fittings fixed by accurate positioning and the coordinates of those positions specified in terms of the KDC'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 KDC 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

KDC Water Supply Bylaw 2020

#### 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. KDC Documents

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

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

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

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

KDC Application to Connect Services

WDC Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

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

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

WDC Policy 0020 - Backflow Prevention Policy and Code of Practice 2012

#### 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 KDC, 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 KDC.

### 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) or contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate.

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.

KDC 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 KDC Licensed Contractor or contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate

A KDC Application to Connect to Services shall be submitted to KDC and approved before any work may be undertaken.

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

## 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 KDC.

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 KDC approved location on the existing water supply network.

The KDC 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, KDC 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. KDC requires a capacity assessment (using the network model) to be completed by KDC's consultants for

development over three new residential connections (or equivalent) at the developers cost.

Where this information is not available from KDC records, or further information is required for the design, the Developer shall consult with KDC 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 1.5.3.2.5 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. 4 people per household is the default value for KDC.

#### 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 KDC 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 KDC shall specify PF.

The minimum flow for an individual 20mm 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 KDC, head losses in existing and new mains at peak flow shall be limited to:

a. DN less than or equal to 150mm: 5m per 1,000m of pipeline
b. DN greater than or equal to 200mm: 3m per 1,000m of pipeline.

#### 6.2.2.7. Flow Velocities

Pipelines shall be designed for flow velocities within the range of 0.5 – 2.0m/s.

#### 6.2.2.8. Operating Pressures

The minimum service water pressure, in other than firefighting conditions, shall be 250kPa 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 KDC 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 KDC. 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 KDC 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 offline to serve future development. KDC 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 KDC 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 KDC owned reticulation within private property, or down right-of-way or private roads, requires specific approval from the KDC.

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 KDC 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 KDC may require the legal width of the access to be greater than the minimum specified in Chapter 3 in order to ensure minimum clearances from other services.

Details on points of supply are as stated in the KDC 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. 600mm in areas not subjected to traffic loading, or
b. 900mm under carriageways and trafficked areas.

The KDC 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 500mm 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 600mm 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 Asset Management/Infrastructure Manager or delegate.

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 Asset Management/Infrastructure Manager or delegate.

If a pipe bridge is approved by KDC for construction, the following Specific Design requirements shall be satisfied:

a. The underside of the pipe bridge structure shall be a minimum of 300mm 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 KDC
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 50mm 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 Fighting Water Requirements

The required flow shall be obtained from the maximum number of fire hydrants 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 standard requirements 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.

#### 6.2.4.2. Dedicated Sprinkler and Fire Fighting Watermains

Dedicated sprinkler and firefighting watermains require specific approval from the KDC.

Design of sprinkler systems shall demonstrate that the minimum operating pressure of 250kPa is available.

All dedicated watermains for sprinkler systems shall have a KDC 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 KDC 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.

#### 6.2.4.3. 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. Alternative Design Life values can be submitted for components of the system at the discretion of the Asset Manager

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 Asset Management/Infrastructure Manager or delegate. 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 Asset Management/Infrastructure Manager or delegate.

The WDC Approved Materials List - Water Services will be updated from time to time at the discretion of the KDC.

Materials and pressure ratings for pipelines greater than DN 150 shall be determined by Specific Design and in consultation with the KDC.

### 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 KDC shall specify the diameter of larger pipes.

Design documentation and drawings shall clearly indicate whether diameters of pipes are specified as inside (ID) or outside (OD) diameters.

Principal Main sizing shall be in accordance with Table 6-3. Rider Main sizing shall be in accordance with Table 6-4.

***Table 6-3: Empirical Guide for Principal Main Sizing***

| Nominal diameter of main DN | Capacity of main (single direction feed only) | | | |
|---|---|---|---|---|
| | Residential (lots) | Rural residential (lots | General/light industrial (ha) | High usage industrial (ha) |
| 100 | 40 | 10 | - | - |
| 150 | 160 | 125 | 23 | - |
| 200 | 400 | 290 | 52 | 10 |
| 225 | 550 | 370 | 66 | 18 |
| 250 | 650 | 470 | 84 | 24 |
| 300 | 1,000 | 670 | 120 | 35 |
| 375 | 1,600 | 1,070 | 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 | 15 | 30 |
| Low <400 kPa | 7 | 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 KDC'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 KDC.

PE pipes shall conform to the following requirements:

a. Rider mains and service connections of 50mm 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 100mm 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 KDC. 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 Kaipara District.*

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

***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 KDC 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 6mm 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 75mm and 250mm and the spindle shall be truly vertical. Where depth to the spindle exceeds 500mm a spindle extension shall be used to bring the top of the spindle between 75mm and 250mm 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 63mm PE compression coupling can be screwed.

Use of butterfly valves is subject to Specific Design, and approval shall be at the discretion of the Asset Management/Infrastructure Manager or delegate. 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 |
| * In rural areas, the maximum spacing may be increased to 500m | | |

### 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 KDC 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 KDC where water pressure is greater than 600kPa and a significant number of properties are affected or potentially may be affected (typically over a distance of 500m 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 KDC 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 150mm 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 KDC Asset Management/Infrastructure Manager or delegate

## 6.2.9. Hydrants

### 6.2.9.1. Hydrant General Requirements

All mains of 100mm 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 nitrite rubber and the gland seal shall be either braided PTFE yarn or a minimum of two captive 'O' sealing rings.
g. Hydrants shall not be self-draining.

### 6.2.9.2. Hydrant Locations

Hydrants shall be located opposite the common boundaries of lots and spaced at intervals not exceeding 135m on principal mains.

For developments requiring pipelines greater than or equal to 100mm 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 270m.

Terminal hydrants shall be within 135m of the furthermost portion of any building site along a route that is fully accessible[1]. In cul-de sacs or other terminal streets the last hydrant shall be as per Sheet 45and not be more than 65m from the end of the street.

Where a private way is more than 65m 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.

[1] The definition of accessible is a route from the fire hydrant to the building or building site following roads, driveways or right of ways

The KDC may require a 100mm 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 50m of the end of the private way. Adequate turning shall mean a turning area of no less than 11.3m radius, or as per Fire and Emergency NZ requirements. The access shall be designed to take heavy vehicles.

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 6m from any building.

Hydrant risers shall be used where necessary to ensure that the top of the spindle is not less than 75mm nor greater than 250mm 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 by 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 retroflective paint.

Yellow painted, KDC 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 150mm 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 200mm 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

KDC 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 100mm 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 12mm wide cut in the kerb and a 250mm 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 500mm 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 KDC 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 20mm 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

For water supplies to public assets that will be maintained by KDC 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 KDC 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 KDC 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 KDC Application to Connect to Services available from the KDC website or on request to install a meter shall be submitted and approved before any work may be undertaken.

Connection sizes up to and including 25mm diameter, meters shall be in accordance with the WDC Approved Materials List - Water Services.

For connections larger than 25mm diameter, KDC 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 KDC 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 KDC Asset Management/Infrastructure Manager or delegate 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 KDC.

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

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

Access and water supply easements shall be provided in favour of KDC 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 KDC. Only a Licensed Contractor may undertake work on existing water assets or on live watermains or contractor under supervision of the KDC Maintenance Contractor, KDC Operations Manager or delegate

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 100mm and shall surround the pipe by at least 100mm 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 KDC Asset Management/Infrastructure Manager or delegate 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 125mm square of blue paint: in addition, a notch 12mm wide and 12mm deep shall be cut in the top of the kerb before painting.

Service connections shall be a minimum of 1m 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 50mm ID shall be welded joints unless mechanical fittings have been specifically approved by the KDC.

100mm ID pipes (125mm OD) may be supplied in coils and joined using electrofusion couplers. Where pipe is supplied in 6m or 12m lengths and the pipeline length is greater than 50m, 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 KDC 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, personnel 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 KDC:

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 180mm 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 250mm 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 2.5mm$^2$ multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy-duty adhesive tape, at a maximum of 3.0m 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 KDC 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 KDC.

### 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.

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

Test results shall be forwarded to the KDC.

#### 6.3.3.2. Pipeline Pressure Testing

On completion of the pipe laying and jointing, sufficient backfill materials shall be placed over the pipes to prevent movement during pressure testing, leaving joints, fittings and anchor blocks visible. No connections of a permanent nature between existing mains and the new work will be allowed at this stage. PE 80 rider mains shall not to be connected to the mains before testing but shall be tested separately. Service connections shall be included within the test.

To complete the preliminary test, the new reticulation system shall be swabbed, and any air eliminated using a temporary supply. All valves on the new main shall be fully opened and all hydrants, stop taps and valves on the consumer end of the service pipes shall be shut. Water for tests may be obtained from the existing system provided prior KDC approval is obtained and a metered standpipe with a check valve is used. Standpipes are available from the KDC.

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 KDC at least 24 hours' notice before carrying out testing. The test shall be carried out in the presence of a KDC 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 2,000 kPa for PN 16). Test sections shall not exceed 500m 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 50mm ID pipes and to 100mm ID pipes where the length to be tested does not exceed 135m.

The contractor shall supply a graph or data logger printout of the pressure test and show calculations $n_1$ and $n_2$ where applicable.

***Note**: 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 KDC-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 KDC-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 KDC 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, Sodium hypochlorite solution, or
c. HTH dry chlorine granules dissolved in water before putting 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 20ppm 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 KDC'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 and 0.2ppm.

The laboratory will then issue KDC 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 1.0mg/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 300m of pipe disinfected, including the extremity of any branches.
c. The contractor shall provide KDC 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 KDC, an ES-W1 (in Appendix D) shall be completed by a KDC representative.

Upon completion of ES-W1 the Developer shall keep the new reticulation continuously charged with water under pressure and obtain KDC approval to connect to the existing reticulation. This approval is requested by notifying KDC 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 KDC and left operational.

If KDC considers that the main being connected is critical, then only the KDC'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.

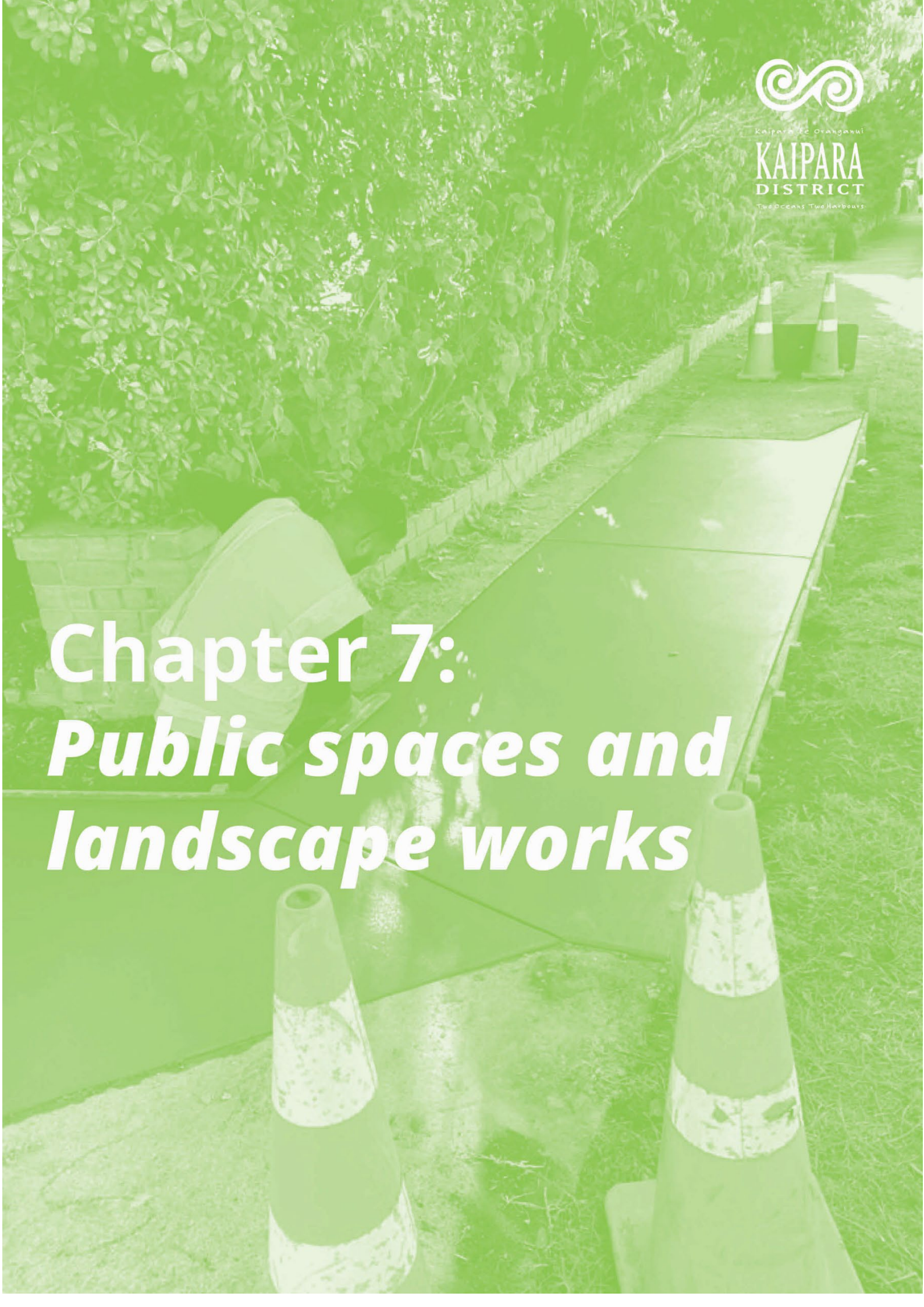
Additional information to be included in the asset information schedule, is required for all hydrants, valves and meter box locations as follows:

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 KDC 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 KDC.



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# Chapter 7: *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, hydrological, 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
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, native vegetation, and landscape features, and contribute to ecological and habitat biodiversity
h. Protect and enhance existing native vegetation
i. Provide amenity open space, “buffer areas”, open space connections and access to watercourses
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. KDC Documents

#### 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 KDC 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 (2026)

### 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 KDC (whether as road or reserve) shall vest in KDC 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 KDC 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

KDC may accept the gift of land in certain circumstances and subject to the written agreement of the KDC. The vesting or gifting of land will not result in any financial offset or payment from KDC, unless specific agreement is reached with KDC. The conditions of any application shall confirm the basis of the KDCs 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 KDC 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
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 KDC 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 KDC, 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 KDC.
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 KDC 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 KDC 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 3000m$^2$, to provide for expected recreation activities unless reasonable case can be made for a smaller area
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.
    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.
    Seek to maximise ecological and overland flow linkages.

f. Provide public access points from walkways to roads at 300m 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 KDC 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 6m (also to allow for maintenance vehicle access) with a central permanently surfaced pedestrian path 2.20m in width, or shared path 3m 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 area by building on the urban context including:

a. Landscape
b. Built form
c. Existing use
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 KDC 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 KDC is required for all play equipment (including hard courts and skateboarding facilities) in reserves and shall only be approved where KDC considers the equipment and location meets the recreational needs of the local community and complies with other related strategies and policies.

Approved play equipment may be installed by the Developer or by KDC 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 KDC may require.

### 7.2.6.2. Landscape Structures

Approval from KDC 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 relevant sections of Chapter 3.

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 1.2m on side boundaries constructed in accordance with **Sheet 54**, and
c. Pedestrian path 2.20m in width, or shared path 3m 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 KDC to control unauthorised vehicles, these shall be constructed as detailed in **Sheet 58** or otherwise as agreed with KDC.

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

#### 7.2.6.3. Fencing styles

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

The standard fences in Table 7-1 shall be used.

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

| Fence Type | Use |
|---|---|
| Type 1 (post and mesh) | Urban walkways and reserves |
| 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 KDC from liabilities relating to fences and shall require fencing to be agreed by KDC 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 KDC where the planting adds to visual amenity, urban legibility, improved ecological/hydrological outcomes and/or reduce maintenance requirements.

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
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 habitat, 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
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 1.5m 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 KDC. If species or grades specified are unobtainable, KDC 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 KDC.

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 3m from paths.

### 7.2.7.5. Irrigation Provision

The KDC 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 using a public network 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 KDC. 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 $m^2$ 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 2.0m, have a 30mm 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 KDC 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 400mm 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 KDC 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 KDC.

Drawings of proposed street trees provided for in the EDA shall show all KDC 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 KDC 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 KDC 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 KDC.

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

The Tree Protection Zone identified in the approved ETVP shall be fenced or otherwise restricted to the satisfaction of KDC 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 50mm in diameter or more may only be carried out by an Arborist or other expert as approved by the KDC and shall be in accordance with approved ETVP. All tree roots severed that are between 10mm and 50mm shall be neatly cut with a saw or other suitable pruning equipment. Roots larger than 25mm 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 KDC. If this is not practicable, an assessment of the effects on the tree(s) from a qualified arborist shall be provided to the KDC.

***Note**: Works within the tree dripline of trees protected by the District Plan may require resource consent. The KDC may require that a suitably qualified KDC 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 KDC.

### 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 KDC.

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

The KDC 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 KDC 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 KDC, 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 KDC. 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 100mm 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 KDC. 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 KDC 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 KDC.

#### 7.3.6.3. Fencing

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

Livestock fencing shall be provided where required. At road frontages, no hot wires shall be used unless they are attached at 300mm 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 KDC 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 100mm 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 100mm 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 25mm 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 25mm 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 KDC, 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 KDC 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 $100m^2$, 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 $100m^2$ 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 100mm in height, it shall be cut to 50mm high
b. For subsequent mowing, the mowing frequency shall be governed by growth rate. Minimum grass height to be 40mm - maximum grass height to be 70mm
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
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 20mm depth, 450mm 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 KDC, its survival after placement is doubtful. All turf shall be laid immediately after delivery to site. Where this is not practicable, the turf 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 turf previously laid.

The turf shall be thoroughly watered until the turf mat and top 50mm of soil is wet. After allowing a 'soaking in' period the turf 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 12mm 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 25mm of flat surfaces or 50mm of vertical structures. Grass shall not be allowed to encroach over flat paved or sealed surfaces by more than 25mm,
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 KDC's discretion but will be subject to additional maintenance requirements.

The KDC 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 KDC 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 KDC 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, KDC may approve reduced excavation areas. KDC 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 KDC 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 KDC prior to placement. Additions to modify soil for back filling shall be as directed by KDC.

## 7.3.12. Street Tree Planting

### 7.3.12.1. Layout

Confirmation shall be obtained that the planting has been approved by KDC prior to planting. The KDC 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, KDC 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 150mm 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, 100mm 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 KDC, a street tree shall have a 1900mm long section of 65mm 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 20mm. Underground irrigation systems can be installed instead of manually watering.

#### 7.3.12.4. Tree Root Barriers

At the KDC'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 2,000m 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/m2 | 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 KDC. The system shall provide a minimum soil moisture level of 50% to 200mm depth, throughout the planted areas or within the dripline of trees specified. It shall be capable of fully re-wetting the root zone to 200mm depth when the irrigation is applied: and shall be 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 KDC.

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 500mm of tree trunks, within 50mm of the edge of any undefined mulch surface, and within 50mm of any posts or the base of any landscape structures.

### 7.3.15. Pruning

Pruning shall be carried out in accordance with acceptable modern aboricultural 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 KDC, 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 (1.0m high by 2.0m long), bark mulch shall be spread evenly to a depth of 100mm over the planted area, creating an inverted cone hollow around each plant stem with a maximum 25mm 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 KDC for approval prior to spread.

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

##### *7.3.16.1.2. Steep Site Mulch*

On slopes steeper than 1:3, mulching for weed control shall consist of a KDC 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 1,000gsm 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 KDC's discretion, mat rounds may be used instead of matting. These shall be a minimum 500mm diameter and have the same characteristics as the mulch fabric. Each round shall have 8 pins: 4 pins equidistant near the outer edge and 4 pins around the plant stem.

On steep slopes with erosion issues that are receiving planting, biodegradable netting with no geotextile or geonet content shall be used at the KDC'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 1.8m hardwood stakes with at least one third of their length (600mm) in the ground and at least 1.0m exposed minimum, or as specified on the approved plan. One 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 KDC 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 400mm away from the tree trunk and no more than 500mm away.

Street trees shall have two hardwood stakes located outside of the root ball to firmly anchor the tree. Stakes shall be rough sawn 40mm x 40mm 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 KDC, all mass-planted trees including revegetation plantings shall be staked with a single 1.2m minimum long 22-25 mm diameter dead bamboo stake, positioned outside the root ball, driven into the ground to at least a 400mm 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 KDC.

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, 1m (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 KDC 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 KDC. 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 KDC.

As-built information for specimen trees shall include the following:

a. Species and Common names
b. Planting date
c. Height
d. Address / Location description
e. GPS X/Y co-ordinates.

As-built information for planting areas shall show the extent of the area planted as a polygon. .

As-built drawings may be checked by KDC on site for accuracy on completion of the development.

An Engineering Design Approval 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 KDC 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
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 KDC, 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 KDC 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 KDC's discretion.

#### 7.4.3.1. Works Clearance Inspection

After completing all proposed works, KDC 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, KDC shall be provided notice at least seven working days prior to the proposed commencement of KDC 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 recommended 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 100mm 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 KDC, the stakes shall be removed and disposed without damaging the plant
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 extend by at least three months. The KDC 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 recommended 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 25mm of grass or other vegetation is allowed to encroach. Vertical elements without mowing edges shall have vegetation maintained clear of the structure by no less than 25mm and no more than 75mm.

### 7.4.3.6. Grassing and Turf Defects Liability Period

After initial establishment, during and at the end of the Defects Liability Period, the following recommended standards shall be maintained:

a. All kerb and channelled berms shall have grass growth no more than 50mm high. Non-kerb-and-channelled berms shall have grass growth no more than 200mm high and banks shall have grass growth not more than 250mm 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

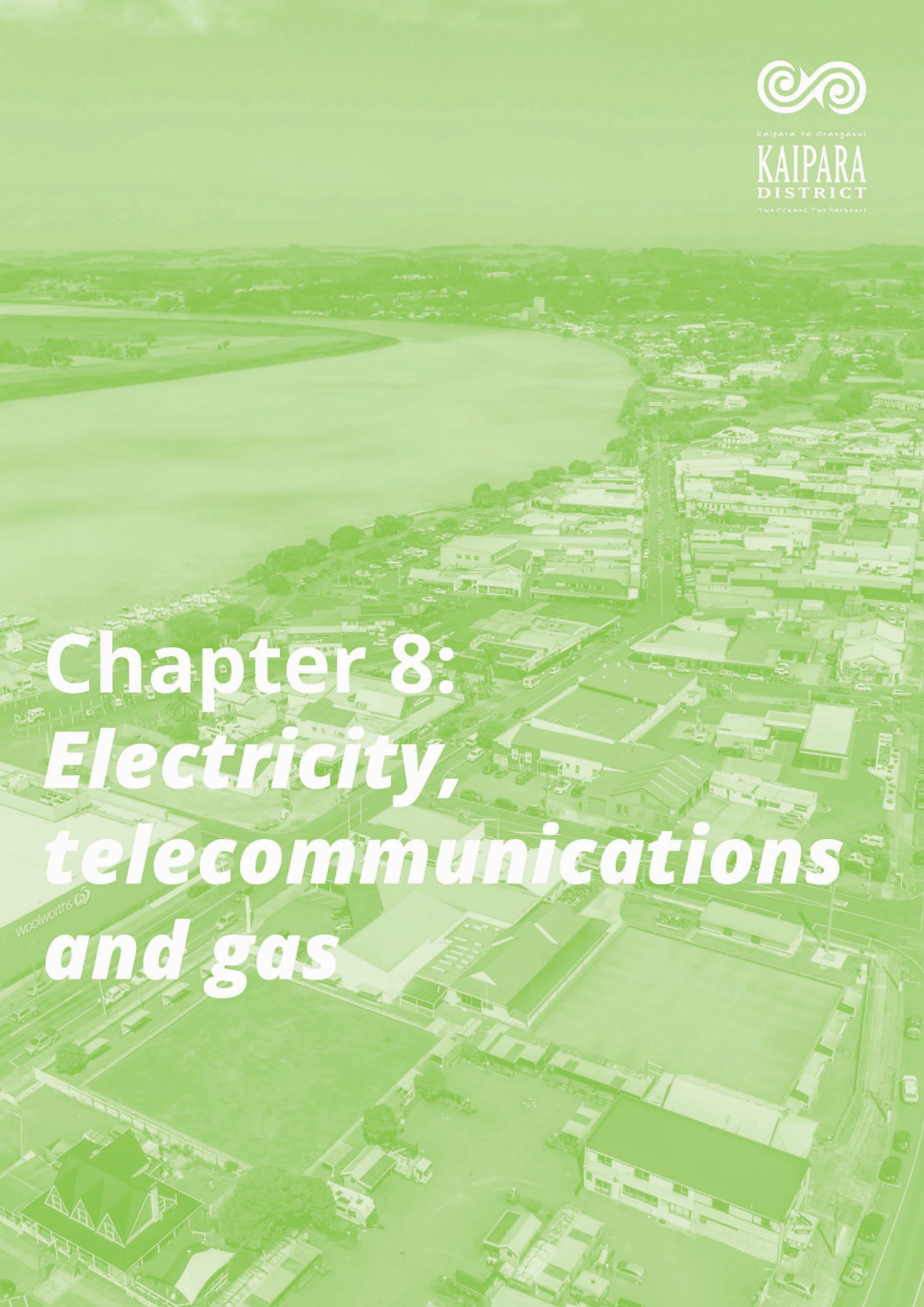
d. Maintenance and mowing operations shall be carried out at times which minimise disruption to the public

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.

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# 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 KDC: 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 KDC.

## 8.1.2. Objectives

a. To ensure that each network is located so as to be capable of servicing the intended users
b. To ensure that networks are designed to acceptable urban design, landscaping and engineering standards
c. To ensure all networks are laid underground unless not required by the District Plan
d. To ensure that any network that is to be located above ground within the road reserve shall be located clear of footpaths, cycleways, accessways and vehicular sightlines.

## 8.1.3. Reference Documents

The following documents are referenced in this Chapter:

***Note** it is the responsibility of the 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. KDC Documents

#### 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, KDC will require the use of a 'no electricity supply encumbrance' or 'no telecommunications supply encumbrance' registered on the affected land title(

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 shall 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
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 KDC.

### 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 Roading 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 the state of completion of other infrastructure
c. 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 ±300mm and vertical ±100mm.

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.

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# *Appendices*

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Note: Appendix E is not used by Kaipara District Council. Refer to the applicable E1/VM1 or GD07 Guidance.

# 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.

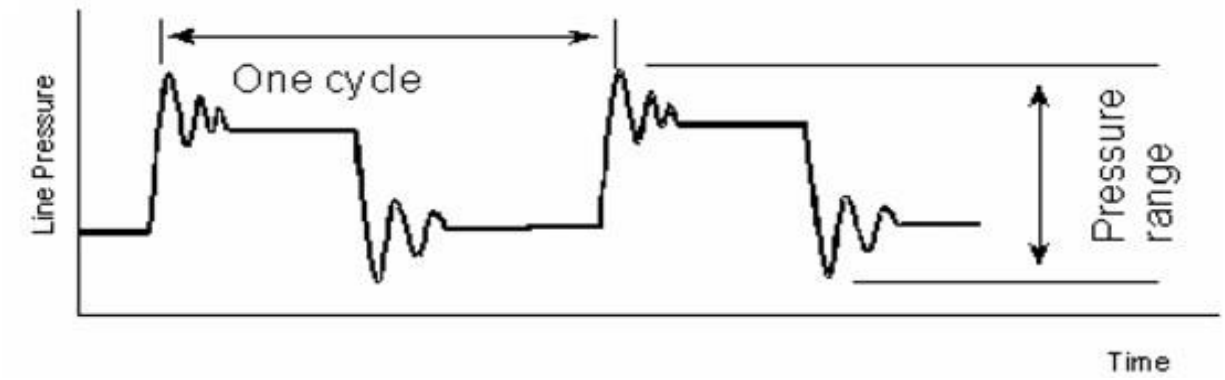



***Figure 0-1: Pressure Cycle and Pressure Range (From POP101 Figure1)***

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:

$$Peo = \frac{\Delta P}{FLF}$$

Peo = $\underline{\Delta P}$

Peo = Equivalent operating pressure (bar)

ΔP = Cyclic pressure range (bar).

