Chapter 5

Stormwater

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CHAPTER 5 STORMWATER

INTRODUCTION

5 PURPOSE

The purpose of this section is to outline standards and good practice matters for the design and construction of stormwater systems for land development and subdivision in the Nelson and Tasman Districts. These aim to achieve flood management, environmental and amenity expectations in an effective and efficient matter. In all situations the provisions of the Nelson Tasman Land Development Manual (NTLDM) are also subject to the applicable Resource Management Plan (RMP).

5.1 Performance Outcomes

The performance outcomes for the design and construction of stormwater systems sought by the standards and good practice matters in this document are as follows:

a) A management solution that is based on a holistic catchment-based assessment, including consideration of topography, soil and slope, vegetation, built development, existing drainage patterns, freshwater resources, stormwater network infrastructure, natural values and natural hazards;

b) An integrated design approach to stormwater management, which accommodates stormwater functions including access for