FLF = Fatigue Load Factor

## Appendix B ES-SEW1

## Onsite Wastewater Disposal Investigation

This form is to be read in conjunction with AS/NZS 1547:2012 (or any amendments as applicable), and, in particular with Part 4: Means of Compliance

### Part A – Contact Details

#### 1 - Applicant

Name: _____

_____

Property Address: _____

_____

Lot/DP Number: _____

#### 2 - Consultant / Site Evaluator

Site Evaluator Name: _____

_____

Company Name: _____

_____

Postal Address: _____

_____

Business Phone: _____ Mobile: _____

Email: _____

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)*

| □ | WDC REQUIREMENT | APPLIES TO LOT(S) | COMMENTS |
|---|---|---|---|
| **1** | **Hazard maps/GIS hazard layer - stability** | | |
| | Low stability risk | | |
| | Moderate stability risk | | |
| | High stability risk | | |
| **2** | **GIS hazard layer – effluent on slope stability** | | |
| | Low disposal potential | | |
| | Moderate disposal potential | | |
| | High disposal potential | | |
| **3** | **GIS hazard layer – effluent suitability** | | |
| | Medium unsuitability | | |
| | High unsuitability | | |
| **4** | **GIS hazard layer – flood susceptibility** | | |
| | Is flood susceptible | | |
| | Is partially flood susceptible | | |
| | Is not flood susceptible | | |
| **5** | **GIS land resources layer - streams** | | |

| | | | | |
|---|---|---|---|---|
| Are there streams on or adjacent to land under investigation? | | Yes | | |
| | | No | | |
| **6** | **GIS land resources layer – aquifers at risk** | | | |
| Is land situated over or adjacent to aquifer? | | Yes | | |
| | | No | | |
| **7** | **Annual Rainfall (HIRDS)** | | | |

*Note: It is to be noted that all information obtained off 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 | | Structureless (massive) | | |
| 2 Sandy loams | | Weakly Structured | | |
| | | Massive | | |
| 3 Loams | | High/Moderate structured | | |
| | | Weakly structured or Massive | | |
| 4 Clay loams | | High/moderate structured | | |
| | | Weakly structured | | |
| | | Massive | | |
| 5 Light clays | | Strongly structured | | |
| | | Moderately structured | | |
| | | Weakly structured or massive | | |
| 6 Medium to heavy clays | | Strongly structured | | |
| | | Moderately structured | | |
| | | Weakly structured or massive | | |

*Note: Refer 4.1 A4 – Soil Assessment AS/NZS 1547:2012 for assessment criteria.*

*Note: Details of the method used to determine soil type etc. are to be clearly stated, along with positions of boreholes/test pits etc. clearly marked on a site plan. Bore logs are to be provided. Photos should be included.*

*Note: The site plan should also clearly show the intended area for effluent disposal, along with any site features such as drains, water bores, overland flows etc., along with separation distance achieved.*

## On-Site Evaluation Continued

b. Site Characteristics for Proposed Disposal Area: (if there is a marked difference between sites, please fill in a separate form for each site and clearly note which site the assessment applies to) (✓ appropriate box)

| □ | DETAILS | APPLIES TO SITE(S) |
|---|---|---|
| 1 | **Flooding potential to proposed field and reserve field (refer note 1 below)** | |
| | Fields will not flood, or | |
| | **Fields will flood in** | |
| | 20% AEP event | |
| | 5% AEP event | |
| | 1% AEP event | |
| 2 | **Surface water separation to proposed field and reserve field (refer note 2 below)** | |
| | Main/reserve disposal field comply with NRC rules | |
| | Main/reserve disposal field do not comply with NRC rules | |
| 3 | **Surface water separation to proposed field and reserve field (refer note 2 below)** | |
| | Main/reserve disposal field comply with NRC rules | |
| | Main/reserve disposal field do not comply with NRC rules | |
| 4 | **Winter ground water separation to proposed field and reserve field (refer note 3 below)** | |
| | Main and reserve disposal field comply with NRC rules | |
| | Main and reserve disposal field do NOT comply with NRC rules | |
| 5 | **Slope of ground of proposed field and reserve field (refer note 4)** | |
| Description | | |
| 6 | **Shape of ground of proposed field and reserve field (Refer note 5 below)** | |

| | | | | | |
|---|---|---|---|---|---|
| | Waxing divergent | | Linear divergent | | Waning divergent |
| | Waxing planar | | Liner planar | | Waning planar |
| | Waxing convergent | | Linear convergent | | Waning convergent |

| | |
|---|---|
| Comments | |
| | |
| | |

| | | |
|---|---|---|
| | **DETAILS** | **APPLIES TO SITE(S)** |
| **7** | **Intended water supply source** | |
| | Public supply | |
| | Rainwater | |
| | Bore | |
| **8** | **Proposed method of disposal and recommended Daily Loading rate (DLR) (refer note 6 below)** | |

| | |
|---|---|
| Description | |
| | |
| | |
| | |

| | | | |
|---|---|---|---|
| **Peak loading factored in (refer not 6 below)** | | Yes | | No |

| | |
|---|---|
| Comments | |
| | |

| | | | |
|---|---|---|---|
| **9** | **Site exposure (refer note 7 below)** | **Description** | **Applies to Site(s)** |
| Site(s) aspect | | | |
| Pre-dominant wind direction | | | |
| Presence of shelter belts | | | |
| Presence of topographical features or structures | | | |
| **10** | **Proximity of water bores (include adjacent to properties) (refer note 9 below)** | | |
| | | | |

| | |
|---|---|
| | |
| **11** | **Visible evidence of slips / instability (refer not 8 below)** |
| | |
| | |
| **12** | **Total suitable area available for type of effluent disposal proposed (including reserve area)** |
| | |
| | |
| **13** | **Setback areas proposed (if any) (refer note 10 below)** |
| | |
| | |

*Notes*

1. *If the 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. _____

iv. _____

4 This professional opinion is furnished to the TA and the Developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building

5 This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report

| | | |
|---|---|---|
| *Signature* | *Professional Qualifications* | *Date* |

# Appendix 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

Not used by Kaipara District Council. Refer to the applicable E1/VM1 or GD07 Guidance.

## 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

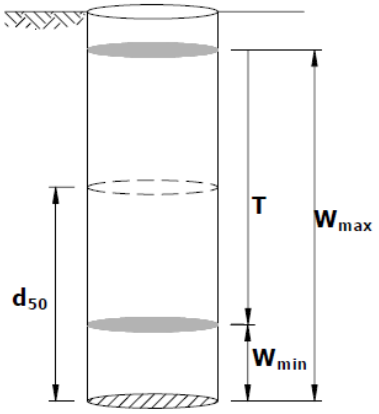
| Test 1 | |
|---|---|
| c. depth to water (m) | Time (min) |
| | |
| | |
| | |
| | |
| | |
| | |

| 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 | d50 = ($W_{max}$ – $W_{min}$) /2 + $W_{min}$ = | | m |
| | d | As50 = (22 x D x d50) / 7 = | | $m^2$ |

| | | | | |
|---|---|---|---|---|
|  | e | Vol = (22 x $D^2$) / 28 = | | $m^3$ |
| | f | T (time between $W_{max}$ and $W_{min}$)(Test #3) = | | min |
| | g | Soil permeability = P = Vol / $A_{s50}$ x T x 60) = | | m/sec |
| | h | Safe soil permeability = $P_{safe}$ = P / 2 = | | m/sec |

## Falling-Head Permeability Test (Soak Pit)

Site Address _____

Completed By _____

Date of Test _____ Signature _____

## Ensure the following procedures are followed (☐ when complete)

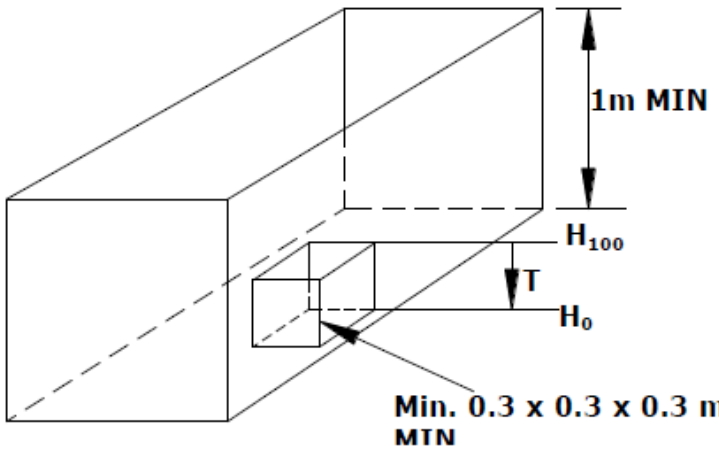
- ❒ Excavate 0.3 x 0.3 x 0.3 m test pit at base of main excavation (minimum 1 m deep)
- ❒ Refill test pit 3 times
- ❒ Use results from 3rd test

## 1 – Test Pit Details

a. depth of pit = H = _____m

b. Length of pit = L = _____m

c. width of pit = W = _____m




| Test 1 – Time (min) | Test 2 – Time (min) | Test 3 – Time (min) |
|---|---|---|

| | | |
|---|---|---|
| | | |

## 2 – Calculate Permeability Rate

| | | | |
|---|---|---|---|
| a. | Test pit volume = V = W x L x D = | | $m^3$ |
| b. | A = (H x L x 2) + (W x H x 2) = | | $m^2$ (base ignored) |
| c. | Time for pit to drain full to empty $H_{100}$ to $H_0$ = T = | | minutes (Test 3 result) |
| d. | Permeability (test) $P_t$ = V / (T x 60 x A) = | | m/sec |
| e. | Permeability (final) $P_f$ = $P_t$ x 0.5 = | | m/sec |

Use $P_f$ for soak pit designs

## Appendix 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.<br>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),

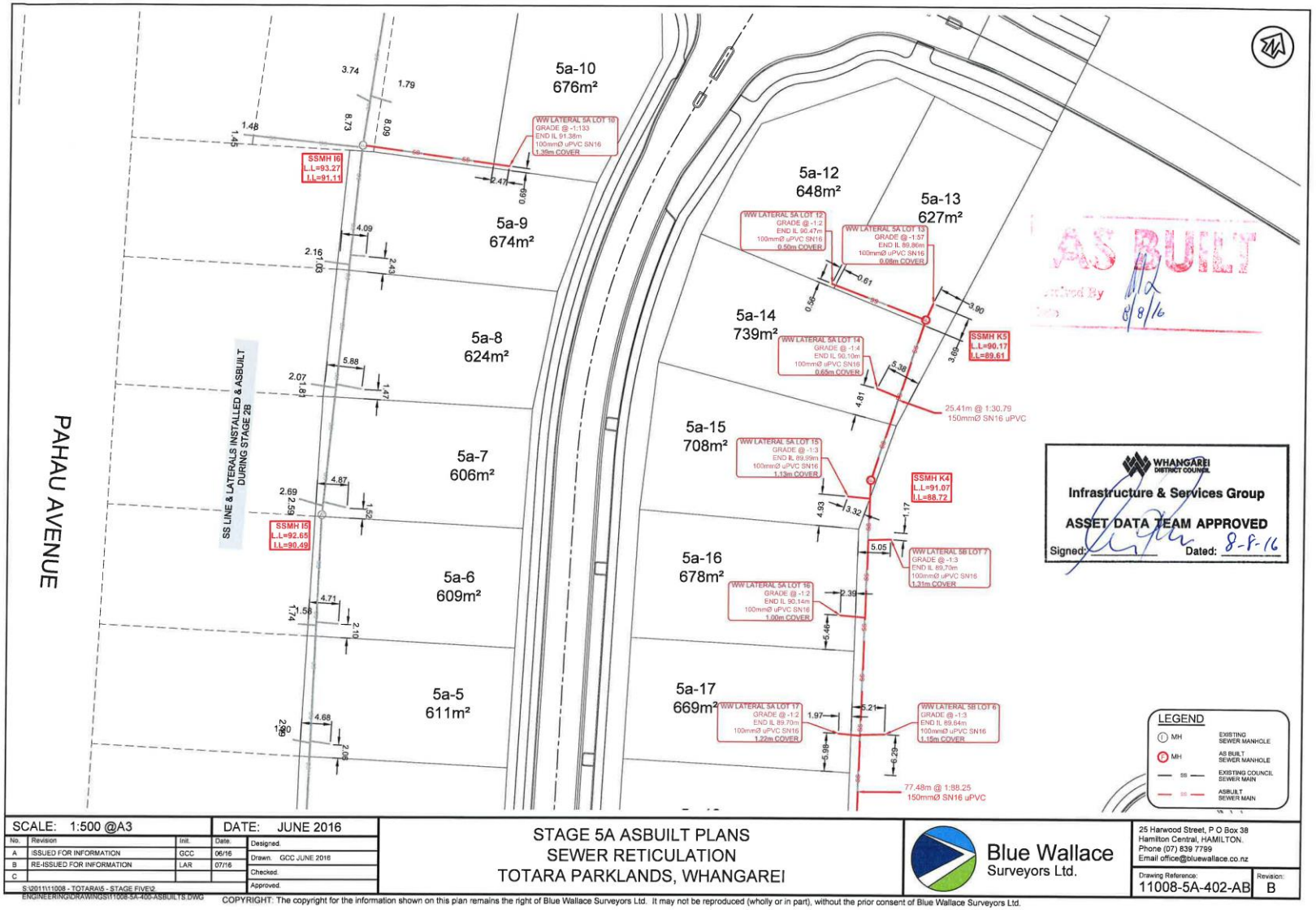
d. Different elements of the plan shall be drawn on its own appropriately named layer, e.g. sewer manholes on a ‘SWMH’ layer,

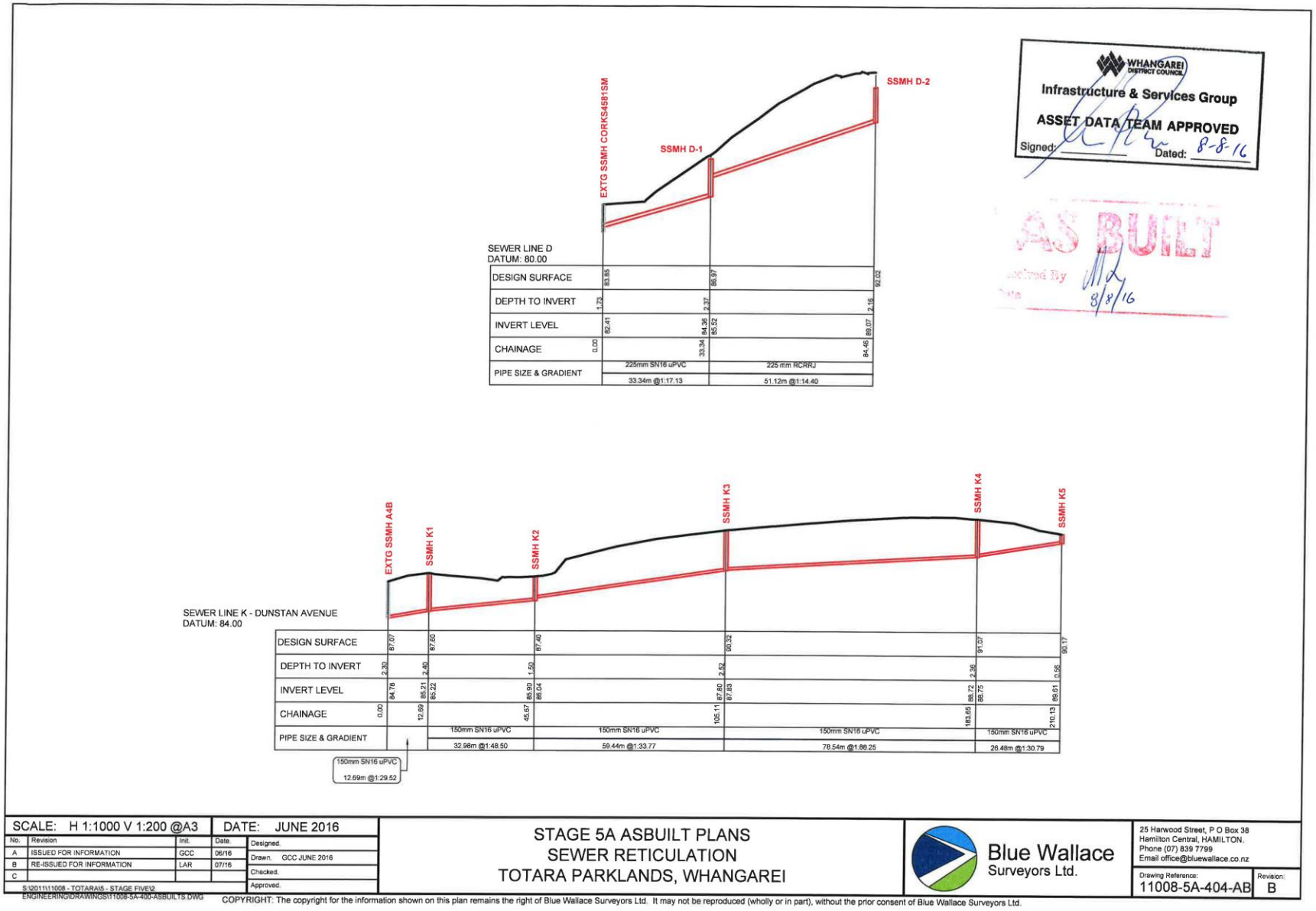
e. As-built layouts shall have ‘As-built’ incorporated in the title, and

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*


PAHAU AVENUE
SS LINE & LATERALS INSTALLED & ASBUILT DURING STAGE 2B
5a-10 676m²
5a-9 674m²
5a-8 624m²
5a-7 606m²
5a-6 609m²
5a-5 611m²
5a-12 648m²
5a-13 627m²
5a-14 739m²
5a-15 708m²
5a-16 678m²
5a-17 669m²
SSMH I6 I.L=93.27 I.L=91.11
SSMH I5 I.L=92.65 I.L=90.49
SSMH K5 I.L=90.17 I.L=89.61
SSMH K4 I.L=91.07 I.L=88.72
25.41m @ 1:30.79 150mmØ SN16 uPVC
77.48m @ 1:88.25 150mmØ SN16 uPVC
AS BUILT
8/8/16
WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-8-16
LEGEND
EXISTING SEWER MANHOLE
AS BUILT SEWER MANHOLE
EXISTING COUNCIL SEWER MAIN
ASBUILT SEWER MAIN
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
Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.
S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-400-ASBUILTS.DWG
STAGE 5A ASBUILT PLANS
SEWER RETICULATION
TOTARA PARKLANDS, WHANGAREI
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7789
Email office@bluewallace.co.nz
Drawing Reference: 11008-5A-402-AB
Revision: B
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.



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WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-8-16

AS BUILT
Signed By 8/8/16

| | | | | | | Mt Eden Circuit 2000 | | NZTM Proj | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CODE | XREF | UNIT TYPE | DESCRIPTION | INSTALL DATE | EXP LIFE | X Co-Ord (Easting) | Y Co-Ord (Northing) | X Co-Ord (Easting) | Y Co-Ord (Northing) | Z Co-Ord (Elevation) | US Invert | DS Invert | Material | Size | Quantity | Public/ Private | Surface |
| Stage 5A Sewer Reticulation | | | | | | | | | | | | | | | | | |
| SSMH | EXTG SSMH A4B | SSMH | | Jun-16 | 50 | 359860.84 | 933517.62 | 1719525.33 | 6051234.91 | 87.06 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH K1 | SSMH | | Jun-16 | 50 | 359849.88 | 933524.02 | 1719514.49 | 6051241.51 | 87.80 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH K2 | SSMH | | Jun-16 | 50 | 359824.66 | 933502.77 | 1719488.90 | 6051220.72 | 87.46 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH K3 | SSMH | | Jun-16 | 50 | 359787.74 | 933549.34 | 1719452.82 | 6051267.94 | 90.47 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH K4 | SSMH | | Jun-16 | 50 | 359749.86 | 933618.15 | 1719416.19 | 6051337.40 | 91.38 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH K5 | SSMH | | Jun-16 | 50 | 359744.20 | 933644.02 | 1719411.00 | 6051363.36 | 90.94 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SSMH | SSMH D1 | SSMH | | Jun-16 | 50 | 359688.81 | 933761.81 | 1719357.73 | 6051482.12 | 86.73 | | | CC | 1200 | 1 | PUBLIC | GRASS |
| SSMH | SSMH D2 | SSMH | | Jun-16 | 50 | 359663.35 | 933717.48 | 1719331.49 | 6051438.26 | 91.23 | | | CC | 1050 | 1 | PUBLIC | GRASS |
| SMN | | SEWER | SSMH K1 - EXTG SSMH A4B | Jun-16 | 50 | | | | | | 85.21 | 84.78 | uPVC | 150 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH K2 - SSMH K1 | Jun-16 | 50 | | | | | | 85.90 | 85.22 | uPVC | 150 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH K3 - SSMH K2 | Jun-16 | 50 | | | | | | 87.80 | 86.04 | uPVC | 150 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH K4 - SSMH K3 | Jun-16 | 50 | | | | | | 88.72 | 87.83 | uPVC | 150 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH K5 - SSMH K5 | Jun-16 | 50 | | | | | | 89.61 | 88.75 | uPVC | 150 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH D1 - CORKS4581SM | Jun-16 | 50 | | | | | | 84.36 | 82.41 | uPVC | 225 | | PUBLIC | GRASS |
| SMN | | SEWER | SSMH D2 - SSMH D1 | Jun-16 | 50 | | | | | | 89.07 | 85.52 | RCRRJ | 225 | | PUBLIC | GRASS |
| SND | 5A-1-A | JUNCT-Y | LOT 5A-1 CONN. TO MAIN | Jun-16 | 50 | 359757.51 | 933458.17 | 1719420.97 | 6051177.34 | 84.76 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-1-B | SEWER | LOT 5A-1 LINE | Jun-16 | 50 | | | | | | 84.80 | 84.76 | uPVC | 100 | 3.39 | PUBLIC | GRASS |
| SND | 5A-1-C | END PT | LOT 5A-1 CONN. END | Jun-16 | 50 | 359759.27 | 933461.07 | 1719422.78 | 6051180.20 | 84.80 | | | uPVC | | 1 | PUBLIC | GRASS |
| SND | 5B-2-A | JUNCT-Y | LOT 5B-2 CONN. TO MAIN | Jun-16 | 50 | 359844.06 | 933519.12 | 1719508.58 | 6051236.71 | 85.38 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5B-2-B | SEWER | LOT 5B-2 LINE | Jun-16 | 50 | | | | | | 87.07 | 85.38 | uPVC | 100 | 7.18 | PRIVATE | GRASS |
| SND | 5B-2-C | END PT | LOT 5B-2 CONN. END | Jun-16 | 50 | 359839.42 | 933524.32 | 1719504.03 | 6051241.99 | 87.07 | | | uPVC | | 1 | PRIVATE | GRASS |
| SND | 5A-21-A | JUNCT-Y | LOT 5A-21 CONN. TO MAIN | Jun-16 | 50 | 359821.14 | 933507.22 | 1719485.45 | 6051225.23 | 86.20 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-21-B | SEWER | LOT 5A-21 LINE | Jun-16 | 50 | | | | | | 86.80 | 86.20 | uPVC | 100 | 19.88 | PRIVATE | GRASS |
| SND | 5A-21-C | END PT | LOT 5A-21 CONN. END | Jun-16 | 50 | 359805.44 | 933495.03 | 1719469.54 | 6051213.32 | 86.80 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5B-1-A | JUNCT-Y | LOT 5B-1 CONN. TO MAIN | Jun-16 | 50 | 359820.44 | 933508.10 | 1719484.77 | 6051226.12 | 86.23 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5B-1-B | SEWER | LOT 5B-1 LINE | Jun-16 | 50 | | | | | | 86.85 | 86.23 | uPVC | 100 | 2.9 | PRIVATE | GRASS |
| SND | 5B-1-C | END PT | LOT 5B-1 CONN. END | Jun-16 | 50 | 359822.53 | 933510.01 | 1719486.90 | 6051227.99 | 86.85 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5A-22-A | JUNCT-Y | LOT 5A-22 CONN. TO MAIN | Jun-16 | 50 | 359819.98 | 933508.67 | 1719484.33 | 6051226.70 | 86.25 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-22-B | SEWER | LOT 5A - 22 LINE | Jun-16 | 50 | | | | | | 86.84 | 86.25 | uPVC | 100 | 4.21 | PRIVATE | GRASS |
| SND | 5A-22-C | END PT | LOT 5A-22 CONN. END | Jun-16 | 50 | 359816.60 | 933506.24 | 1719480.90 | 6051224.33 | 86.84 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5A-20-A | JUNCT-Y | LOT 5A-20 CONN. TO MAIN | Jun-16 | 50 | 359797.76 | 933536.70 | 1719462.62 | 6051255.12 | 87.33 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-20-B | SEWER | LOT 5A-20 LINE | Jun-16 | 50 | | | | | | 88.90 | 87.33 | uPVC | 100 | 4 | PRIVATE | GRASS |
| SND | 5A-20-C | END PT | LOT 5A-20 CONN. END | Jun-16 | 50 | 359794.76 | 933534.57 | 1719459.57 | 6051253.04 | 88.90 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5B-3-A | JUNCT-Y | LOT 5B-3 CONN. TO MAIN | Jun-16 | 50 | 359797.57 | 933536.94 | 1719462.43 | 6051255.37 | 87.34 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5B-3-B | SEWER | LOT 5B-3 LINE | Jun-16 | 50 | | | | | | 88.68 | 87.34 | uPVC | 100 | 3.72 | PRIVATE | GRASS |
| SND | 5B-3-C | END PT | LOT 5B-3 CONN. END | Jun-16 | 50 | 359800.17 | 933539.26 | 1719465.07 | 6051257.63 | 88.68 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5A-19-A | JUNCT-Y | LOT 5A-19 CONN. TO MAIN | Jun-16 | 50 | 359784.22 | 933555.73 | 1719449.42 | 6051274.39 | 87.90 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-19-B | SEWER | LOT 5A- LINE | Jun-16 | 50 | | | | | | 89.50 | 87.90 | uPVC | 100 | 3.62 | PRIVATE | GRASS |
| SND | 5A-19-C | END PT | LOT 5A-19 CONN. END | Jun-16 | 50 | 359781.28 | 933554.34 | 1719446.46 | 6051273.05 | 89.50 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5B-4-A | JUNCT-Y | LOT 5B-4 CONN. TO MAIN | Jun-16 | 50 | 359784.16 | 933555.84 | 1719449.37 | 6051274.49 | 87.91 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5B-4-B | SEWER | LOT 5B-4 LINE | Jun-16 | 50 | | | | | | 89.23 | 87.91 | uPVC | 100 | 3.46 | PRIVATE | GRASS |
| SND | 5B-4-C | END PT | LOT 5B-4 CONN. END | Jun-16 | 50 | 359786.86 | 933557.55 | 1719452.09 | 6051276.16 | 89.23 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5A-18-A | JUNCT-Y | LOT 5A-18 CONN. TO MAIN | Jun-16 | 50 | 359778.08 | 933566.89 | 1719443.48 | 6051285.66 | 88.05 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-18-B | SEWER | LOT 5A-18 LINE | Jun-16 | 50 | | | | | | 89.44 | 88.05 | uPVC | 100 | 3.24 | PRIVATE | GRASS |
| SND | 5A-18-C | END PT | LOT 5A-18 CONN. END | Jun-16 | 50 | 359775.42 | 933565.66 | 1719440.80 | 6051284.47 | 89.44 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5B-5-A | JUNCT-Y | LOT 5B-5 CONN. TO MAIN | Jun-16 | 50 | 359778.07 | 933566.91 | 1719443.47 | 6051285.67 | 88.05 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5B-5-B | SEWER | LOT 5B-5 LINE | Jun-16 | 50 | | | | | | 88.99 | 88.05 | uPVC | 100 | 3.16 | PRIVATE | GRASS |
| SND | 5B-5-C | END PT | LOT 5B-5 CONN. END | Jun-16 | 50 | 359780.61 | 933568.53 | 1719446.04 | 6051287.25 | 88.99 | | | uPVC | 100 | 1 | PRIVATE | GRASS |
| SND | 5A-17-A | JUNCT-Y | LOT 5A-17 CONN. TO MAIN | Jun-16 | 50 | 359769.16 | 933583.10 | 1719434.85 | 6051302.02 | 88.26 | | | uPVC | 100/150 | 1 | PUBLIC | GRASS |
| SND | 5A-17-B | SEWER | LOT 5A-17 LINE | Jun-16 | 50 | | | | | | 89.70 | 88.26 | uPVC | 100 | 3.68 | PRIVATE | GRASS |

SCALE:

| No. | Revision | Init. | Date. |
|---|---|---|---|
| A | ISSUED FOR INFORMATION | GCC | 06/16 |
| B | RE-ISSUED FOR INFORMATION | LAR | 07/16 |
| C | | | |

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-400-ASBUILTS.DWG

DATE: JUNE 2016

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

STAGE 5A ASBUILT PLANS
SEWER RETICULATION
TOTARA PARKLANDS, WHANGAREI

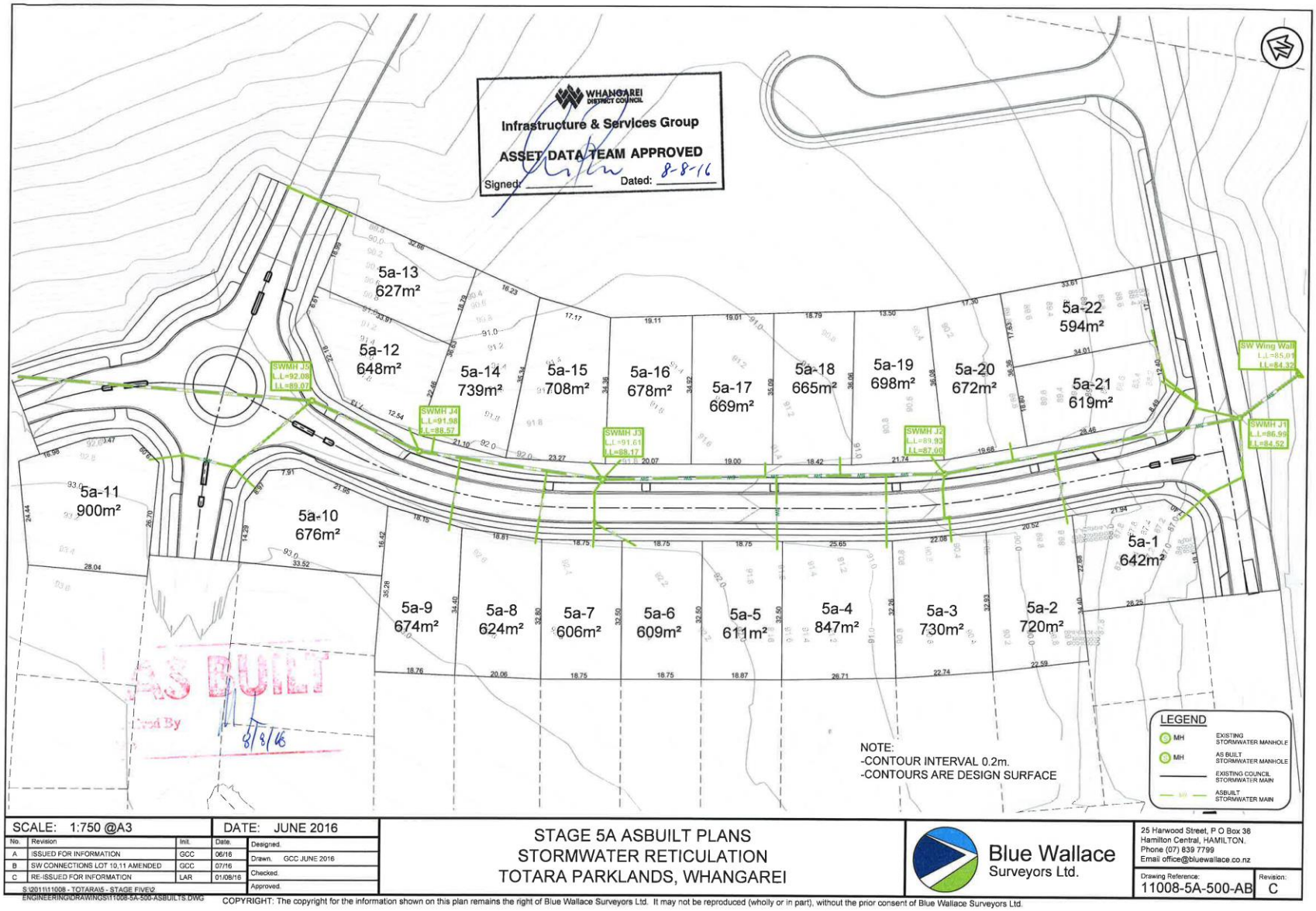
Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-405-AB
Revision: B

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*Stormwater As-Built examples*


WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed:
Dated: 8-8-16
5a-13 627m²
5a-12 648m²
5a-14 739m²
5a-15 708m²
5a-16 678m²
5a-17 669m²
5a-18 665m²
5a-19 698m²
5a-20 672m²
5a-21 619m²
5a-22 594m²
5a-11 900m²
5a-10 676m²
5a-9 674m²
5a-8 624m²
5a-7 606m²
5a-6 609m²
5a-5 611m²
5a-4 847m²
5a-3 730m²
5a-2 720m²
5a-1 642m²
SWMH J5 L.L=92.08 I.L=89.87
SWMH J4 L.L=91.98 I.L=88.57
SWMH J3 L.L=91.64 I.L=88.17
SWMH J2 L.L=89.93 I.L=87.00
SWMH J1 L.L=86.99 I.L=84.52
SW Wing Wall L.L=85.0 I.L=84.32
AS BUILT
Approved By
8/8/16
NOTE:
-CONTOUR INTERVAL 0.2m.
-CONTOURS ARE DESIGN SURFACE
LEGEND
MH EXISTING STORMWATER MANHOLE
MH AS BUILT STORMWATER MANHOLE
EXISTING COUNCIL STORMWATER MAIN
ASBUILT STORMWATER MAIN
SCALE: 1:750 @A3
DATE: JUNE 2016
No. Revision Init. Date.
A ISSUED FOR INFORMATION GCC 06/16
B SW CONNECTIONS LOT 10,11 AMENDED GCC 07/16
C RE-ISSUED FOR INFORMATION LAR 01/08/16
Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.
S:\2011\11008 - TOTARA\5 - STAGE FIVE\2 ENGINEERING\DRAWINGS\11008-5A-500-ASBUILTS.DWG
STAGE 5A ASBUILT PLANS
STORMWATER RETICULATION
TOTARA PARKLANDS, WHANGAREI
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz
Drawing Reference: 11008-5A-500-AB
Revision: C
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WAIRAU-STORMWATER MAIN
DATUM: 82.00

| | SW Wing Wall | SWMH J1 | SWMH J2 | SWMH J3 | SWMH J4 | SWMH J5 | End |
|---|---|---|---|---|---|---|---|
| DESIGN SURFACE | 84.81 | 86.99 | 89.93 | 91.81 | 91.98 | 92.08 | 92.06 |
| DEPTH TO INVERT | 0.69 | 2.48 | 2.94 | 3.45 | 3.42 | 3.02 | 2.15 |
| INVERT LEVEL | 84.36 | 84.56 / 84.65 | 87.04 / 87.22 | 88.21 / 88.27 | 88.61 / 88.72 | 89.11 / 89.21 | 89.95 |
| CHAINAGE | 0.00 | 16.88 | 87.08 | 166.99 | 210.29 | 238.10 | 307.23 |

| PIPE SIZE & GRADIENT | Wing Wall – J1 | J1 – J2 | J2 – J3 | J3 – J4 | J4 – J5 | J5 – End |
|---|---|---|---|---|---|---|
| Pipe size | 600 mm RCRRJ | 600 mm RCRRJ | 600 mm RCRRJ | 600 mm RCRRJ | 600 mm RCRRJ | 600 mm RCRRJ |
| Gradient | 16.88m @-1:84.38 | 70.20m @-1:29.37 | 79.91m @-1:80.72 | 43.31m @-1:127.38 | 27.80m @-1:71.29 | 69.14m @-1:93.43 |

WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: ________ Dated: 8-8-16

| SCALE: H 1:1000 V 1:100 @A3 | | | DATE: JUNE 2016 |
|---|---|---|---|
| No. | Revision | Init. | Date. |
| A | ISSUED FOR INFORMATION | GCC | 06/16 |
| B | SW CONNECTIONS LOT 10,11 AMENDED | GCC | 07/16 |
| C | RE-ISSUED FOR INFORMATION | LAR | 01/08/16 |

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-500-ASBUILTS.DWG

**STAGE 5A ASBUILT PLANS**
**STORMWATER RETICULATION**
**TOTARA PARKLANDS, WHANGAREI**

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-504-AB Revision: C

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WHANGAREI DISTRICT COUNCIL

**Infrastructure & Services Group**

**ASSET DATA TEAM APPROVED**

Signed: Dated: 8-8-16

| | | | | | | Mt Eden Circuit 2000 | | NZTM Proj | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CODE | XREF | UNIT TYPE | DESCRIPTION | APPROVED DATE | EXP LIFE | X Co-Ord (Easting) | Y Co-Ord (Northing) | X Co-Ord (Easting) | Y Co-Ord (Northing) | Z Co-Ord (Elevation) | US Invert | DS Invert | Material | Size | Quantity | Public/ Private | Surface |
| Stage 5A Stormwater Reticulation | | | | | | | | | | | | | | | | | |
| SWMN | | STORM | SW WING WALL - SWMH J1 | Jun-16 | 50 | | | | | | 84.56 | 84.36 | RCRRJ | 600 | 15.67 | Public | Grass |
| SWMN | | STORM | SWMH J1 - SWMH J2 | Jun-16 | 50 | | | | | | 87.04 | 84.65 | RCRRJ | 600 | 69.13 | Public | Road |
| SWMN | | STORM | SWMH J2 - SWMH J3 | Jun-16 | 50 | | | | | | 88.21 | 87.22 | RCRRJ | 600 | 78.84 | Public | Grass |
| SWMN | | STORM | SWMH J3 - SWMH J4 | Jun-16 | 50 | | | | | | 88.61 | 88.27 | RCRRJ | 600 | 42.24 | Public | Grass |
| SWMN | | STORM | SWMH J4 - SWMH J5 | Jun-16 | 50 | | | | | | 89.11 | 88.72 | RCRRJ | 600 | 26.74 | Public | Grass |
| SWMN | | STORM | SWMH J5 - ENDPOINT | Jun-16 | 50 | 359676.06 | 933727.11 | 1719344.37 | 6051447.66 | 89.95 | 89.95 | 89.21 | RCRRJ | 600 | 68.07 | Public | Road |
| SWMN | | STORM | SWMH J1 - CP 1 | Jun-16 | 50 | | | | | | 85.10 | 84.96 | RCRRJ | 375 | 13.84 | Public | Grass |
| SWMN | | STORM | CP1 - CP2 | Jun-16 | 50 | | | | | | 85.33 | 85.16 | RCRRJ | 375 | 9.28 | Public | Road |
| SWC | 5A-1-A | JUNCT-Y | LOT 5A-1 CONNECTION TO CP2 | Jun-16 | 50 | 359780.10 | 933467.82 | 1719443.72 | 6051186.58 | 85.66 | | | | | 1 | Public | Road |
| SWC | 5A-1-B | STORM | LOT 5A-1 CONNECTION LINE | Jun-16 | 50 | | | | | | 86.12 | 85.66 | uPVC | 100 | 8.62 | Private | Grass |
| SWC | 5A-1-C | ENDPT | LOT 5A-1 CONNECTION END | Jun-16 | 50 | 359772.29 | 933470.60 | 1719435.97 | 6051189.50 | 86.12 | | | | | 1 | Private | Grass |
| SWMN | | STORM | CP2 - CP15 | Jun-16 | 50 | | | | | | 85.43 | 85.43 | RCRRJ | 375 | 1.2 | Public | Road |
| SWCP | CP2 | CP | CP2 - DOUBLE CATCH PIT WITH CP15 | Jun-16 | 50 | 359780.30 | 933467.78 | 1719443.92 | 6051186.53 | 86.33 | | | RC | 675 x 450 | 1 | Public | Road |
| SWCP | CP15 | CP | CP15 - DOUBLE CATCH PIT WITH CP2 | Jun-16 | 50 | 359780.57 | 933468.94 | 1719444.21 | 6051187.69 | 86.44 | | | RC | 675 x 450 | 1 | Public | Road |
| SWCP | CP1 | CP | CP1 | Jun-16 | 50 | 359787.80 | 933462.30 | 1719451.32 | 6051180.93 | 86.28 | | | RC | 675 x 450 | 1 | Public | Road |
| SWMN | | STORM | SWMH-J1 - CP3 | Jun-16 | 50 | 359799.62 | 933469.98 | 1719463.27 | 6051188.39 | | 85.74 | 85.59 | RCRRJ | 375 | 9.87 | Public | Road |
| SWMN | | STORM | CP3 - CP14 | Jun-16 | 50 | 359797.32 | 933479.74 | 1719461.15 | 6051198.18 | | 86.12 | 86.12 | RCRRJ | 375 | 1.2 | Public | Road |
| SWC | | JUNCT-Y | LOT 5A-21 - CONNECTION TO CP14 | Jun-16 | 50 | 359798.07 | 933480.20 | 1719461.91 | 6051198.63 | 86.16 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-21 - CONNECTION LINE | Jun-16 | 50 | | | | | | 86.99 | 86.16 | uPVC | 100 | 9.36 | Private | Grass |
| SWC | | ENDPT | LOT 5A-21- CONNECTION END | Jun-16 | 50 | 359798.84 | 933489.53 | 1719462.84 | 6051207.94 | 86.99 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-22 - CONNECTION TO CP14 | Jun-16 | 50 | 359798.13 | 933480.22 | 1719461.97 | 6051198.65 | 86.16 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-22 - CONNECTION LINE | Jun-16 | 50 | | | | | | 87.03 | 86.16 | uPVC | 100 | 20.83 | Private | Grass |
| SWND | | BEND | BEND IN LOT 5A-22 CONNECTION | Jul-16 | 50 | 359799.76 | 933489.11 | 1719463.76 | 6051207.51 | 86.54 | | | | | 1 | Private | Grass |
| SWC | | ENDPT | LOT 5A-22 - CONNECTION END | Jun-16 | 50 | 359808.39 | 933497.15 | 1719472.53 | 6051215.39 | 87.03 | | | | | 1 | Private | Grass |
| SWCP | CP14 | CP | CP14 - DOUBLE CATCH PIT WITH CP3 | Jun-16 | 50 | 359798.12 | 933480.00 | 1719461.96 | 6051198.43 | 86.99 | | | RC | 675 x 450 | 1 | Public | Road |
| SWCP | CP3 | CP | CP3 - DOUBLE CATCH PIT WITH CP14 | Jun-16 | 50 | 359797.01 | 933479.65 | 1719460.84 | 6051198.10 | 86.99 | | | RC | 675 x 450 | 1 | Public | Road |
| SWC | | JUNCT-Y | LOT 5A-2 - CONNECTION TO LINE | Jun-16 | 50 | 359772.33 | 933503.91 | 1719436.60 | 6051222.80 | 86.15 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-2 - CONNECTION LINE | Jun-16 | 50 | | | | | | 87.97 | 86.15 | uPVC | 100 | 16.78 | Private | Grass |
| SWC | | ENDPT | LOT 5A-2 - CONNECTION END | Jun-16 | 50 | 359759.19 | 933493.47 | 1719423.28 | 6051212.60 | 87.97 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-20 - CONNECTION TO LINE | Jun-16 | 50 | 359766.20 | 933511.63 | 1719430.61 | 6051230.62 | 86.49 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-20 - CONNECTION LINE | Jun-16 | 50 | | | | | | 88.35 | 86.49 | uPVC | 100 | 4.18 | Private | Grass |
| SWC | | ENDPT | LOT 5A-20 - CONNECTION END | Jun-16 | 50 | 359769.47 | 933514.23 | 1719433.93 | 6051233.16 | 88.35 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-19 - CONNECTION TO SWMH J2 | Jun-16 | 50 | 359756.24 | 933524.90 | 1719420.90 | 6051244.07 | 89.14 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-19 - CONNECTION LINE | Jun-16 | 50 | | | | | | 89.56 | 89.14 | | | 4.46 | Private | Grass |
| SWC | | ENDPT | LOT 5A-19 - CONNECTION END | Jun-16 | 50 | 359758.06 | 933528.97 | 1719422.78 | 6051248.11 | 89.56 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-3 - CONNECTION TO CP16 | Jun-16 | 50 | 359747.27 | 933518.49 | 1719411.81 | 6051237.82 | 89.06 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-3 - CONNECTION LINE | Jun-16 | 50 | | | | | | 89.60 | 89.06 | uPVC | 100 | 5.37 | Private | Grass |
| SWC | | ENDPT | LOT 5A-3 - CONNECTION END | Jun-16 | 50 | 359742.78 | 933515.56 | 1719407.27 | 6051234.97 | 89.60 | | | | | 1 | Private | Grass |
| SWCP | CP16 | CP | CP16 - DOUBLE CATCH PIT WITH CP4 | Jun-16 | 50 | 359747.52 | 933518.65 | 1719412.07 | 6051237.98 | 89.79 | | | RC | 675 x 450 | 1 | Public | Road |
| SWMN | | STORM | CP16 - CP4 | Jun-16 | 50 | | | | | | 88.95 | 88.95 | RCRRJ | 375 | 0.5 | Public | Road |
| SWCP | CP4 | CP | CP4 - DOUBLE CATCH PIT WITH CP16 | Jun-16 | 50 | 359746.90 | 933519.58 | 1719411.47 | 6051238.91 | 89.82 | | | RC | 675 x 450 | 1 | Public | Road |
| SWMN | | | CP4 - CP5 | Jun-16 | 50 | | | | | | 88.69 | 88.66 | RCRRJ | 375 | 6.39 | Public | Road |
| SWCP | CP5 | CP | CP5 | Jun-16 | 50 | 359752.64 | 933523.11 | 1719417.26 | 6051242.35 | 89.82 | | | RC | 675 x 450 | 1 | Public | Road |
| SWMN | | STORM | CP5 - SWMH J2 | Jun-16 | 50 | 359752.80 | 933523.22 | 1719417.43 | 6051242.45 | | 88.59 | 88.50 | RCRRJ | 375 | 2.92 | Public | Road |
| SWC | | JUNCT-Y | LOT 5A-4 - CONNECTION TO LINE | Jun-16 | 50 | 359749.46 | 933536.47 | 1719414.32 | 6051255.76 | 87.39 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-4 - CONNECTION LINE | Jun-16 | 50 | | | | | | 89.39 | 87.37 | uPVC | 100 | 17.03 | Private | Road |
| SWC | | ENDPT | LOT 5A-4 - CONNECTION END | Jun-16 | 50 | 359734.51 | 933528.32 | 1719399.23 | 6051247.88 | 89.37 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-18 - CONNECTION TO LINE | Jun-16 | 50 | 359744.33 | 933545.88 | 1719409.37 | 6051265.26 | 87.52 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-18 - CONNECTION LINE | Jun-16 | 50 | | | | | | 89.76 | 87.52 | uPVC | 100 | 4.19 | Private | Grass |
| SWC | | ENDPT | LOT 5A-18 - CONNECTION END | Jun-16 | 50 | 359748.01 | 933547.89 | 1719413.08 | 6051267.20 | 89.76 | | | | | 1 | Private | Grass |
| SWC | | JUNCT-Y | LOT 5A-5 - CONNECTION TO LINE | Jun-16 | 50 | 359737.21 | 933558.96 | 1719402.48 | 6051278.46 | 87.71 | | | | | 1 | Public | Road |
| SWC | | STORM | LOT 5A-5 - CONNECTION LINE | Jun-16 | 50 | | | | | | 89.67 | 87.71 | uPVC | 100 | 17.06 | Private | Road |

SCALE:

DATE: JUNE 2016

| No. | Revision | Init. | Date. |
|---|---|---|---|
| A | ISSUED FOR INFORMATION | GCC | 06/16 |
| B | SW CONNECTIONS LOT 10,11 AMENDED | GCC | 07/16 |
| C | RE-ISSUED FOR INFORMATION | LAR | 01/08/16 |

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2 ENGINEERING\DRAWINGS\11008-5A-500-ASBUILTS.DWG

STAGE 5A ASBUILT PLANS
STORMWATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

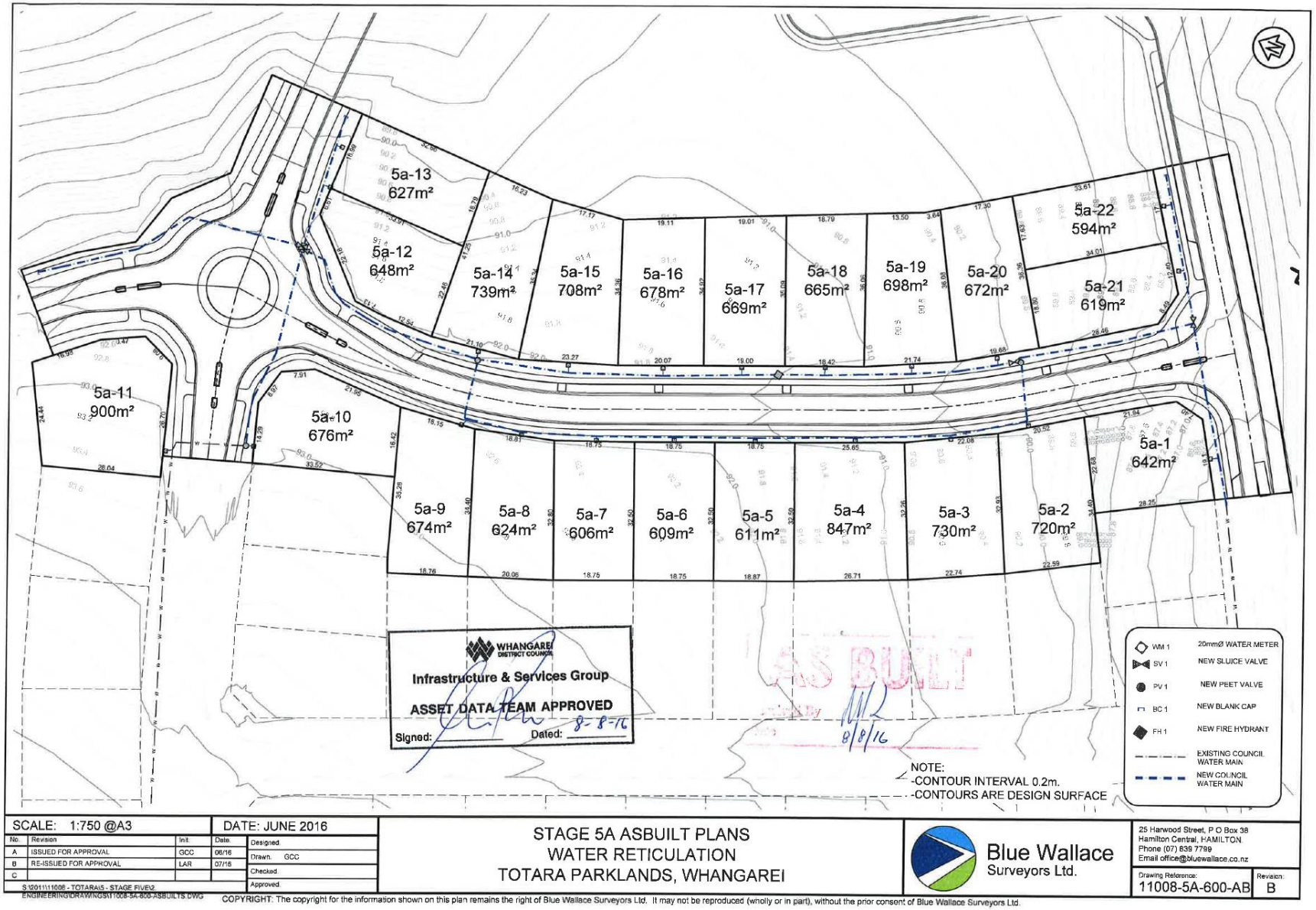
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

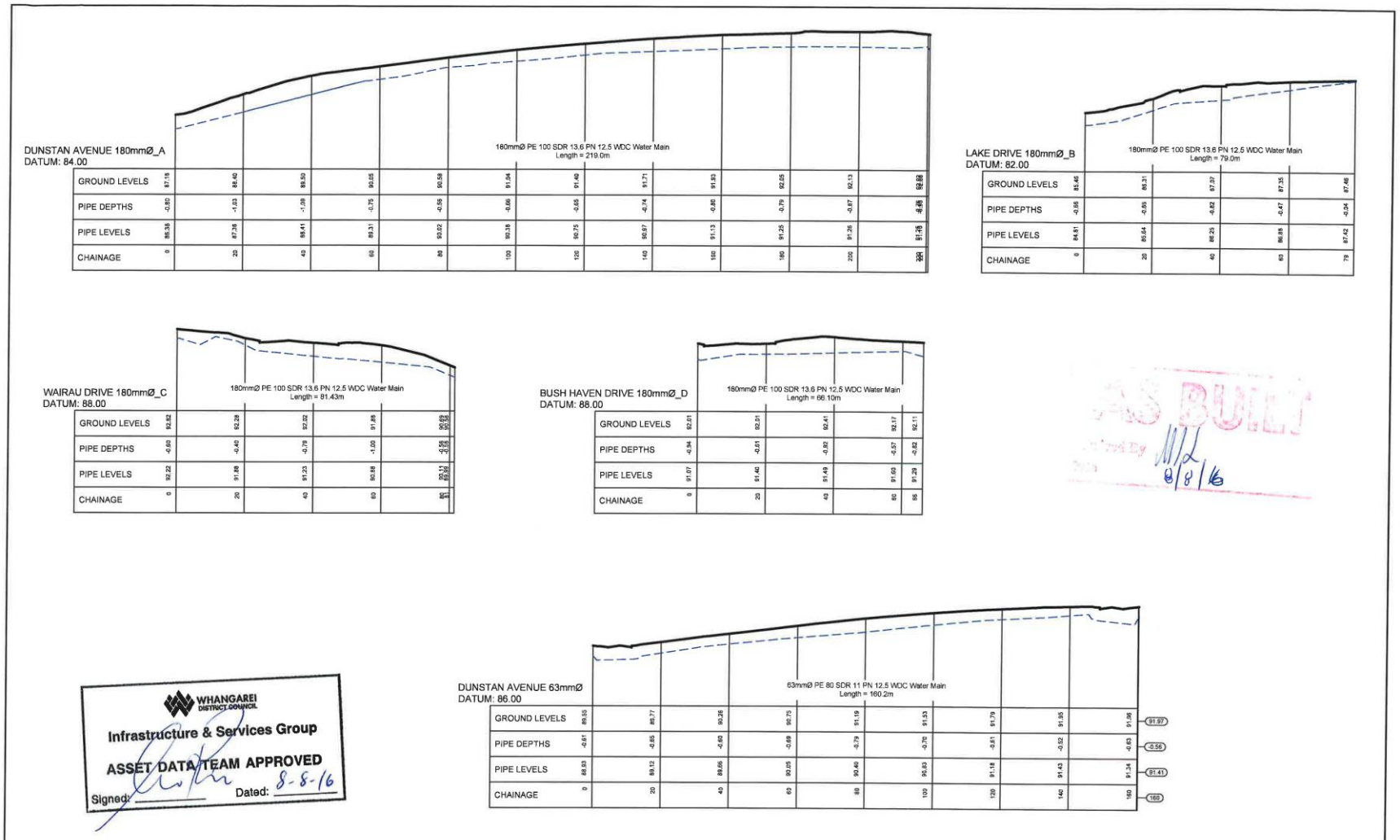
Drawing Reference: 11008-5A-506-AB

Revision: C

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*Water Reticulation As-Built examples*


5a-13
627m²
5a-12
648m²
5a-14
739m²
5a-15
708m²
5a-16
678m²
5a-17
669m²
5a-18
665m²
5a-19
698m²
5a-20
672m²
5a-22
594m²
5a-21
619m²
5a-11
900m²
5a-10
676m²
5a-1
642m²
5a-9
674m²
5a-8
624m²
5a-7
606m²
5a-6
609m²
5a-5
611m²
5a-4
847m²
5a-3
730m²
5a-2
720m²
WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed:
Dated: 8-8-16
AS BUILT
8/8/16
NOTE:
-CONTOUR INTERVAL 0.2m.
-CONTOURS ARE DESIGN SURFACE
WM 1 20mmØ WATER METER
SV 1 NEW SLUICE VALVE
PV 1 NEW PEET VALVE
BC 1 NEW BLANK CAP
FH 1 NEW FIRE HYDRANT
EXISTING COUNCIL WATER MAIN
NEW COUNCIL WATER MAIN
SCALE: 1:750 @A3
DATE: JUNE 2016
No. Revision Init Date
A ISSUED FOR APPROVAL GCC 06/16
B RE-ISSUED FOR APPROVAL LAR 07/16
C
Designed.
Drawn. GCC
Checked.
Approved.
S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-600-ASBUILTS.DWG
STAGE 5A ASBUILT PLANS
WATER RETICULATION
TOTARA PARKLANDS, WHANGAREI
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON
Phone (07) 839 7799
Email office@bluewallace.co.nz
Drawing Reference: 11008-5A-600-AB
Revision: B
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WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-6-16

| CODE | XREF | UNIT TYPE | DESCRIPTION | INSTALL DATE | EXP LIFE | Mt Eden Circuit 2000 X Co-Ord (Easting) | Mt Eden Circuit 2000 Y Co-Ord (Northing) | NZTM Proj X Co-Ord (Easting) | NZTM Proj Y Co-Ord (Northing) | Z Co-Ord (Elevation) | Material | Size | Quantity | Public/ Private | Surface |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage 5A Water Reticulation | | | | | | | | | | | | | | | |
| WW | W1 | WATER | WELD 1 | Jun-16 | 50 | 359759.49 | 933454.86 | 1719422.89 | 6051173.99 | 84.75 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 1 TAPPING BAND | Jun-16 | 15 | 359767.54 | 933461.07 | 1719431.04 | 6051180.06 | 85.07 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP1 | DOMESTIC | LOT 1 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359766.53 | 933462.59 | 1719430.06 | 6051181.59 | 85.80 | | 20 | 1 | PUBLIC | GRASS |
| WW | W2 | WATER | WELD 2 | Jun-16 | 50 | 359792.45 | 933480.85 | 1719456.30 | 6051199.38 | 86.29 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SV | SV1 | SLUICE | SLUICE VALVE 1 | Jun-16 | 50 | 359793.02 | 933481.19 | 1719456.88 | 6051199.71 | 86.76 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | T1 | JUNCT - T | TEE1 180/180 | Jun-16 | 50 | 359792.79 | 933481.05 | 1719456.65 | 6051199.58 | 86.35 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 21 TAPPING BAND | Jun-16 | 15 | 359802.77 | 933488.89 | 1719466.76 | 6051207.24 | 86.77 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP21 | DOMESTIC | LOT 21 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359802.05 | 933489.86 | 1719466.06 | 6051208.22 | 87.34 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 22 TAPPING BAND | Jun-16 | 15 | 359815.13 | 933498.71 | 1719479.30 | 6051216.83 | 87.22 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP22 | DOMESTIC | LOT 22 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359813.97 | 933500.11 | 1719478.16 | 6051218.25 | 87.54 | | 20 | 1 | PUBLIC | GRASS |
| WND | BC1 | END - PT | BLANK CAP 180 | Jun-16 | 50 | 359820.76 | 933503.19 | 1719485.00 | 6051221.21 | 87.20 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SV | SV2 | SLUICE | SLUICE VALVE 2 | Jun-16 | 50 | 359792.56 | 933481.30 | 1719456.42 | 6051199.83 | 86.64 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | T2 | JUNCT - T | TEE2 180/63 | Jun-16 | 50 | 359766.77 | 933513.16 | 1719431.21 | 6051232.14 | 88.78 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WW | W4 | WATER | WELD4 | Jun-16 | 50 | 359792.35 | 933481.56 | 1719456.21 | 6051200.09 | 86.38 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| PV | PV1 | PEET | PEET VALVE 1 | Jun-16 | 50 | 359765.80 | 933512.46 | 1719430.23 | 6051231.46 | 88.93 | PE 80 | 63 | 1 | PUBLIC | GRASS |
| SV | SV3 | SLUICE | SLUICE VALVE 3 | Jun-16 | 50 | 359765.13 | 933513.96 | 1719429.58 | 6051232.97 | 89.11 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WW | W4 | WATER | WELD 4 | Jun-16 | 50 | 359764.95 | 933514.17 | 1719429.41 | 6051233.19 | 88.83 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WW | W5 | WATER | WELD 5 | Jun-16 | 50 | 359764.97 | 933511.85 | 1719429.39 | 6051230.87 | 88.69 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP2 | DOMESTIC | LOT 2 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359753.52 | 933503.94 | 1719417.80 | 6051223.16 | 89.22 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 2 TAPPING BAND | Jun-16 | 15 | 359753.95 | 933505.16 | 1719418.25 | 6051224.38 | 88.94 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 3 TAPPING BAND | Jun-16 | 15 | 359742.92 | 933519.07 | 1719407.47 | 6051238.48 | 89.49 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP3 | DOMESTIC | LOT 3 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359742.19 | 933518.60 | 1719406.74 | 6051238.02 | 89.79 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 4 TAPPING BAND | Jun-16 | 15 | 359732.06 | 933538.58 | 1719396.97 | 6051258.18 | 89.96 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP4 | DOMESTIC | LOT 4 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359731.45 | 933538.28 | 1719396.35 | 6051257.89 | 90.23 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 5 TAPPING BAND | Jun-16 | 15 | 359721.09 | 933559.23 | 1719386.37 | 6051279.02 | 90.35 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP5 | DOMESTIC | LOT 5 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359720.47 | 933558.94 | 1719385.75 | 6051278.74 | 90.75 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 6 TAPPING BAND | Jun-16 | 15 | 359712.53 | 933576.15 | 1719378.12 | 6051296.09 | 90.77 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP6 | DOMESTIC | LOT 6 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359711.85 | 933575.83 | 1719377.43 | 6051295.78 | 91.05 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 7 TAPPING BAND | Jun-16 | 15 | 359704.27 | 933592.36 | 1719370.15 | 6051312.44 | 91.13 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP7 | DOMESTIC | LOT 7 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359703.41 | 933591.93 | 1719369.28 | 6051312.03 | 91.40 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 8 TAPPING BAND | Jun-16 | 15 | 359696.99 | 933608.34 | 1719363.16 | 6051328.55 | 91.31 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP8 | DOMESTIC | LOT 8 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359696.46 | 933608.03 | 1719362.62 | 6051328.25 | 91.55 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 9 TAPPING BAND | Jun-16 | 15 | 359693.95 | 933620.90 | 1719360.35 | 6051341.16 | 91.51 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP9 | DOMESTIC | LOT 9 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359692.06 | 933621.64 | 1719358.47 | 6051341.93 | 91.74 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 20 TAPPING BAND | Jun-16 | 15 | 359762.72 | 933517.03 | 1719427.23 | 6051236.09 | 89.10 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP20 | DOMESTIC | LOT 20 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359764.06 | 933517.89 | 1719428.59 | 6051236.92 | 89.55 | | 20 | 1 | PUBLIC | GRASS |
| WW | W6 | WATER | WELD 6 | Jun-16 | 50 | 359757.75 | 933523.77 | 1719422.38 | 6051242.91 | 89.20 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WW | W7 | WATER | WELD 7 | Jun-16 | 50 | 359751.57 | 933533.85 | 1719416.39 | 6051253.10 | 89.50 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 19 TAPPING BAND | Jun-16 | 15 | 359751.42 | 933534.02 | 1719416.24 | 6051253.27 | 89.65 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP19 | DOMESTIC | LOT 19 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359753.06 | 933534.80 | 1719417.89 | 6051254.02 | 90.26 | | 20 | 1 | PUBLIC | GRASS |
| WW | W8 | WATER | WELD 8 | Jun-16 | 50 | 359745.78 | 933544.32 | 1719410.79 | 6051263.67 | 90.00 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 18 TAPPING BAND | Jun-16 | 15 | 359741.65 | 933551.86 | 1719406.79 | 6051271.28 | 90.26 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP18 | DOMESTIC | LOT 18 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359743.39 | 933552.55 | 1719408.54 | 6051271.94 | 90.84 | | 20 | 1 | PUBLIC | GRASS |
| WW | W9 | WATER | WELD 9 | Jun-16 | 50 | 359740.08 | 933555.06 | 1719405.28 | 6051274.51 | 90.25 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| FH | FH1 | TALL | FIRE HYDRANT 1 | Jun-16 | 50 | 359736.73 | 933561.40 | 1719402.05 | 6051280.91 | 90.92 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 17 TAPPING BAND | Jun-16 | 15 | 359732.67 | 933569.08 | 1719398.12 | 6051288.66 | 90.62 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP17 | DOMESTIC | LOT 17 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359734.27 | 933569.83 | 1719399.74 | 6051289.38 | 90.99 | | 20 | 1 | PUBLIC | GRASS |
| WND | | JUNCT - T | LOT 16 TAPPING BAND | Jun-16 | 15 | 359723.99 | 933585.32 | 1719389.74 | 6051305.05 | 90.87 | PE 100 | 180 | 1 | PUBLIC | GRASS |
| SCTP | SCTP16 | DOMESTIC | LOT 16 SERVICE CONNECTION TERMINATION POINT | Jun-16 | 15 | 359725.60 | 933586.06 | 1719391.36 | 6051305.76 | 91.39 | | 20 | 1 | PUBLIC | GRASS |

AS BUILT 8/6/16

SCALE:

DATE: JUNE 2016

| No. | Revision | Init. | Date. |
|---|---|---|---|
| A | ISSUED FOR APPROVAL | GCC | 06/16 |
| B | RE-ISSUED FOR APPROVAL | LAR | 07/16 |
| C | | | |

Designed.
Drawn. GCC
Checked.
Approved.

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-600-ASBUILTS.DWG

STAGE 5A ASBUILT PLANS
WATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-605-AB
Revision: B

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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 Donwstream | 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 desposited 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 eater level |
| | Overflow Level | Yes | RL of point at which overflow into the secondary flow path begins |
| | Comments | | Any pertinent comments such as covered by easement over xxx property title |

## Wastewater

| Asset Component Type | Asset Attribute Required | Show on plans | Description of Asset Attribute |
|---|---|---|---|
| Wastewater Pipeline | Plan ID | Yes | Plan number used to identify as-built plan |
| | Upstream MH ID | Yes | Use ‘pipe-end ID’ if pipeline is simply blanked-off |
| | Downstream MH ID | Yes | |
| | Street Name | Yes | If street name is not applicable use a property deposited plan (DP) number |
| | Street Type | Yes | Qualifier to street name e.g. Crescent, Road, Lane, etc |
| | Physical Location | | Private property, roadway, berm, reserve, adjoining street |
| | Pipe Diameter | Yes | Nominal bore |
| | Pipe Length | Yes | Length from upstream MH to downstream MH |
| | Pipe Material | Yes | Material and strength classification e.g. uPVC SN16 |
| | Joint Type | | e.g. RRJ |
| | Invert Level Upstream | Yes | Pipe invert level |
| | Invert Level Downstream | Yes | Pipe invert level |
| | Service Status | Yes | Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank |
| | Install Date | | Installation date |
| | Comments | | Any pertinent comments (particularly water table depth and soil conditions) |
| Wastewater service connection | Plan ID | Yes | Plan number used to identify as-built plan |
| | Upstream MH ID | Yes | Use pipe-end ID if pipeline is simply blanked-off |
| | Downstream MH ID | Yes | |

| 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/Eddress 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.<br><br>at the service valve or toby |
| | Northern Coordinate | | Coordinate of customer end of service pipeline i.e.<br><br>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<br>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** |
| **Site Suitability** | | | |
| Earthworks/Compaction design | | | |
| Land Instability areas | | | |
| Coastal Hazards, Mine zones, Flood zones | | | |
| Road and Access | | | |
| **Roads and Access** | | | |
| Pavement structural design | | | |
| Geometric design | | | |
| Surfacing design | | | |
| Lighting design | | | |
| Bridges and major culverts | | | |
| Retaining walls | | | |
| **Stormwater** | | | |
| Catchment Analysis | | | |
| Overland flow paths (1%AEP) | | | |
| Stormwater treatment devices | | | |
| Stormwater attenuation structures | | | |
| **Wastewater** | | | |
| Gravity reticulation | | | |
| Sewer pump stations | | | |
| Rising mains | | | |
| On-site disposal details | | | |
| Community wastewater treatment systems | | | |
| Pipe bridges & other structure | | | |
| **Water** | | | |

| Summary of SQEP Certification | | | |
|---|---|---|---|
| **Engineering Aspect** | **Detail of works** | **Plan ref** | **SQEP initials** |
| Water booster stations | | | |
| Reservoirs | | | |
| Pipe bridges & other structures | | | |
| Hydraulic design | | | |
| Other design matters | | | |

Kaipara ki Oruawharo

KAIPARA
DISTRICT

Two Oceans Two Harbours

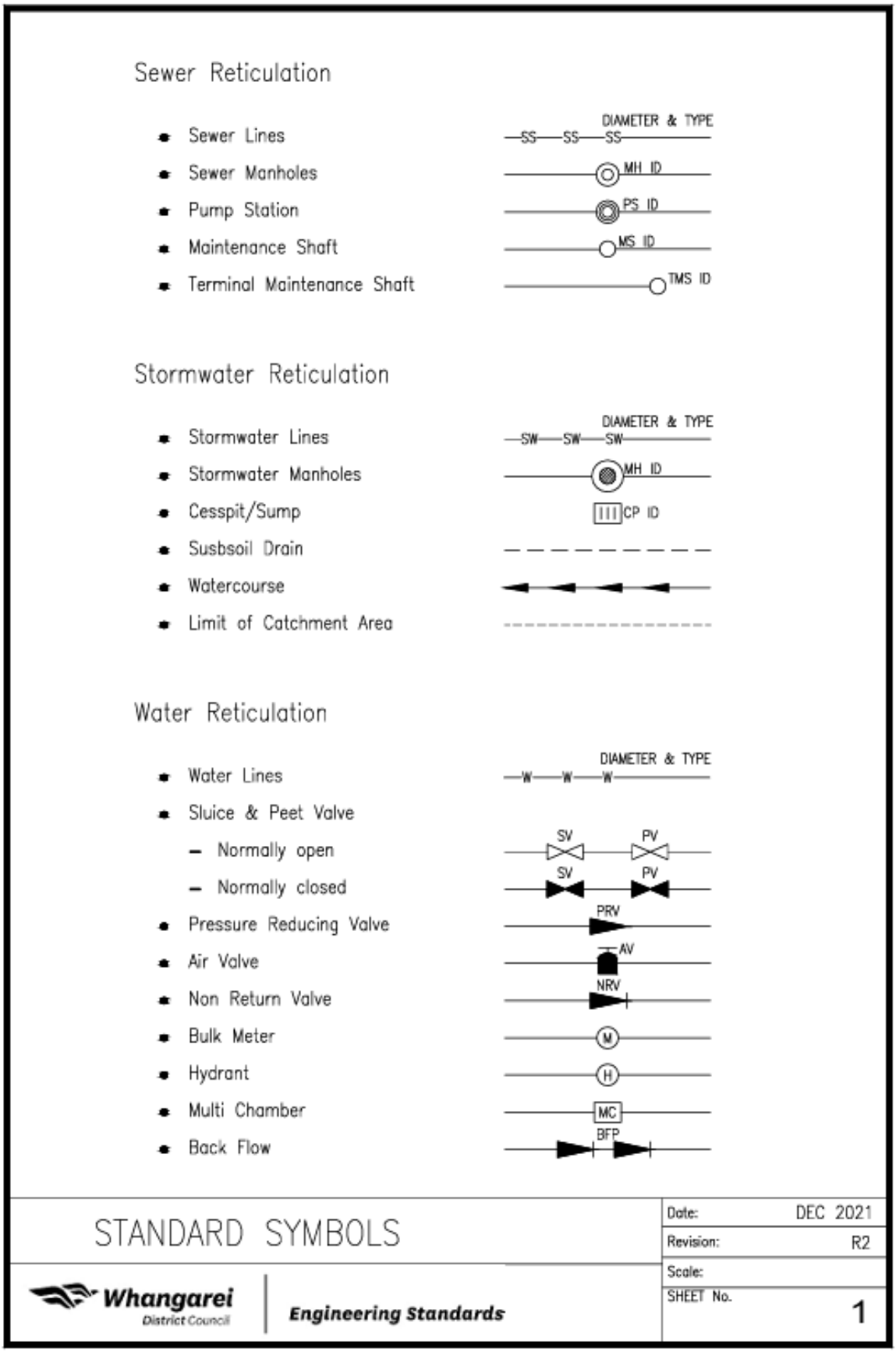
# Drawing sheets



# LIST OF SHEETS

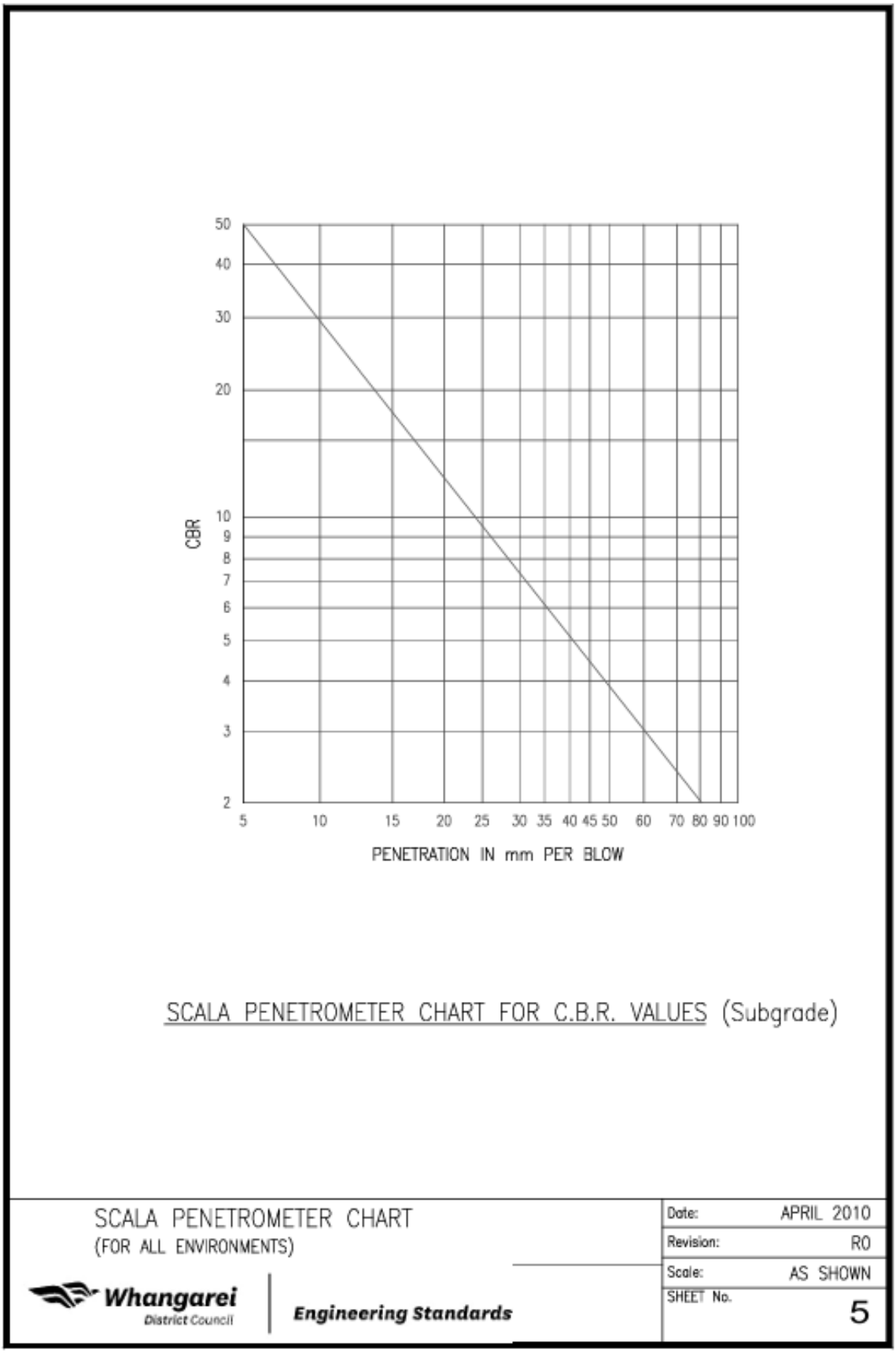

| | | |
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## Sheet 1 Standard Symbols




*Sheet 1 Sheet 1 Standard Symbols*

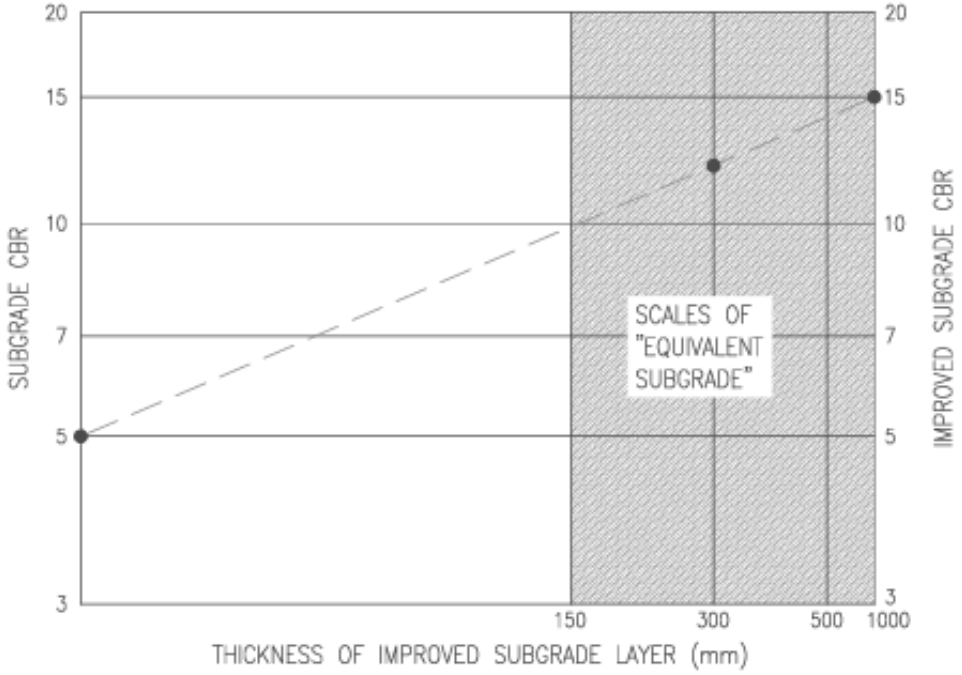
Sheet 5 Scala Penetrometer Chart




*Sheet 2 Sheet 5 Scala Penetrometer Chart*

Sheet 5A Equivalent Subgrade CBR Design Chart.

Example:
Subgrade of CBR 5 will be overlaid by 300mm layer of CBR 15 material. Using the methodology below, the equivalent CBR used to represent the two subgrade layers for the design of the pavement is a CBR of 12.




NOMOGRAPH FOR DETERMINING THE EFFECT OF SUBGRADE IMPROVEMENT LAYERS.
(GRANULAR OF STABILISED SUBGRADE IMPROVEMENT)

Methodology
To use this nomograph:
1. Plot the improved subgrade on the right hand side axis and the underlying design subgrade on the left hand side axis.
2. Join these two points for an inclined line.
3. Rule a vertical line for the desired thickness of the improved subgrade layer from the base axis.
4. Where the two lines intersect is the equivalent subgrade strength.

Note:
Also applicable where weak layers are encountered under an upper layer of stronger material within 1.0m below the design subgrade level.

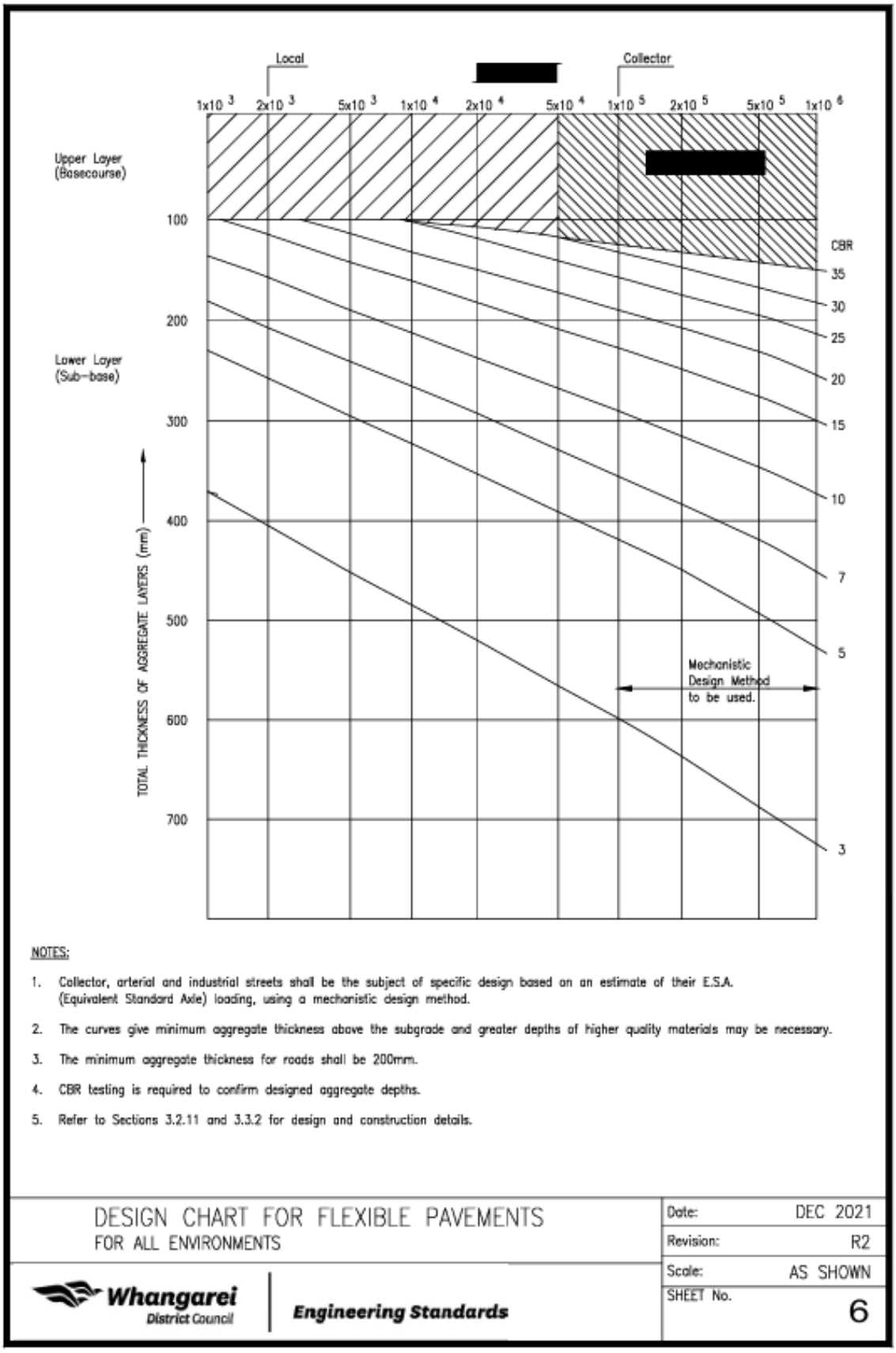
EQUIVALENT SUBGRADE CBR DESIGN CHART
(FOR ALL FNVIRONMFNTS)

Whangarei District Council | Engineering Standards

| | |
|---|---|
| Date: | MARCH 2018 |
| Revision: | R0 |
| Scale: | AS SHOWN |
| SHEET No. | 5A |

*Sheet 3 Sheet 5a Equivalent Subgrade CBR Design Chart*

## Sheet 6 Design Chart for Flexible Pavements



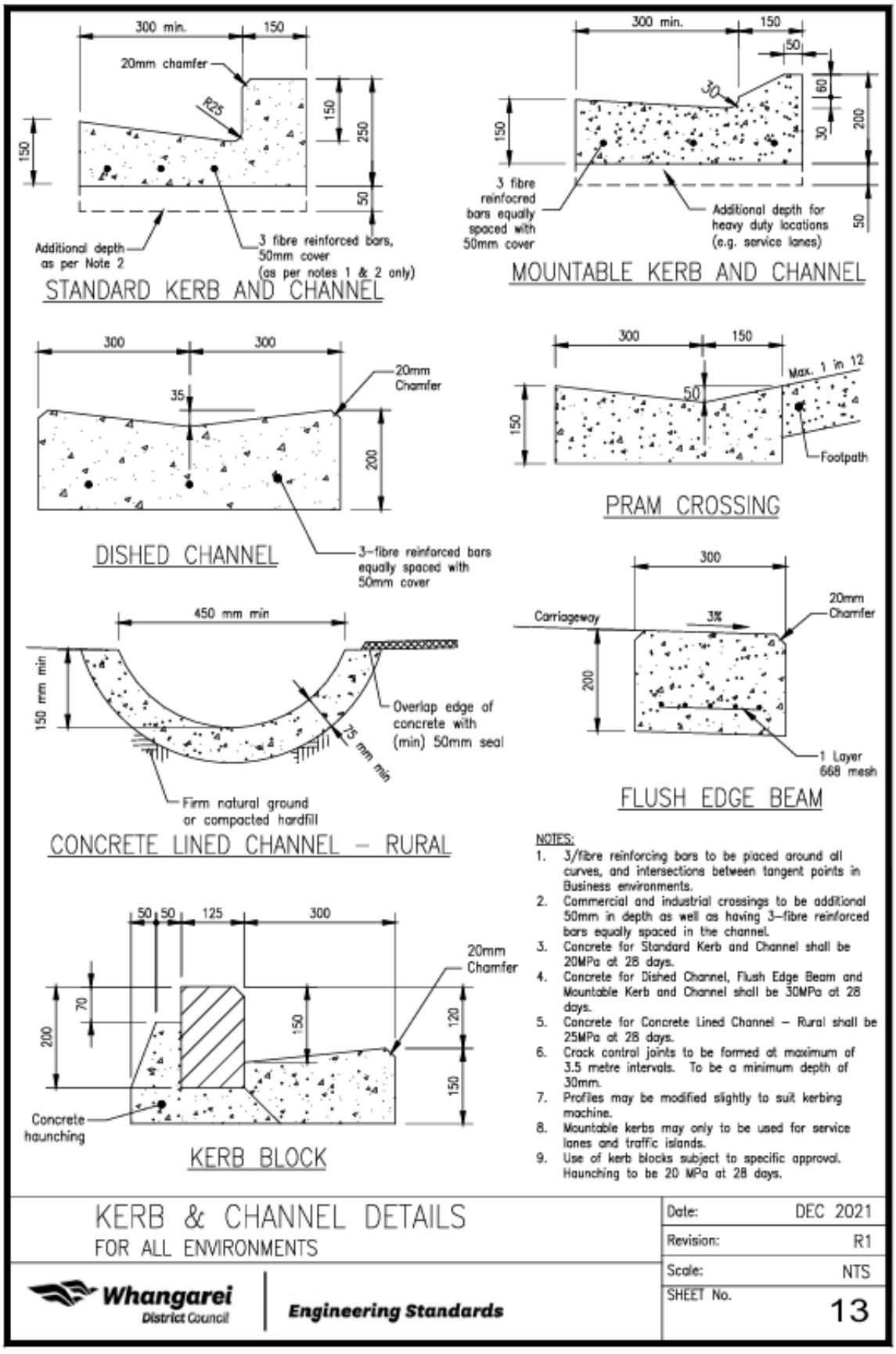

NOTES:

1. Collector, arterial and industrial streets shall be the subject of specific design based on an estimate of their E.S.A. (Equivalent Standard Axle) loading, using a mechanistic design method.
2. The curves give minimum aggregate thickness above the subgrade and greater depths of higher quality materials may be necessary.
3. The minimum aggregate thickness for roads shall be 200mm.
4. CBR testing is required to confirm designed aggregate depths.
5. Refer to Sections 3.2.11 and 3.3.2 for design and construction details.

| DESIGN CHART FOR FLEXIBLE PAVEMENTS FOR ALL ENVIRONMENTS | Date: DEC 2021 |
|---|---|
| | Revision: R2 |
| Whangarei District Council \| Engineering Standards | Scale: AS SHOWN |
| | SHEET No. 6 |

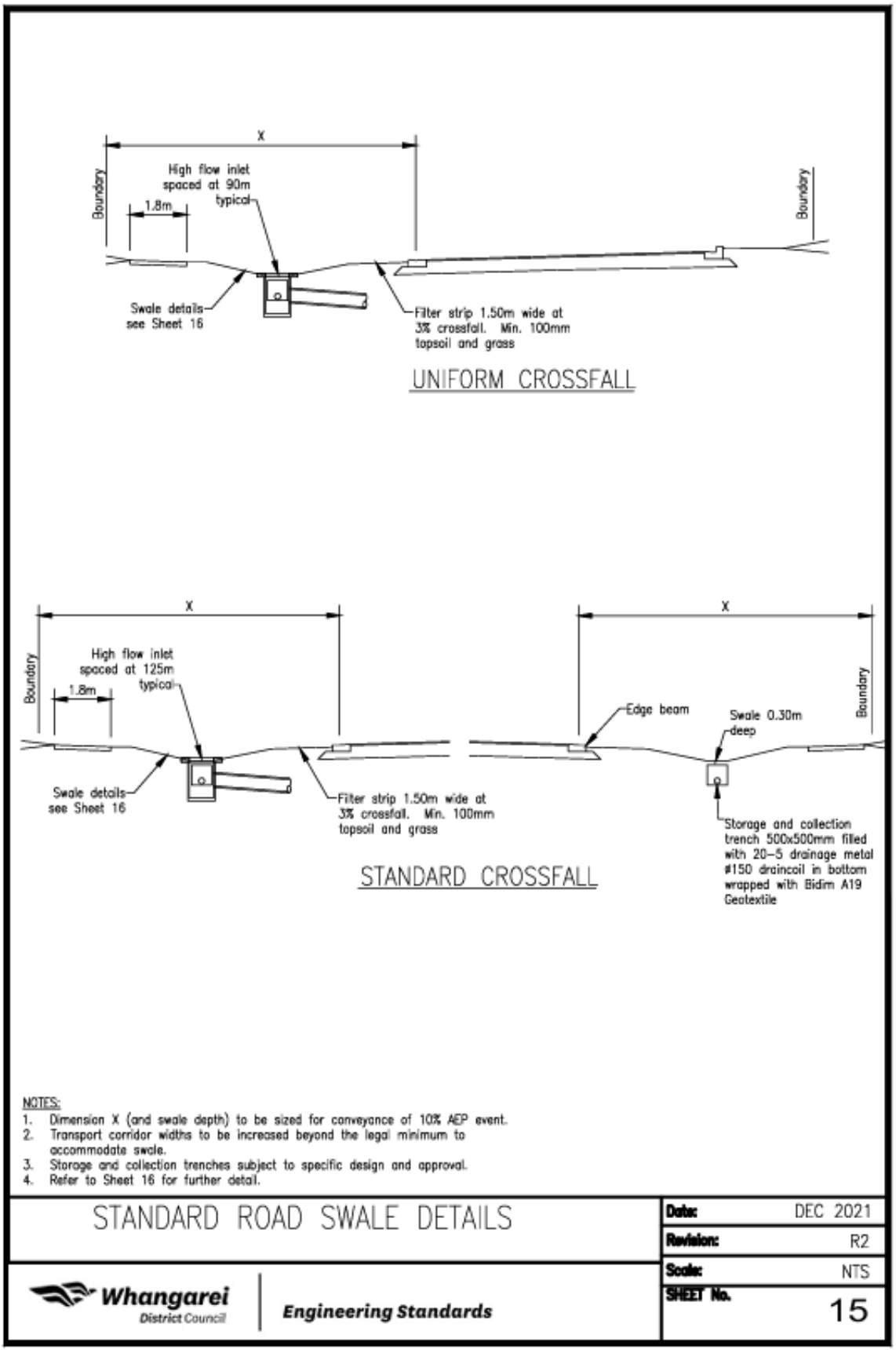
*Sheet 4 Sheet 6 Design Chart for Flexible Pavements*

## Sheet 13 Kerb & Channel Details



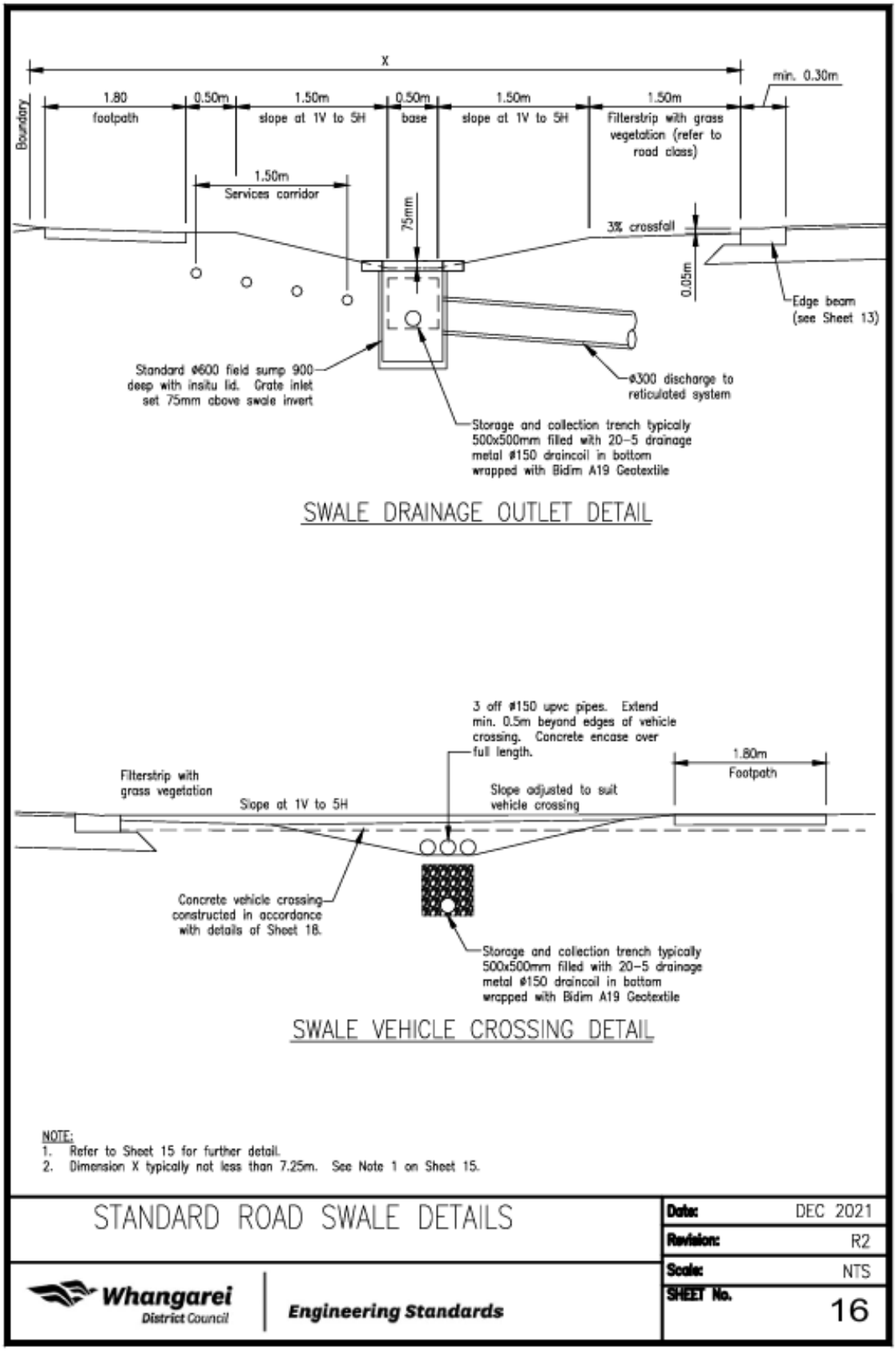

*Sheet 5 Sheet 13 Kerb & Channel Details*

## Sheet 15 Standard Road Swale Details



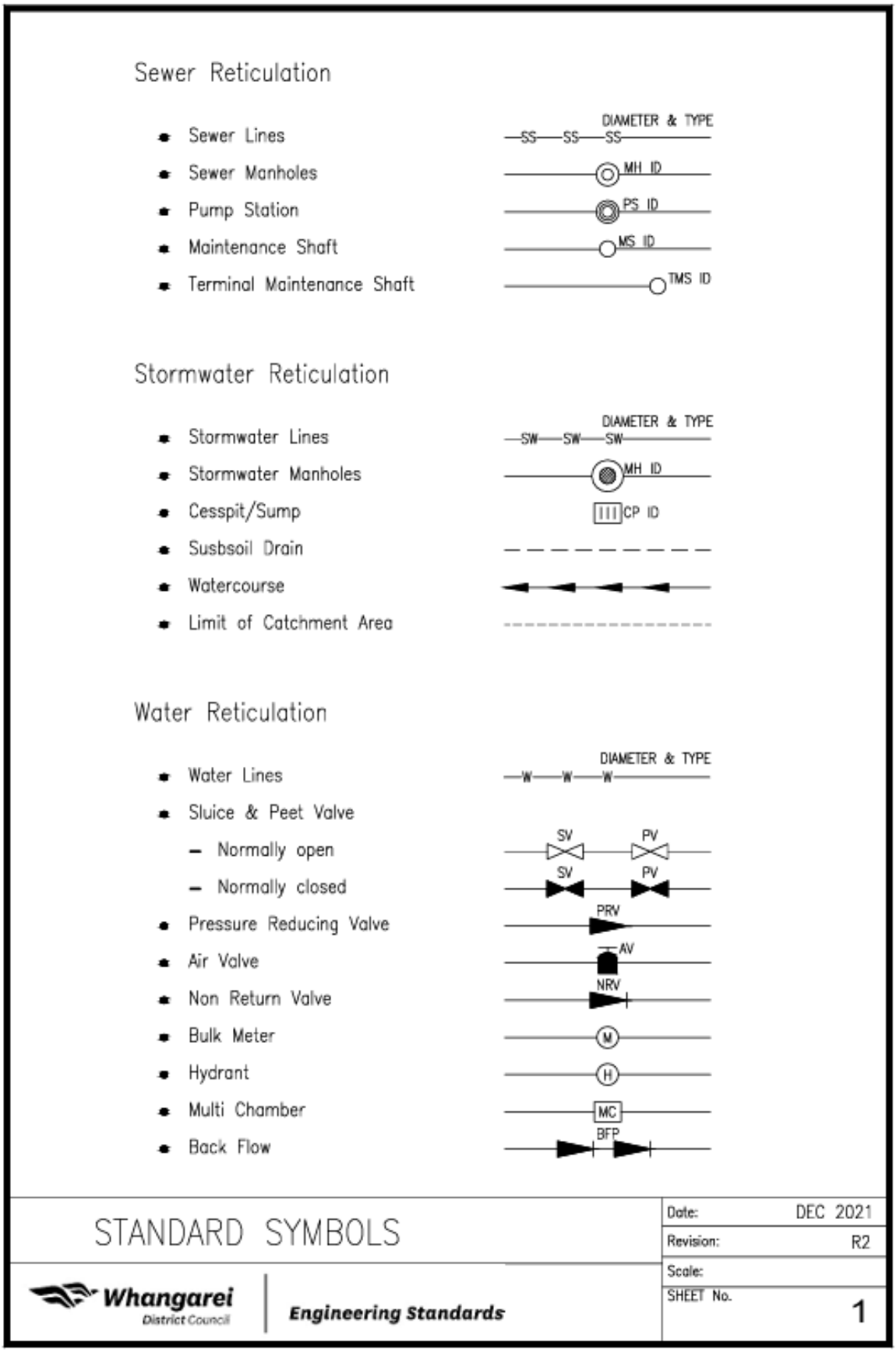

*Sheet 6 Sheet 15 Standard Road Swale Details*

## Sheet 16 Standard Road Swale Details




*Sheet 7*

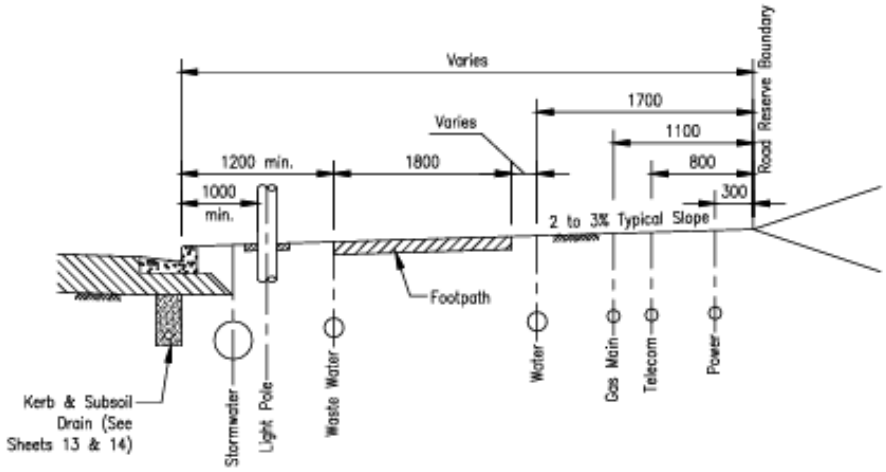
Sheet 1 Standard Symbols




.....1

*Sheet 16 Standard Road Swale Designs*

Sheet 29 Horizontal Order of Services




URBAN ROADS – ALL CLASSIFICATIONS

Notes:
1. This sheet only shows the indicative horizontal order of services, the layout and clearance of services must also meet the requirements of Sheet 30 and the ES.
2. This sheet applies to urban roads of all classifications.

| | |
|---|---|
| HORIZONTAL ORDER OF SERVICES: URBAN ROADS | Date: FEB 2022 |
| | Revision: R2 |
| Whangarei District Council \| Engineering Standards | Scale: NTS |
| | SHEET No. 29 |

*Sheet 8 Sheet 29 Horizontal Order of Services: Urban Roads*

## Sheet 30 Minimum Clearance Between Services

### MINIMUM CLEARANCE BETWEEN SERVICES

The minimum clearance between underground services shall be measured from the outside of each pipe or duct and shall be the greater of the required clearances between the relevant services as follows:

| Utility | Clearance to other Utilities Other than Watermains (mm) | Clearance to Watermains (mm) |
|---|---|---|
| Stormwater | 300 H, 150 V | |
| Wastewater | 300 H, 150 V | 1000 H, 500 V or 600 H, 750 V |
| Electricity | 500 H, 225 V | 500 H, 225 V when watermains < or = 200 mm ID<br>1000 H, 225 V when watermains > 200 mm ID |
| Telecom and Gas | 300 H, 150 V | 300 H, 150 V when watermains < or = 200 mm ID<br>600 H, 150 V when watermains > 200 mm ID |
| Watermains | As above | 600 H, 500 V when new pipeline > 375 mm ID<br>300 H, 150 V when new pipeline < 200 mm ID and existing is < 375 mm ID<br>600H, 150 V when new pipeline > 200 mm ID and existing is < 375 mm ID |

Notes:
1. Vertical clearances apply where services cross, except in the case of watermains when a vertical clearance shall always be maintained, even when the water and wastewater pipes are parallel. The watermain should always be located above the wastewater pipe to minimize the possibility of backflow contamination in the event of a main break.
2. Clearance can be reduced further to 150 mm for distances of up to 2 m when passing installations such as poles, pits and small structures, providing the structure is not destabilized in the process.
3. When a wastewater pipe is at the minimum vertical clearance below the water main (500 mm), a minimum horizontal clearance of 1000 mm shall be maintained. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.
4. Where a water main crosses other services, it shall cross at an angle as near as practicable to 90 degrees.
5. Clearance shall be measured from the outside of each pipe or duct.
6. Watermains shall always cross over wastewater and stormwater drains.
7. Alternative clearances require the WDC's specific approval and written agreement from the affected service owners.
8. All services shall have minimum cover under footpaths and berms as per relevant section in the ES.

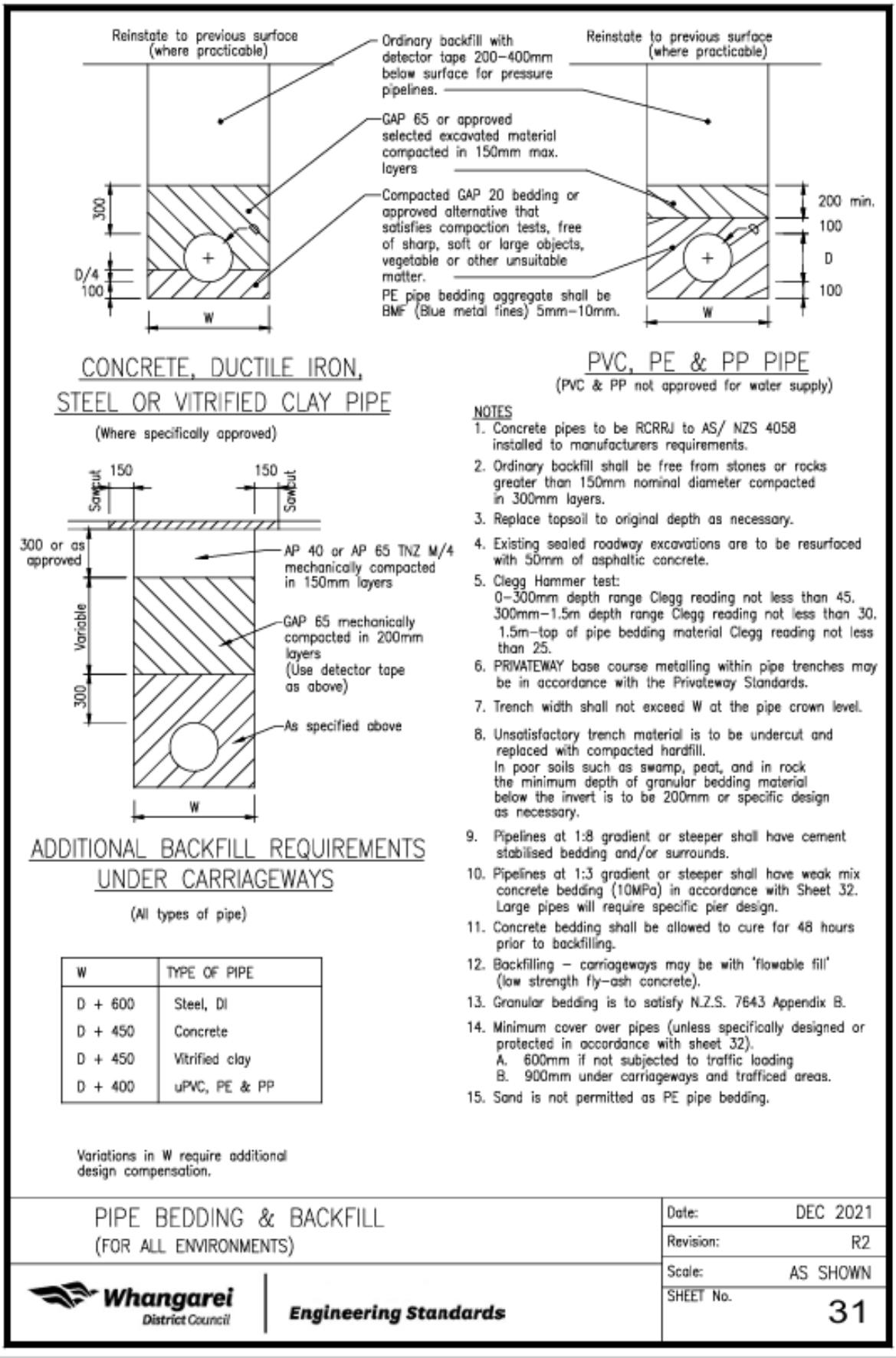
MINIMUM CLEARANCES BETWEEN SERVICES
FOR ALL ENVIRONMENTS

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|---|---|
| Date: | FEB 2022 |
| Revision: | R2 |
| Scale: | NTS |
| SHEET No. | 30 |

Whangarei District Council | Engineering Standards

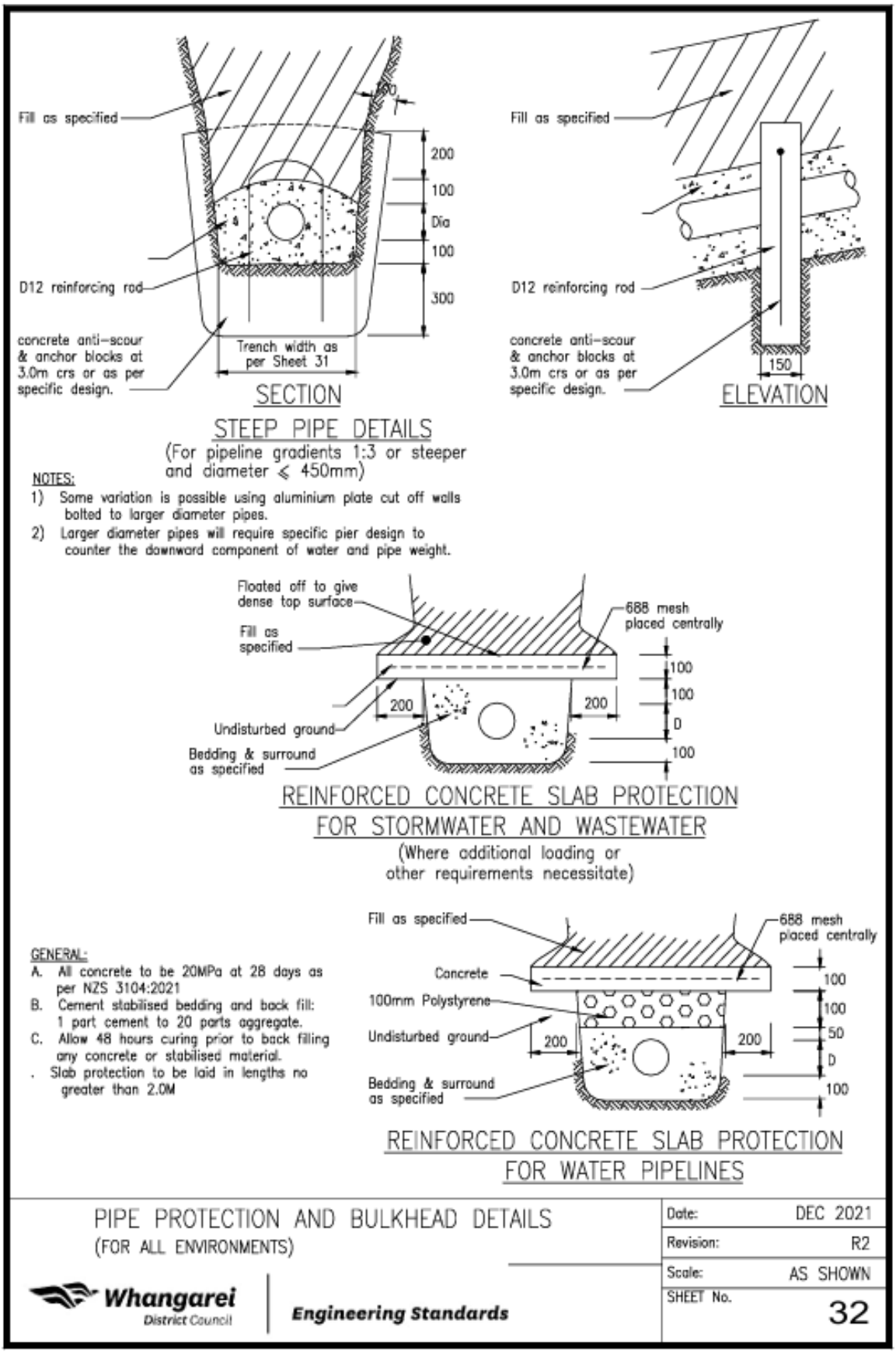
*Sheet 9 Sheet 30 Minimum Clearances Between Services*

## Sheet 31 Pipe Bedding and Backfill



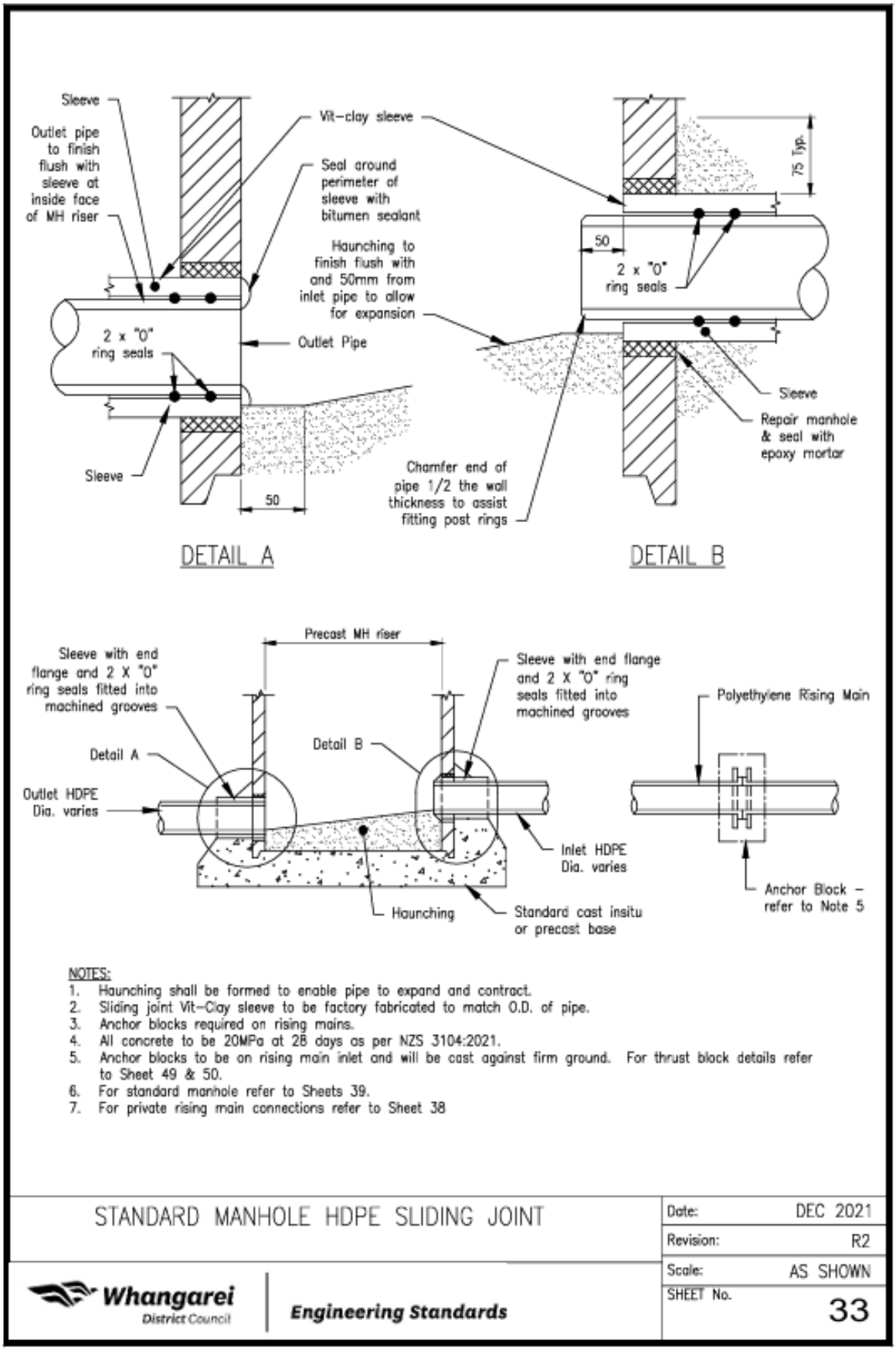

*Sheet 10 Sheet 31 Pipe Bedding & Backfill*

## Sheet 32 Pipe Protection and Bulkhead Details




*Sheet 11 Sheet 32 Pipe Protection and Bulkhead Details*

## Sheet 33 PE Pipe Connections to Manhole

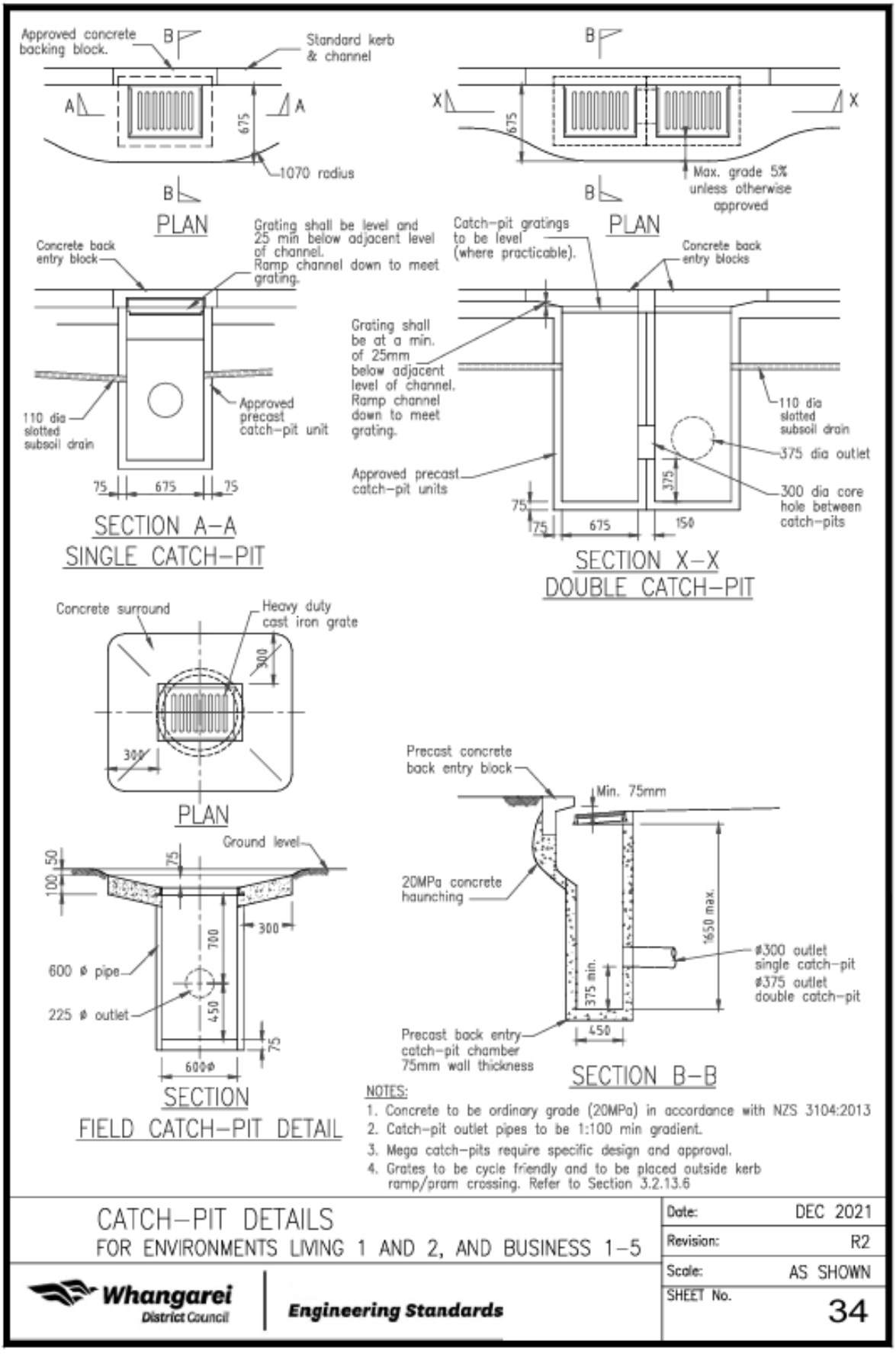



NOTES:
1. Haunching shall be formed to enable pipe to expand and contract.
2. Sliding joint Vit-Clay sleeve to be factory fabricated to match O.D. of pipe.
3. Anchor blocks required on rising mains.
4. All concrete to be 20MPa at 28 days as per NZS 3104:2021.
5. Anchor blocks to be on rising main inlet and will be cast against firm ground. For thrust block details refer to Sheet 49 & 50.
6. For standard manhole refer to Sheets 39.
7. For private rising main connections refer to Sheet 38

| STANDARD MANHOLE HDPE SLIDING JOINT | Date: DEC 2021 |
|---|---|
| | Revision: R2 |
| Whangarei District Council \| Engineering Standards | Scale: AS SHOWN |
| | SHEET No. 33 |

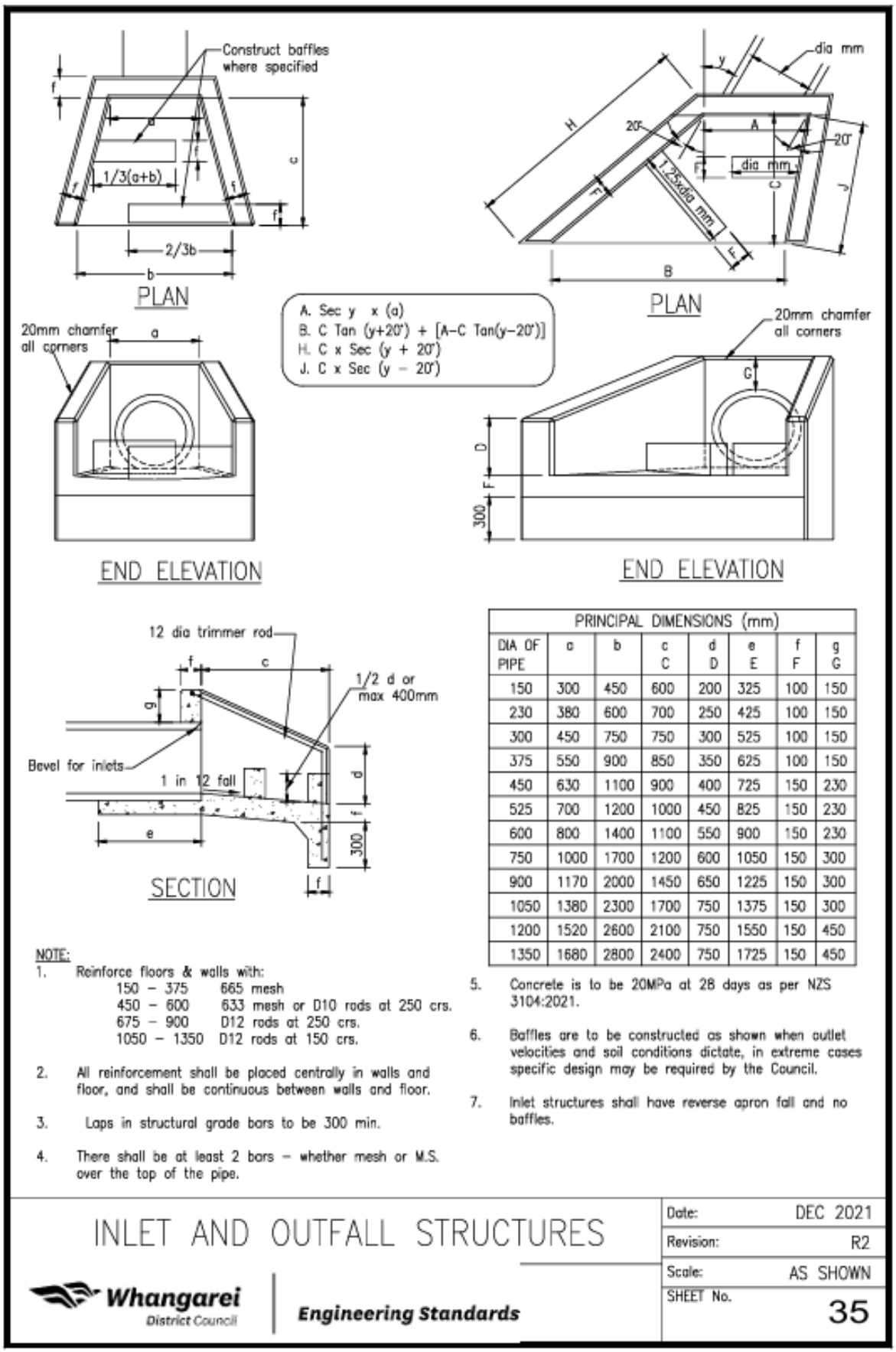
*Sheet 12 Sheet 33 Pipe Connections to Manhole*

## Sheet 34 Catch-Pit Details




*Sheet 13 Sheet 34 Catch-Pit Details*

## Sheet 35 Inlet and Outlet Structures




| PRINCIPAL DIMENSIONS (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| DIA OF PIPE | a | b | c C | d D | e E | f F | g G |
| 150 | 300 | 450 | 600 | 200 | 325 | 100 | 150 |
| 230 | 380 | 600 | 700 | 250 | 425 | 100 | 150 |
| 300 | 450 | 750 | 750 | 300 | 525 | 100 | 150 |
| 375 | 550 | 900 | 850 | 350 | 625 | 100 | 150 |
| 450 | 630 | 1100 | 900 | 400 | 725 | 150 | 230 |
| 525 | 700 | 1200 | 1000 | 450 | 825 | 150 | 230 |
| 600 | 800 | 1400 | 1100 | 550 | 900 | 150 | 230 |
| 750 | 1000 | 1700 | 1200 | 600 | 1050 | 150 | 300 |
| 900 | 1170 | 2000 | 1450 | 650 | 1225 | 150 | 300 |
| 1050 | 1380 | 2300 | 1700 | 750 | 1375 | 150 | 300 |
| 1200 | 1520 | 2600 | 2100 | 750 | 1550 | 150 | 450 |
| 1350 | 1680 | 2800 | 2400 | 750 | 1725 | 150 | 450 |

NOTE:

1. Reinforce floors & walls with:
   150 – 375 665 mesh
   450 – 600 633 mesh or D10 rods at 250 crs.
   675 – 900 D12 rods at 250 crs.
   1050 – 1350 D12 rods at 150 crs.
2. All reinforcement shall be placed centrally in walls and floor, and shall be continuous between walls and floor.
3. Laps in structural grade bars to be 300 min.
4. There shall be at least 2 bars – whether mesh or M.S. over the top of the pipe.
5. Concrete is to be 20MPa at 28 days as per NZS 3104:2021.
6. Baffles are to be constructed as shown when outlet velocities and soil conditions dictate, in extreme cases specific design may be required by the Council.
7. Inlet structures shall have reverse apron fall and no baffles.

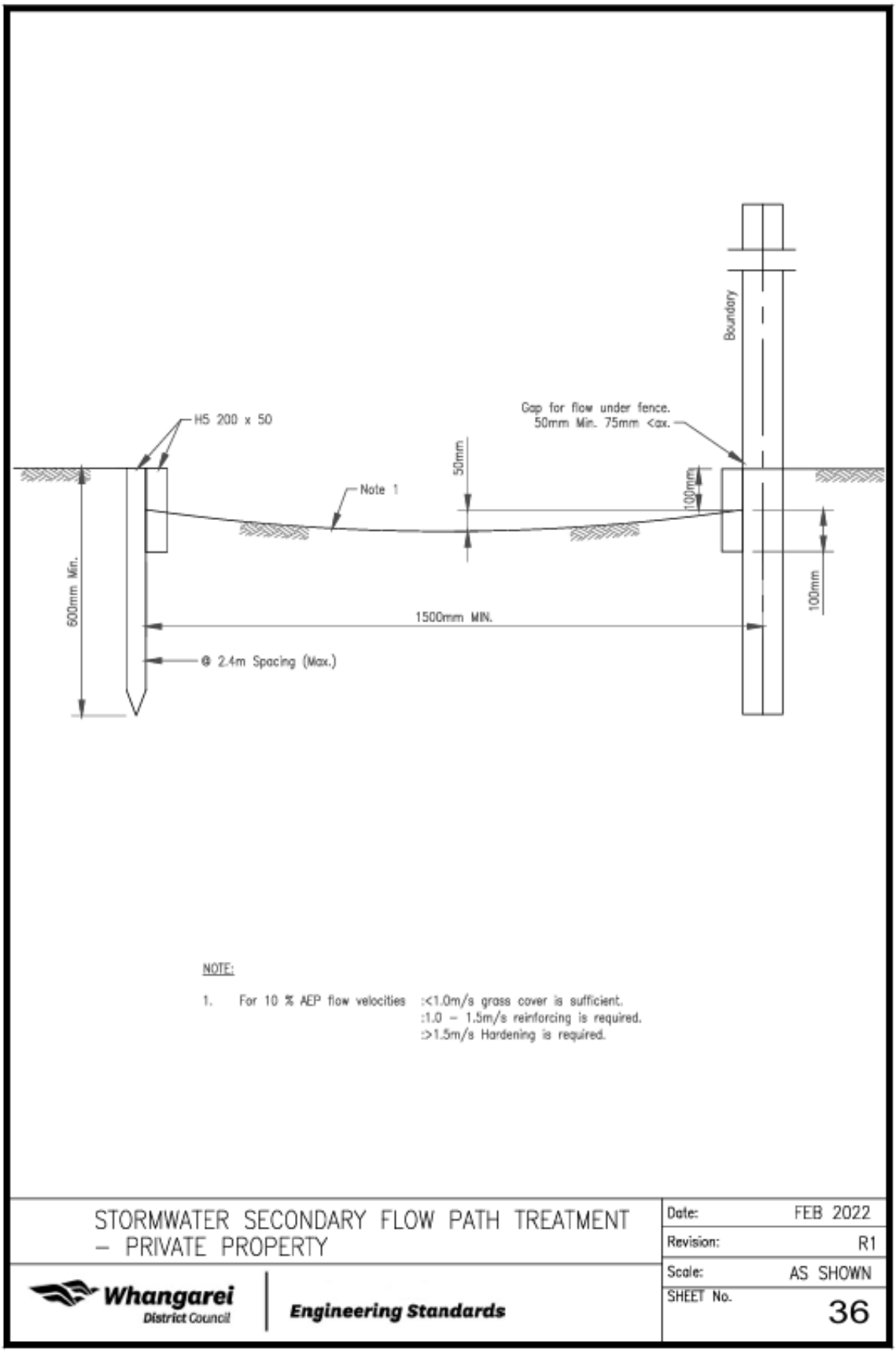
INLET AND OUTFALL STRUCTURES

Whangarei District Council | Engineering Standards

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|---|---|
| Date: | DEC 2021 |
| Revision: | R2 |
| Scale: | AS SHOWN |
| SHEET No. | 35 |

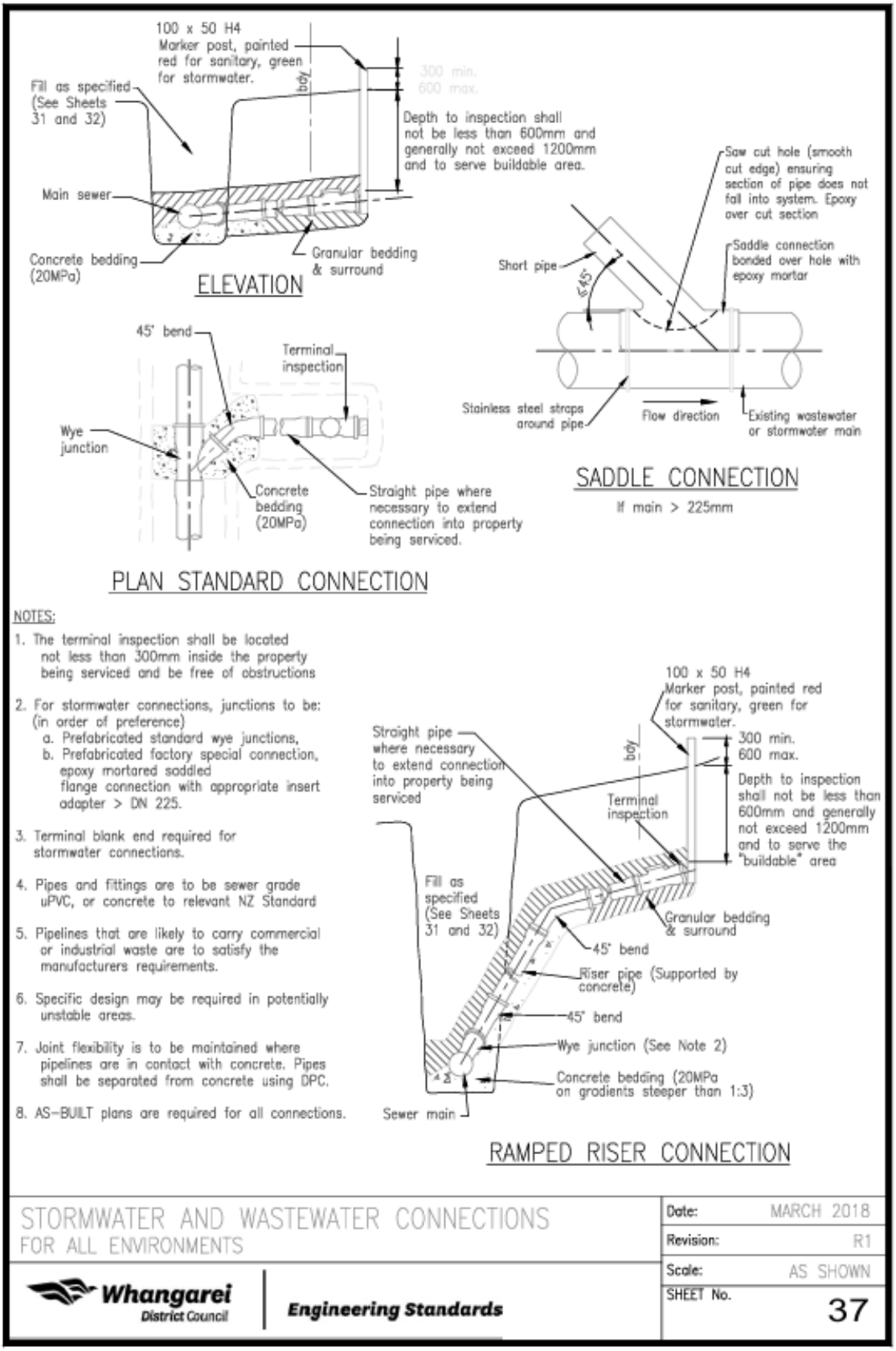
*Sheet 14 Sheet 35 Inlet and Outlet Structures*

Sheet 36 Stormwater Secondary Flow Path Treatment

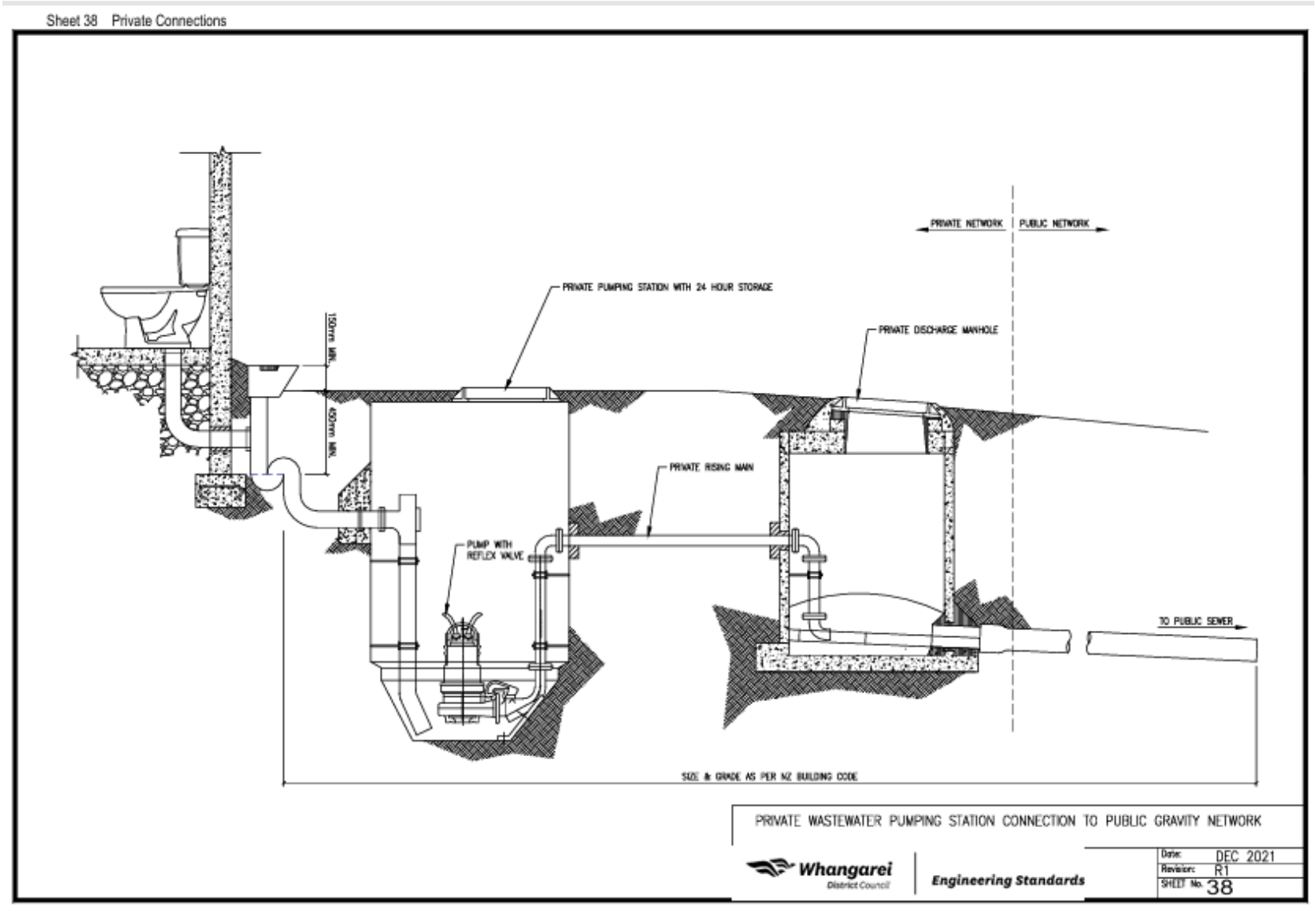



*Sheet 15 Sheet 36 Stormwater Secondary Flow Path Treatment*

## Sheet 37 Stormwater and Wastewater Connections

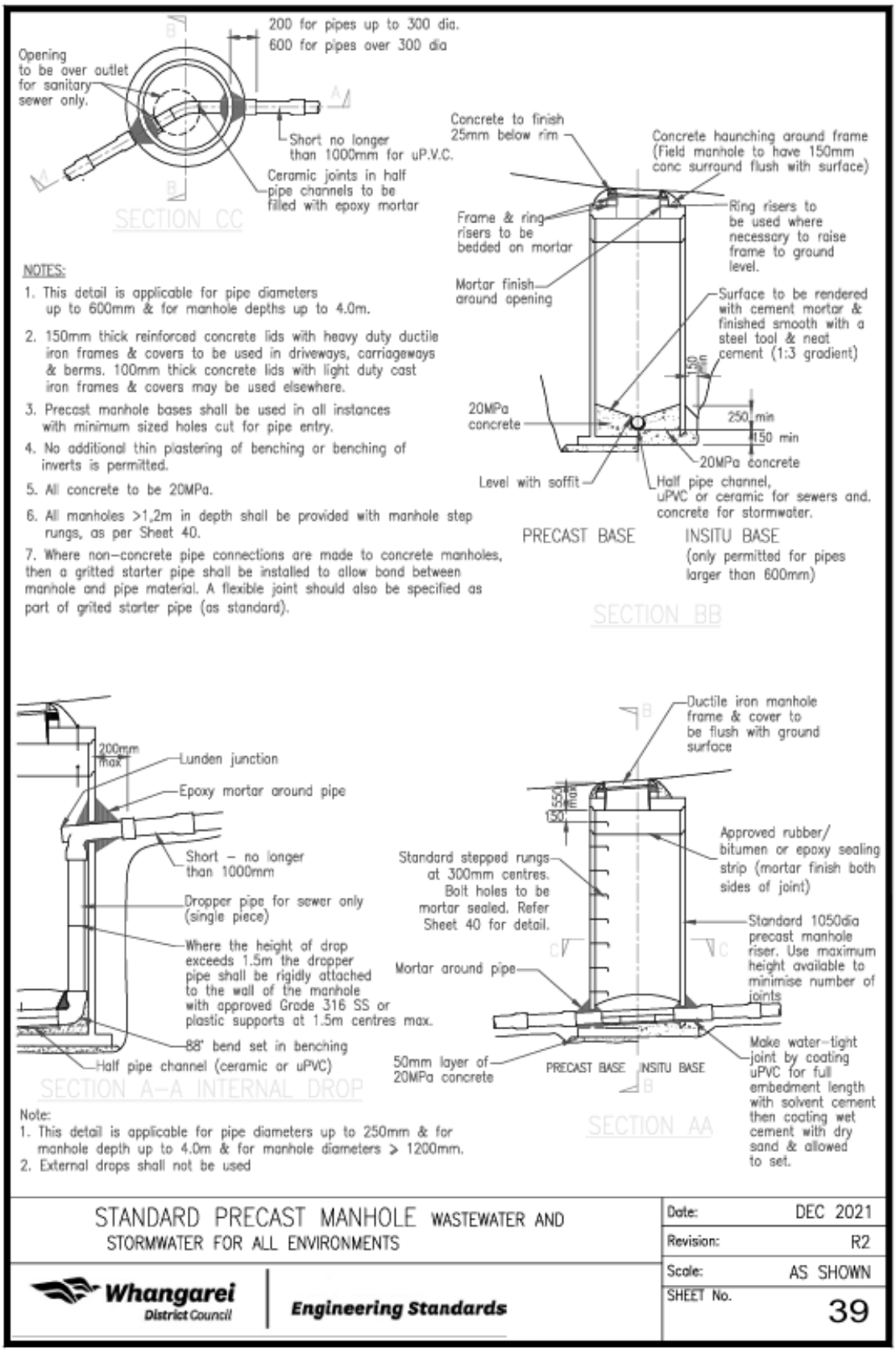



*Sheet 16 Sheet 37 Stormwater and Wastewater Connections*



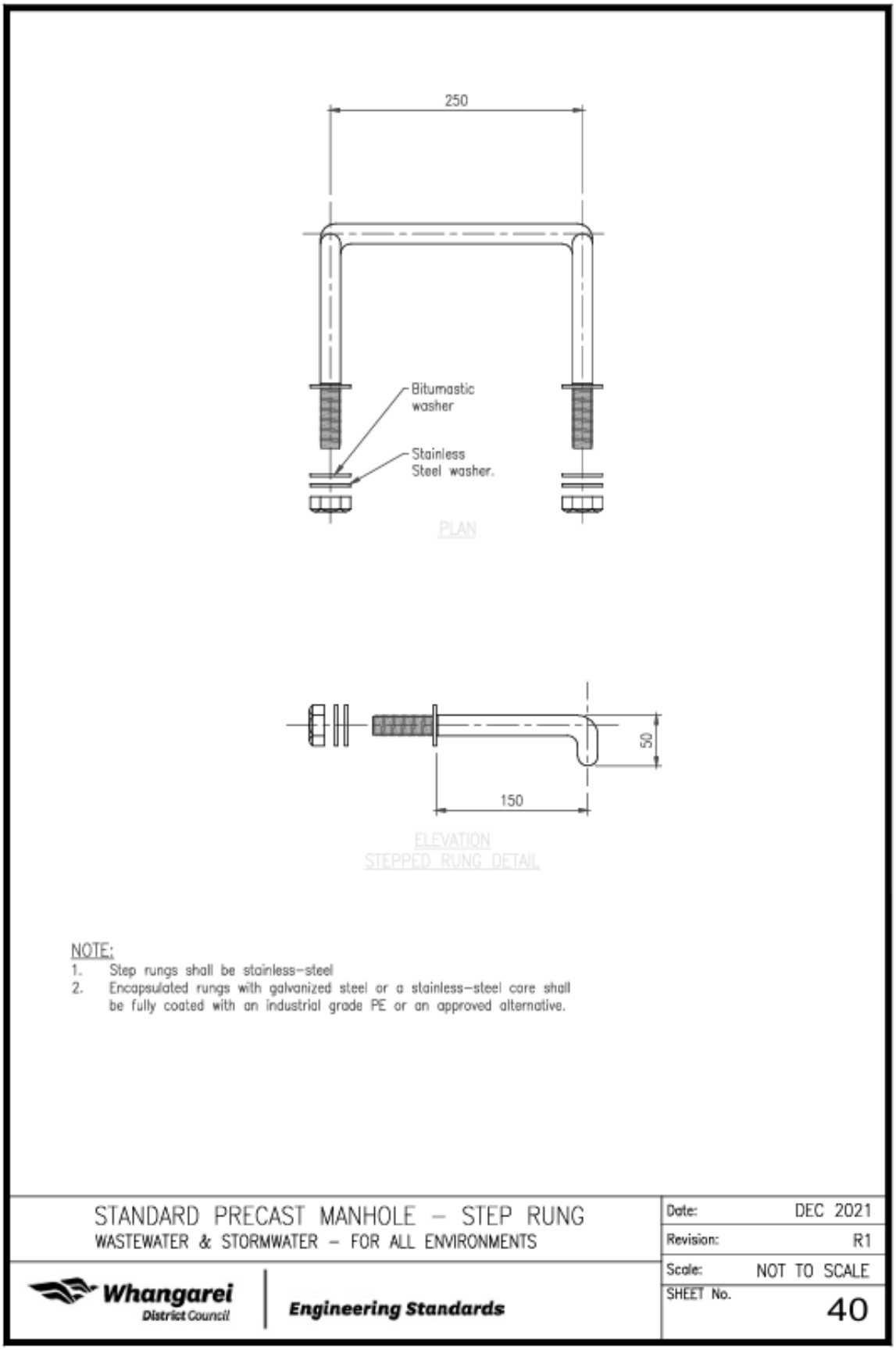

*Sheet 17 Sheet 38 Private Connections*

## Sheet 39 Standard Precast Manhole



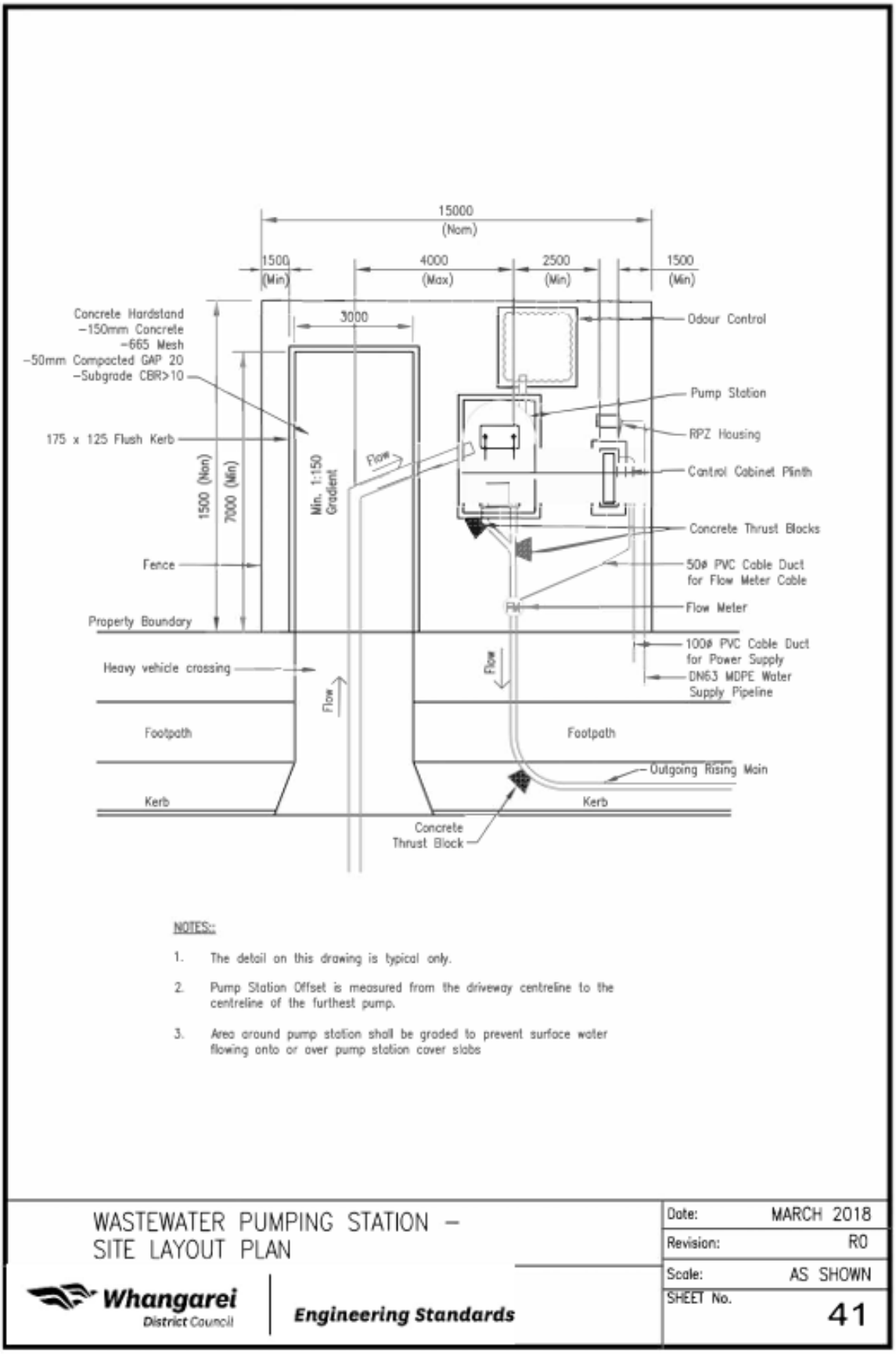

*Sheet 18 Sheet 39 Standard Precast Manhole*

## Sheet 40 Standard Precast Manhole - Step Rung




*Sheet 19 Sheet 40 Standard Precast Manhole - Step Rung*

Sheet 41 Wastewater Pumping Station - Site Layout Plan



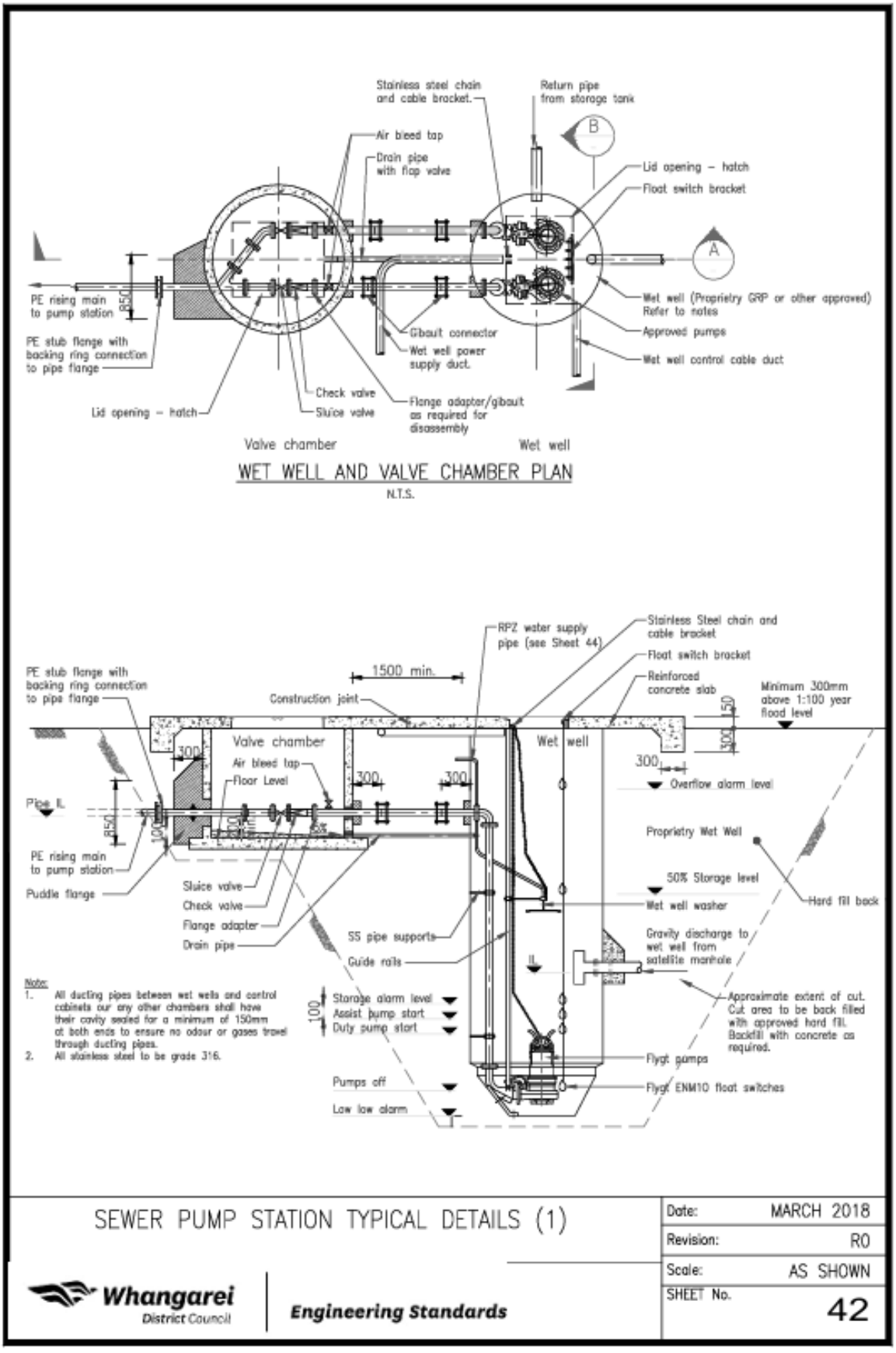

NOTES::

1. The detail on this drawing is typical only.
2. Pump Station Offset is measured from the driveway centreline to the centreline of the furthest pump.
3. Area around pump station shall be graded to prevent surface water flowing onto or over pump station cover slabs

| | |
|---|---|
| WASTEWATER PUMPING STATION – SITE LAYOUT PLAN | Date: MARCH 2018 |
| | Revision: R0 |
| Whangarei District Council \| Engineering Standards | Scale: AS SHOWN |
| | SHEET No. 41 |

*Sheet 20 Sheet 41 Wastewater Pumping Station - Site layout and Plan*

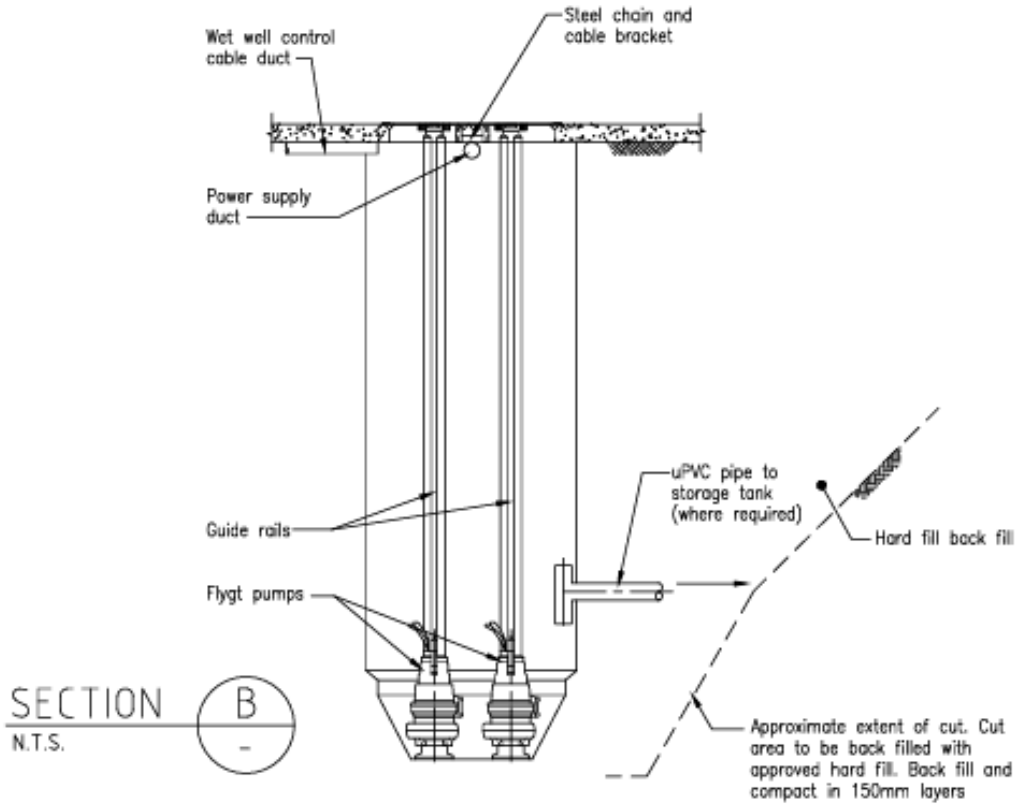
## Sheet 42 Sewer Pump Station Typical Details (1)




*Sheet 21 Sheet 42 Sewer Pump Station Typical Details (1)*

## Sheet 43 Sewer Pump Station Typical Details (2)

Notes:
1. Emergency storage tank to be at least sufficient for 4 hours design average dry weatherflow(ADWF)above standby pump on level.
2. Pumps to be in accordance with Approved Materials List.
3. Pump configuration is to be duty/assist with operator selectable duty.
4. All pumps 5 kw or greater to have variable speed drive.
5. Power supply to include generator connection.
6. IP55 single phase connection to be included in power supply unit.
7. Telemetry unit to include backup 24 hr power supply.
8. Pump station PLC to have 20% redundant I/O.
9. The following alarms are to be available via telemetry: overflow, high level, low level, pump run fault.
10. On site indication shall be available for: cumulative pump run hours, amps (each pump), volts (phase selectable).
11. Pump run signal and current to be available via telemetry.
12. All tanks/ chambers to include buoyancy control based on groundwater being at ground level.
13. All fittings within pump well to be 316 stainless steel including guide rails, lifting chains and safety grids.
14. Float or probe controls for pump and alarm operations.
15. Access to be minimum 900mm x 900mm.
16. Lids shall be in accordance with Approved Material List – Wastewater and Stormwater.
17. Pump stations to be provided with lighting.
18. Odour control to be provided as required.
19. Refer to Sections 5.2.12 & 5.3.8 for further details.




SECTION B
N.T.S.

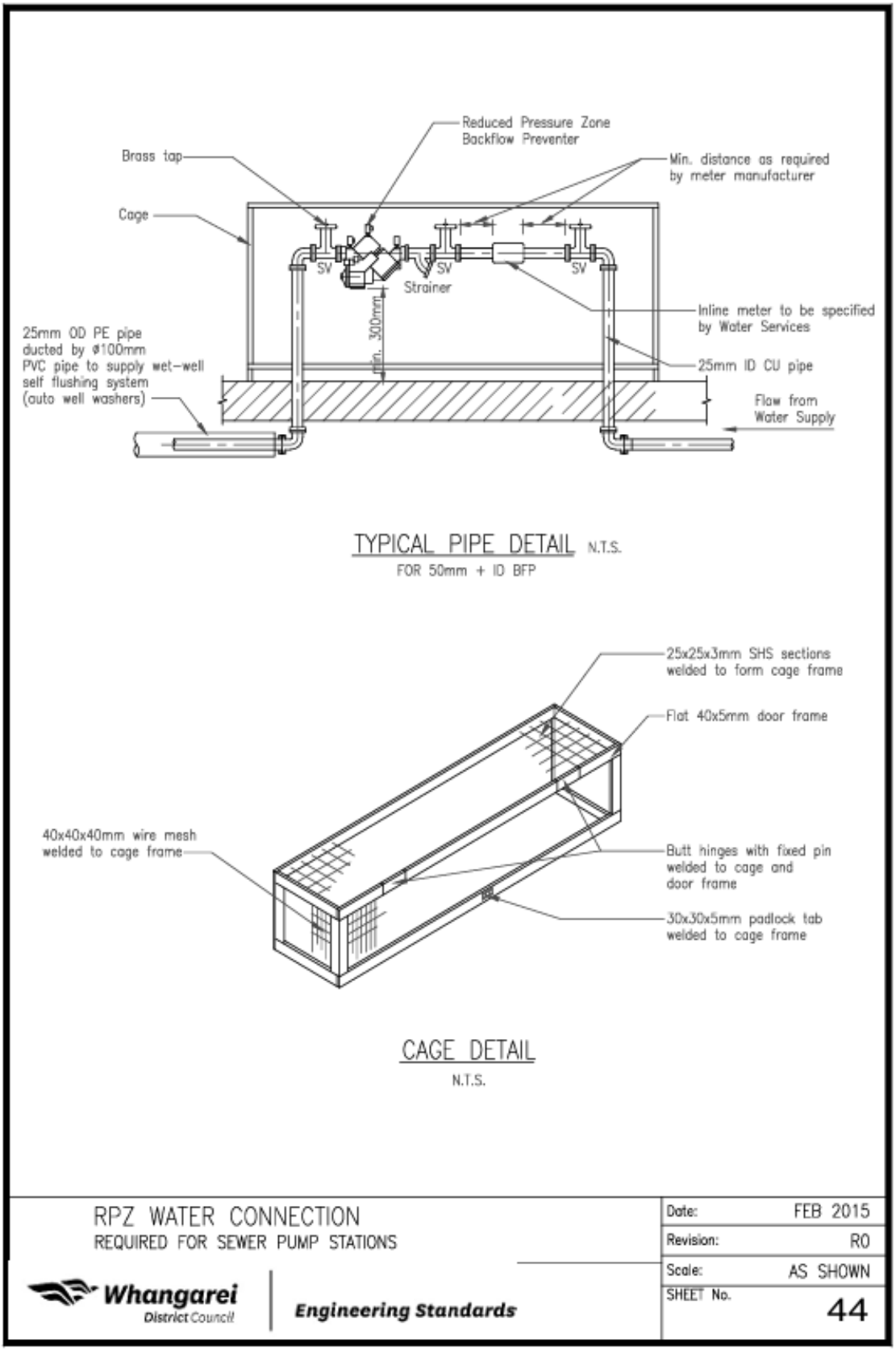
SEWER PUMP STATION TYPICAL DETAILS (2)

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|---|---|
| Date: | DEC 2021 |
| Revision: | R1 |
| Scale: | AS SHOWN |
| SHEET No. | 43 |

Whangarei District Council | Engineering Standards

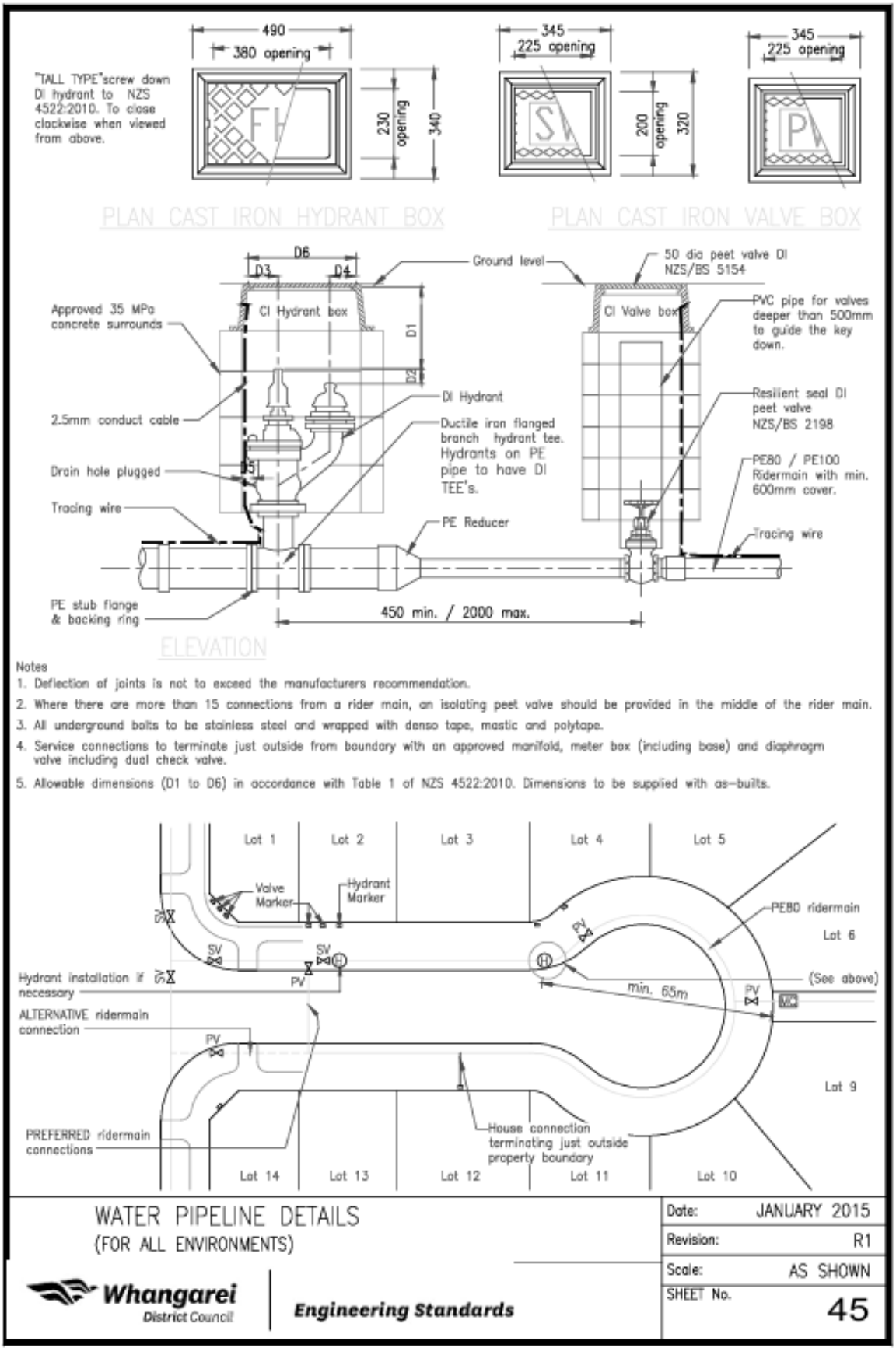
*Sheet 22 Sheet 43 Sewer Pump Station Typical Details (2)*

Sheet 44 RPZ Water Connection



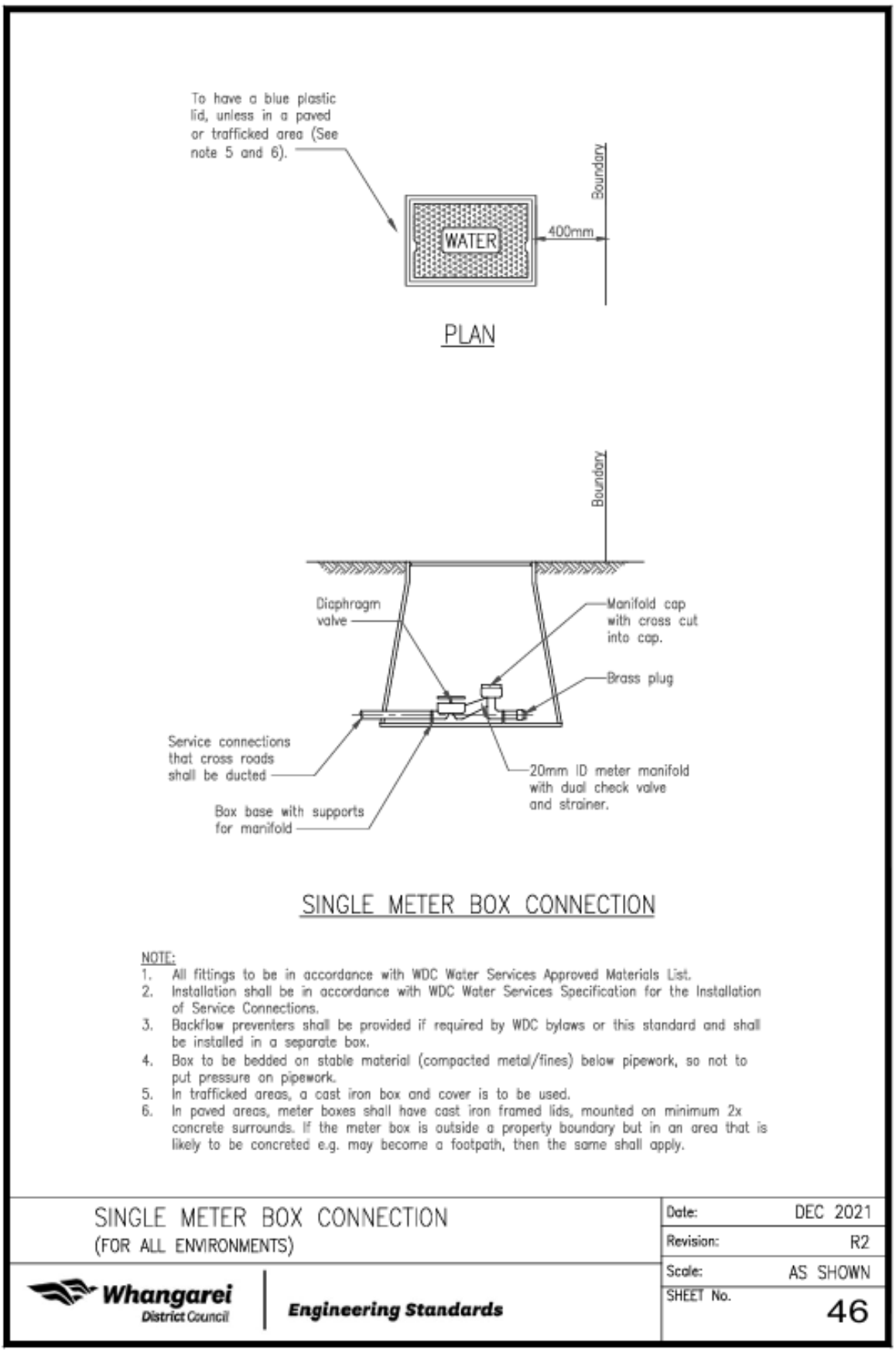

*Sheet 23 Sheet 44 RPZ Water Connection*

## Sheet 45 Water Pipeline Details



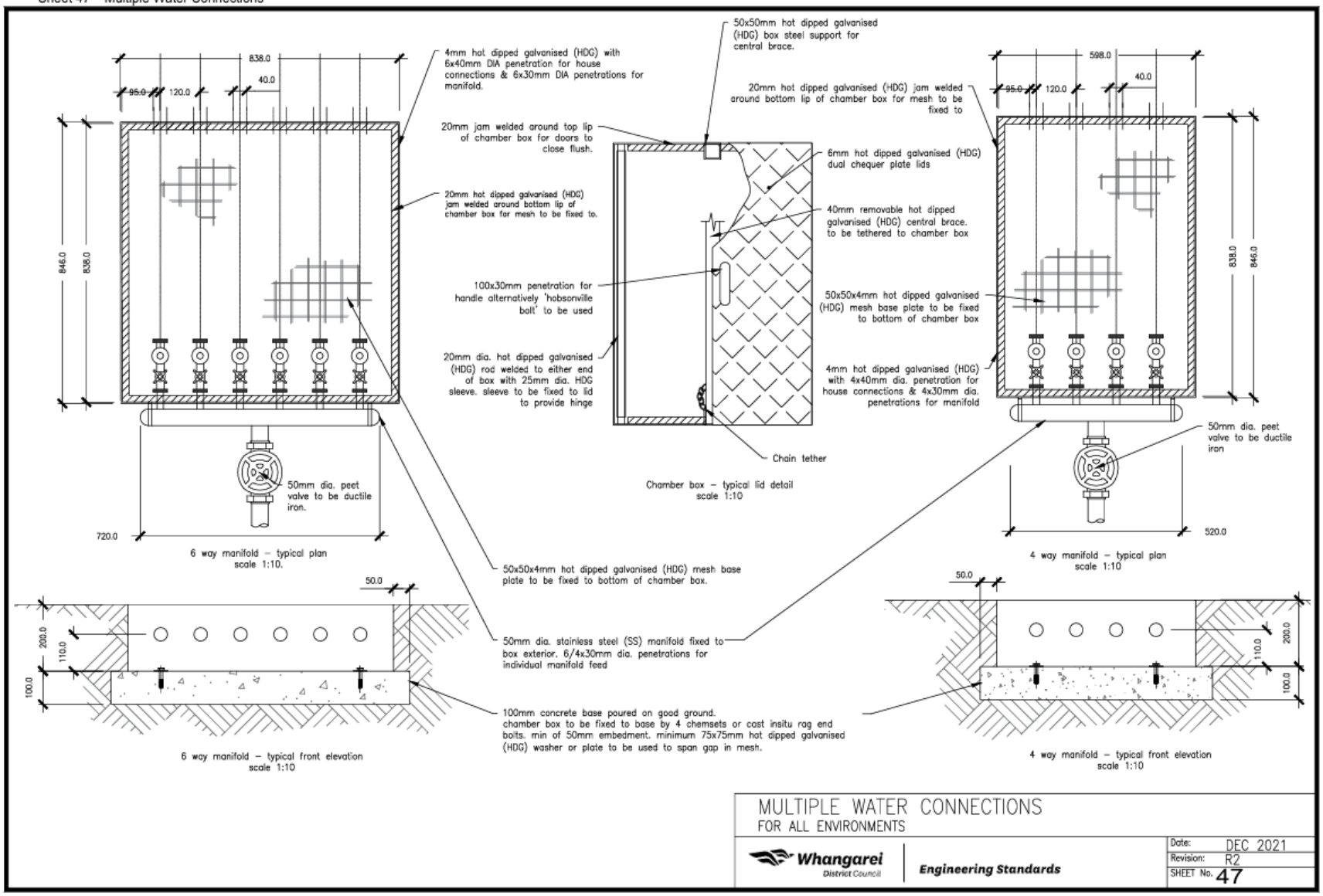

*Sheet 24 Sheet 45 Water Pipeline Details*

## Sheet 46 Single Meter Box Connection



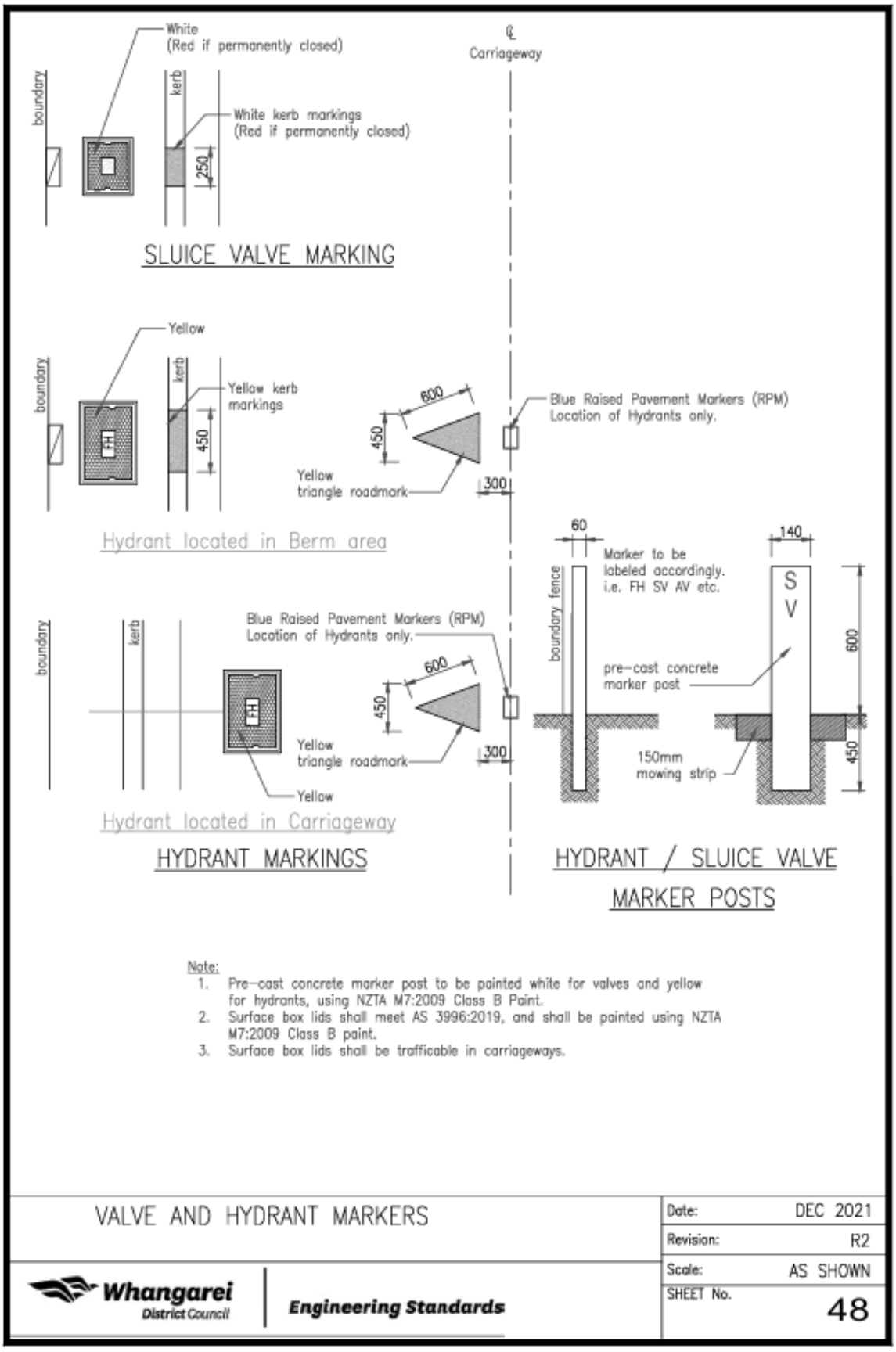

*Sheet 25 Sheet 46 Single Meter Box Connection*

Sheet 47 Multiple Water Connections



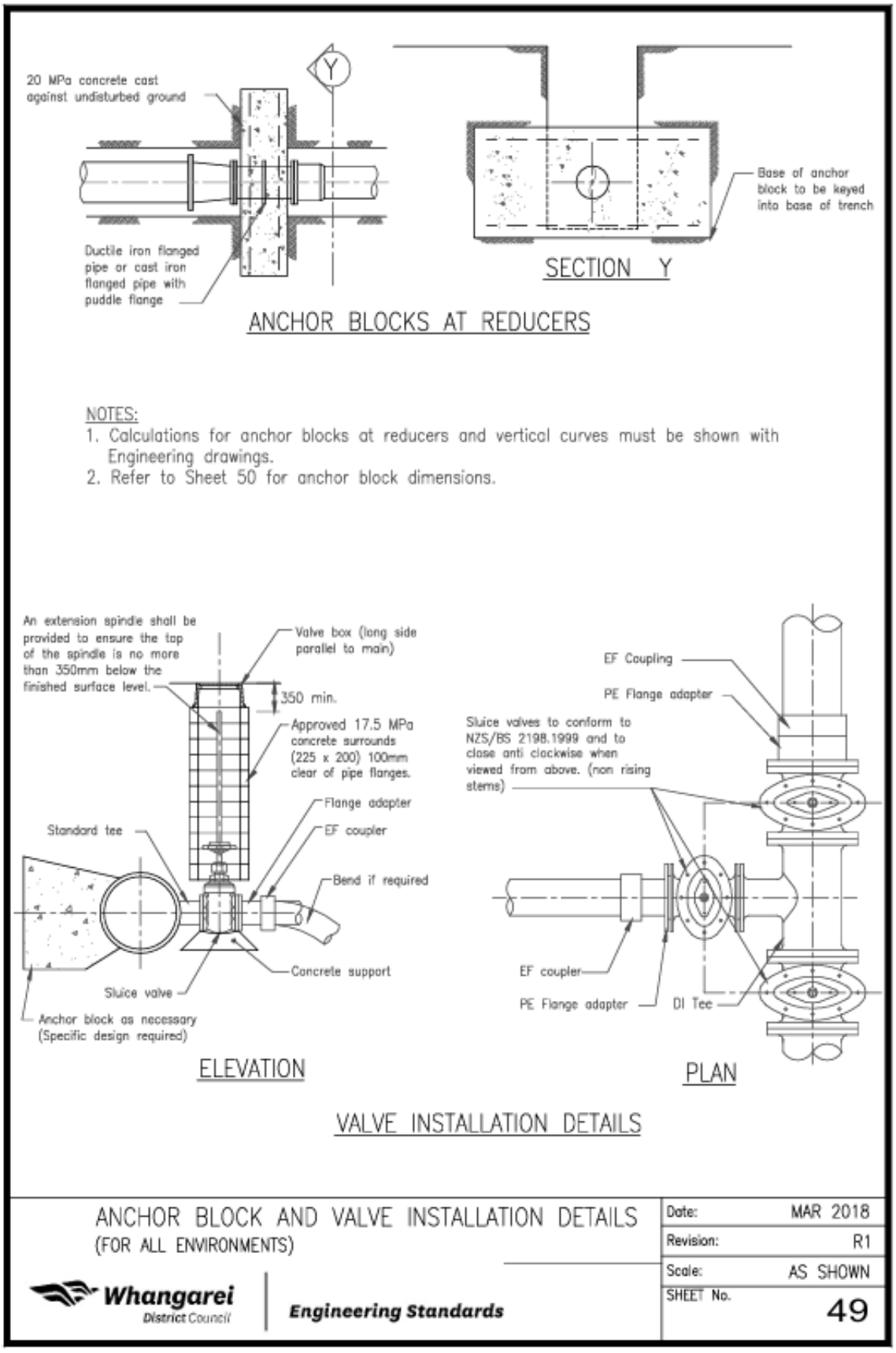

*Sheet 26 Sheet 47 Multiple Water Connections*

Sheet 48 Valve and Hydrant Markers



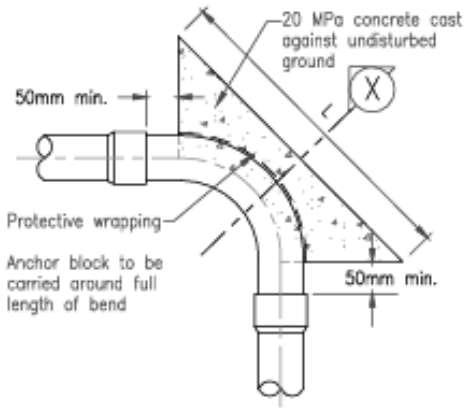

*Sheet 27 Sheet 48 Valve and Hydrant Markers*

Sheet 49 Anchor Block and Valve Installation Details

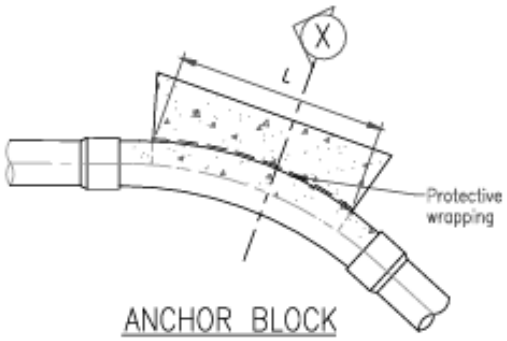



*Sheet 28 Sheet 49 Anchor Block and Valve Installation Details*

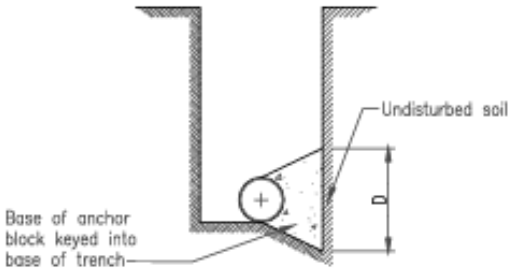
## Sheet 50 Anchor Block Details




ANCHOR BLOCK FOR 90° BENDS




ANCHOR BLOCK FOR 45° BENDS




SECTION X

| Nom Pipe Diameter | 90° Bend L | 90° Bend D | 45° Bend L | 45° Bend D | Tee or Closed End L | Tee or Closed End D | 22.5° Bend L | 22.5° Bend D | 11.25° Bend L | 11.25° Bend D |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 740 | 400 | 500 | 320 | 520 | 400 | 300 | 300 | 300 | 300 |
| 150 | 1340 | 460 | 700 | 470 | 870 | 500 | 500 | 340 | 300 | 300 |
| 200 | 1610 | 660 | 960 | 600 | 1150 | 650 | 740 | 400 | 490 | 300 |
| 250 | 2000 | 800 | 1250 | 700 | 1420 | 800 | 890 | 500 | 640 | 350 |
| 300 | 2330 | 1000 | 1560 | 800 | 1650 | 1000 | 1080 | 600 | 810 | 400 |

NOTES:

1) Anchor block dimensions for firm soil conditions. (≥ CBR of 5)
2) The dimensions to be increased or decreased for variation in soil conditions.
3) Allowable bearing stress used – 100 KPa.
4) Internal pipe test pressure up to 1800 KPa (18Bar).
5) All underground bolts to be wrapped with denso tape.
6) Protective membrane to be bitumised paper, thin roofing felt or polythene film applied to a thickness of 2.5mm.
7) If an anchor block is to be supported by engineered fill material, it shall be specifically designed, taking into account all design actions, including the weight of the concrete, with allowance for safety factors.

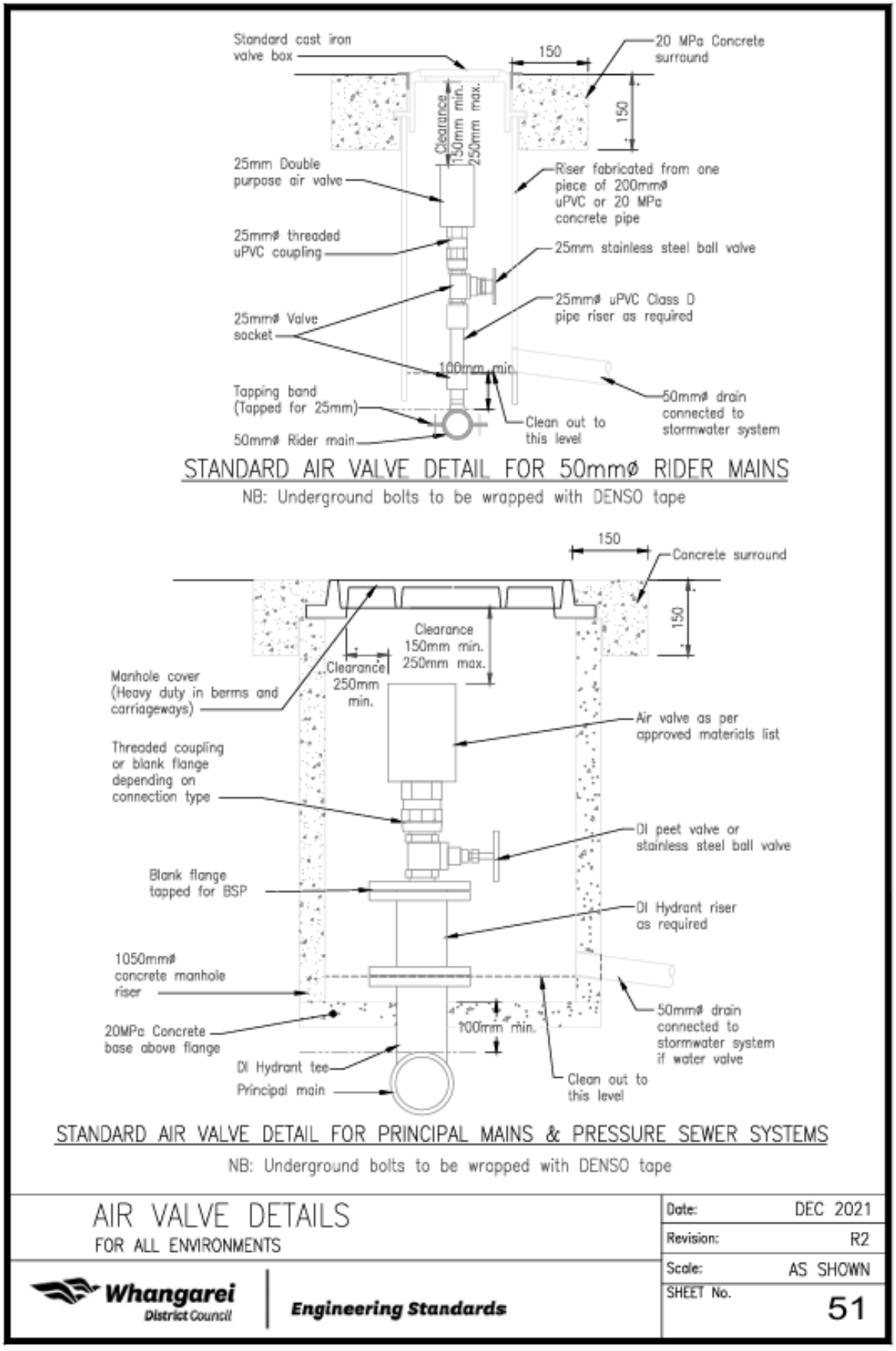
ANCHOR BLOCK DETAILS
(FOR ALL ENVIRONMENTS)

Whangarei District Council | Engineering Standards

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|---|---|
| Date: | MAR 2018 |
| Revision: | R1 |
| Scale: | AS SHOWN |
| SHEET No. | 50 |

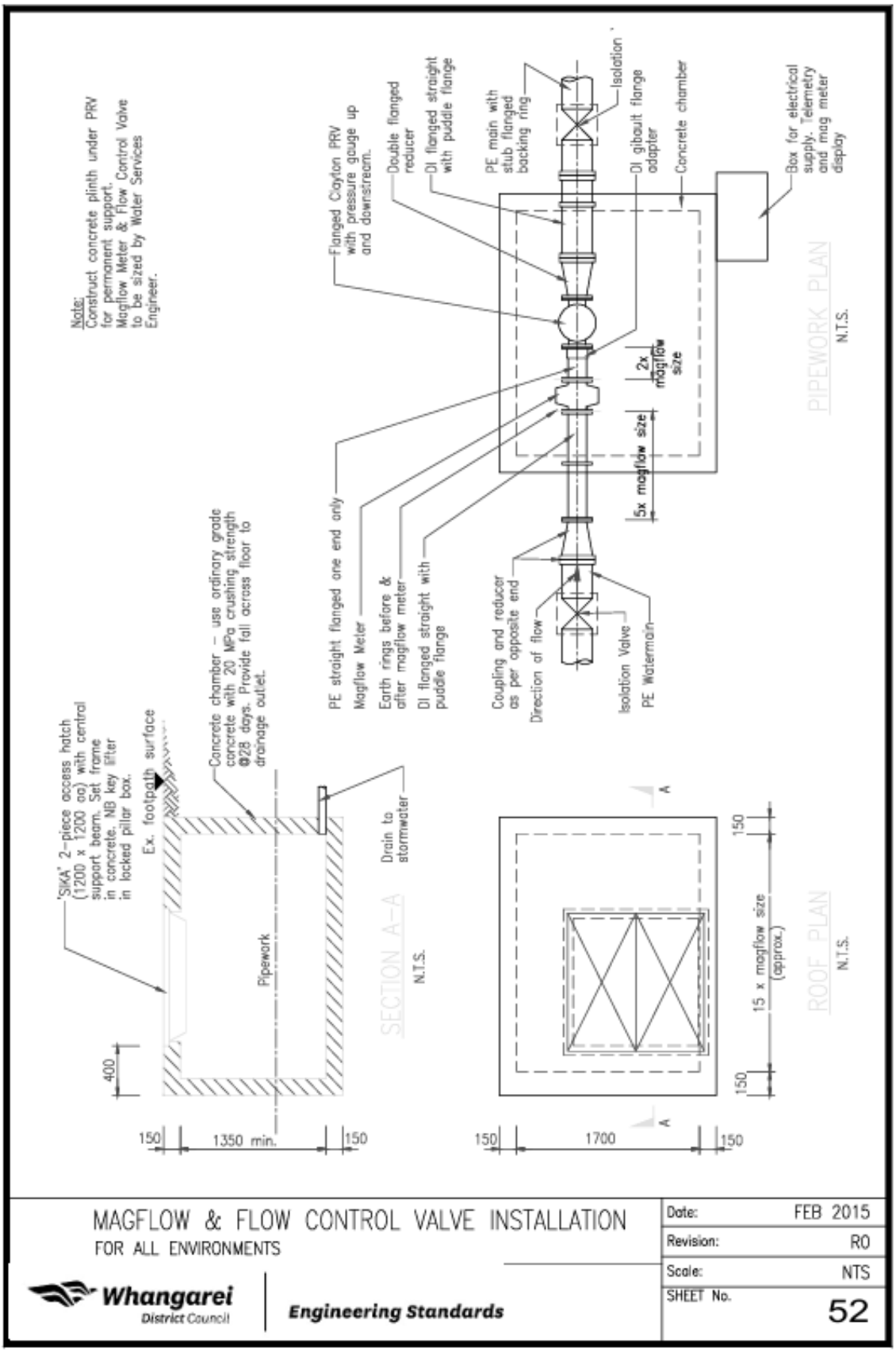
*Sheet 29 Sheet 50 Anchor Block Details*

Sheet 51 Air Valve Details



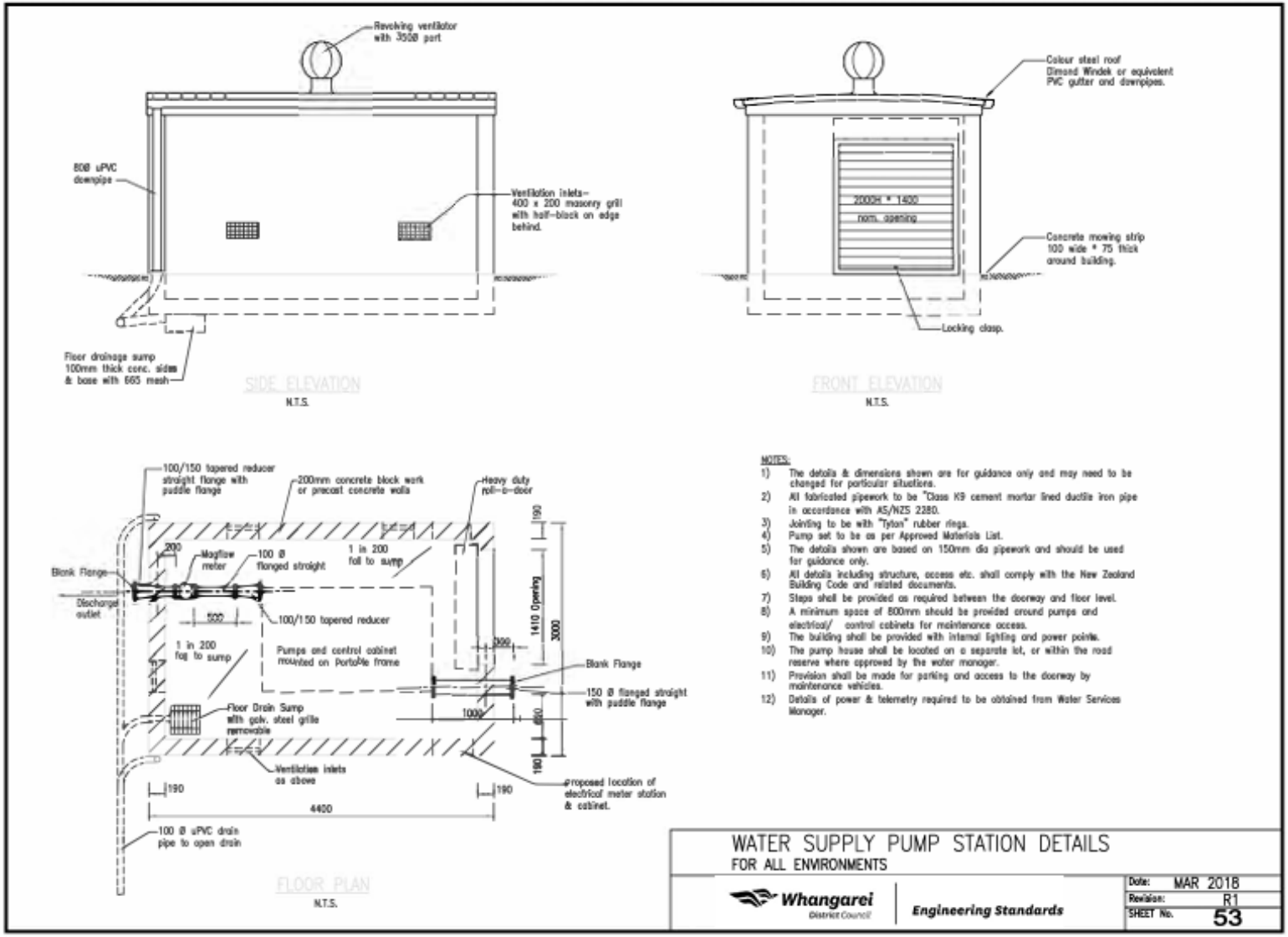

*Sheet 30 Sheet 51 Air Valve Details*

Sheet 52 Magflow & Flow Control Valve Installation



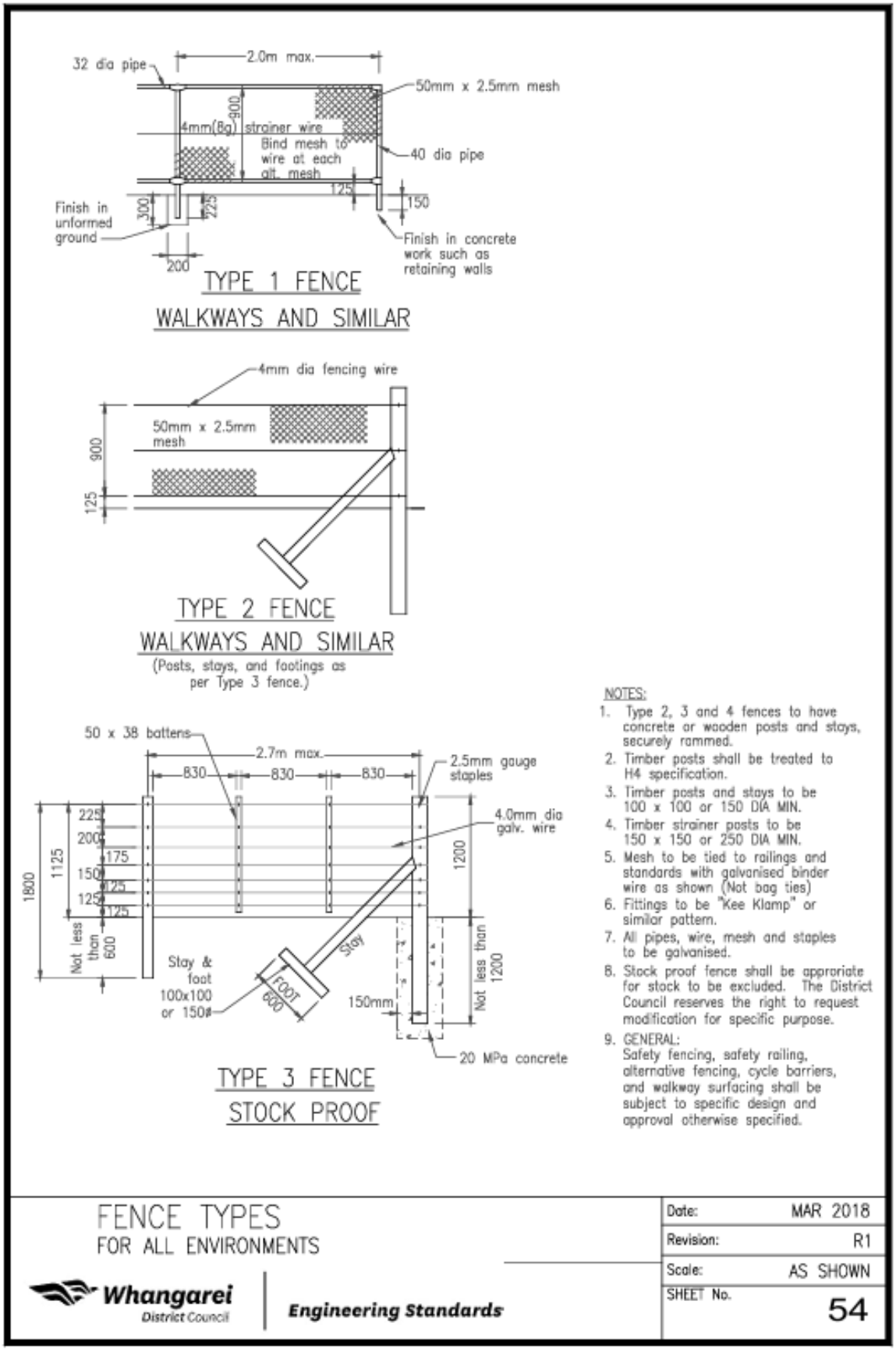

*Sheet 31 Sheet 52 Magflow & Flow Control Valve Installation*

Sheet 53 Water Supply Pump Station Details



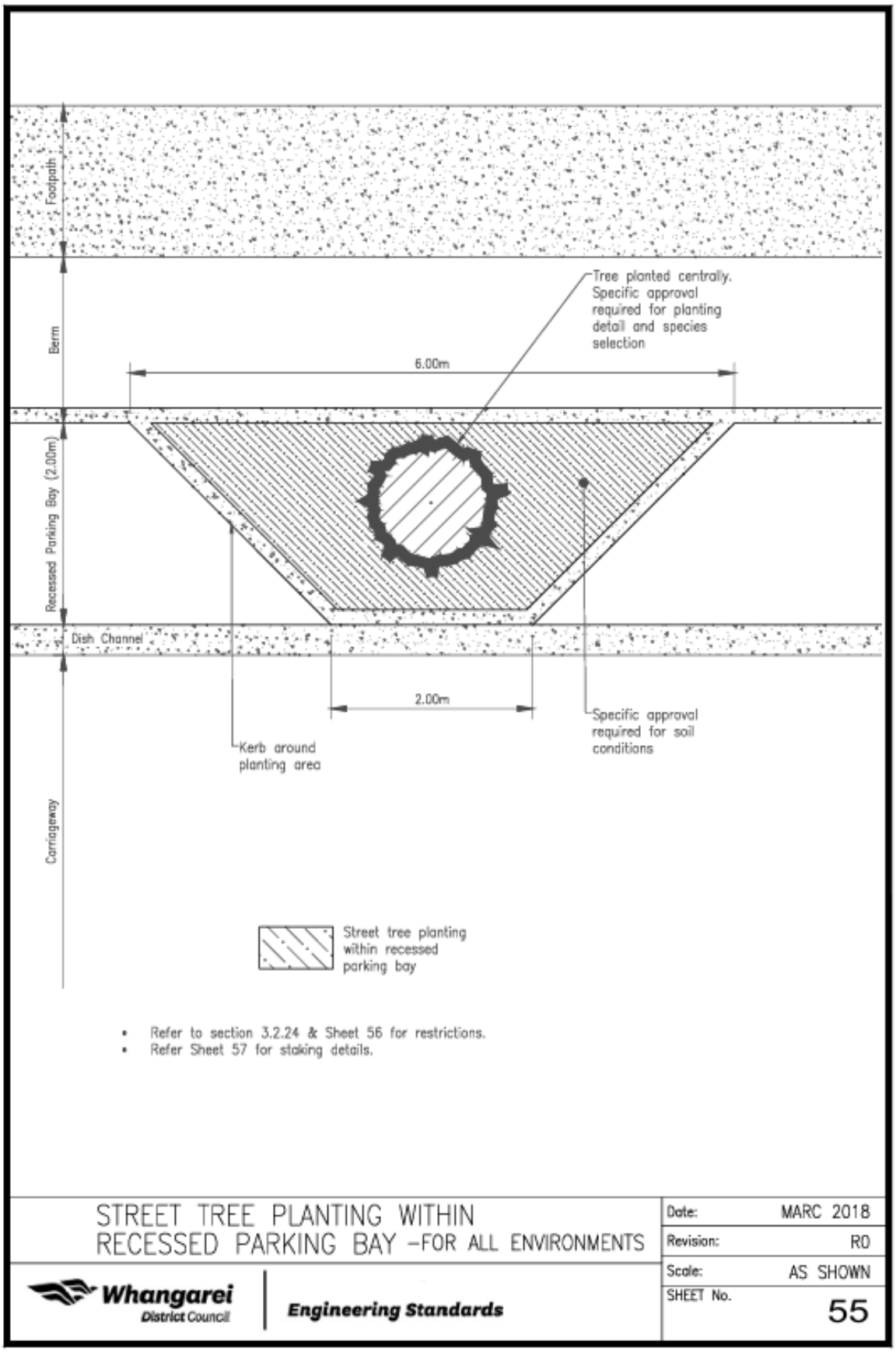

*Sheet 32 Sheet 53 Water Supply Pump Station Details*

## Sheet 54 Fence Types



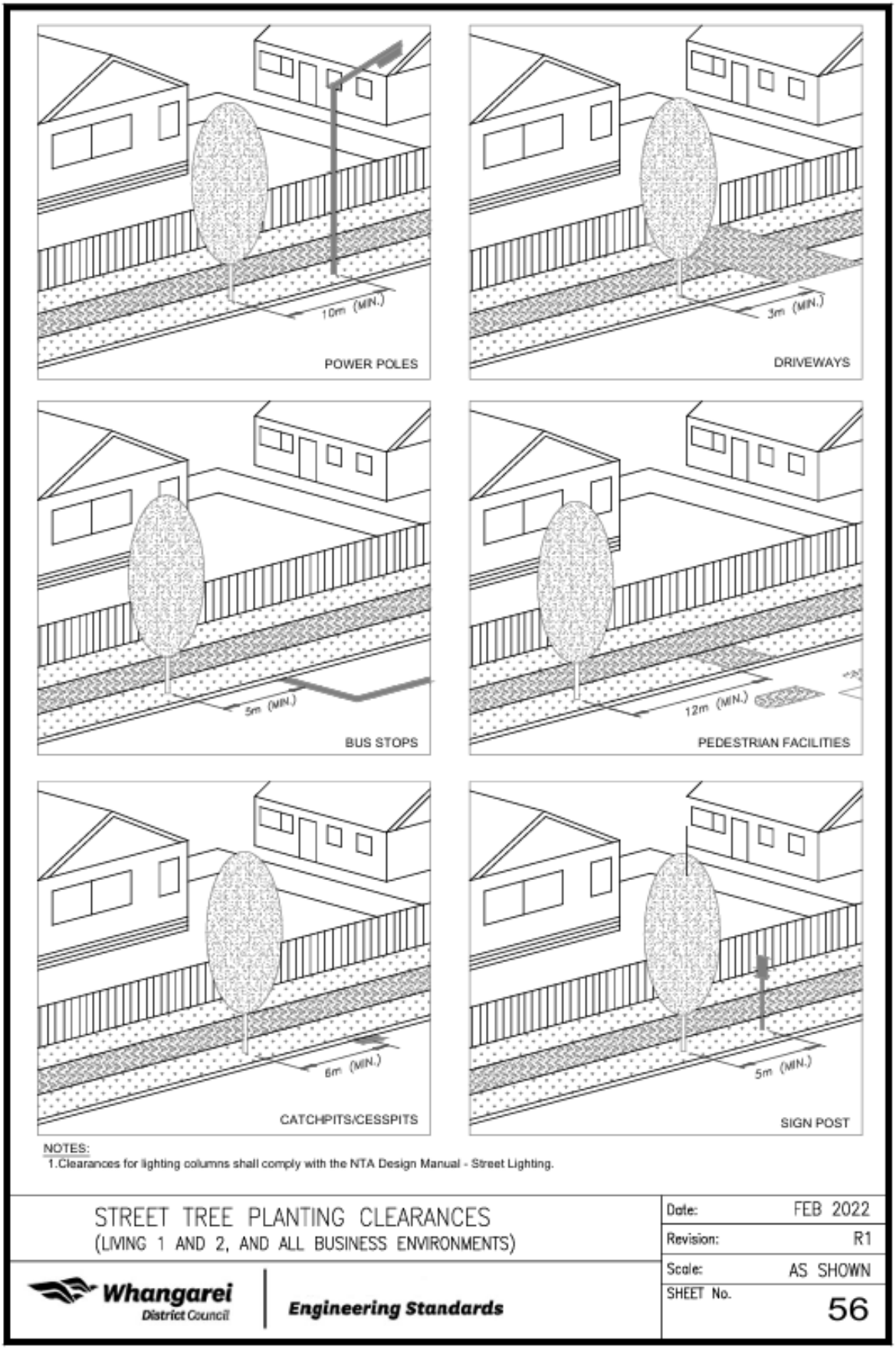

Sheet 33 Sheet 54 Fence Types

Sheet 55 Street Tree Planting Within Recessed Parking Bay



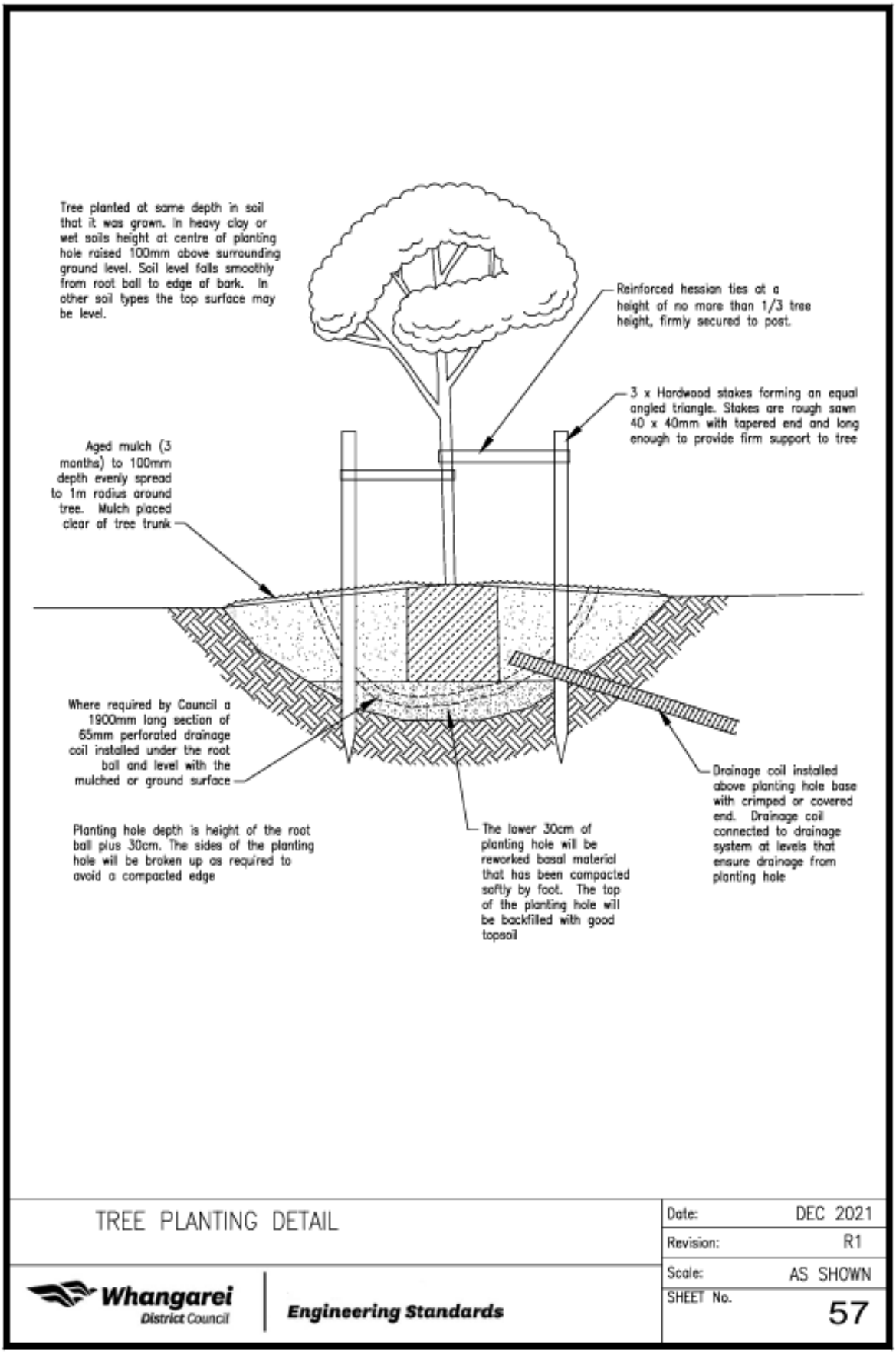

*Sheet 34 Sheet 55 Street Tree Planting Within Recessed Parking Bay*

## Sheet 56 Street Tree Planting Clearances




*Sheet 35 Sheet 56 Street Tree Planting Clearances*

## Sheet 57 Tree Planting Detail




*Sheet 36 Sheet 57 Tree Planting Detail*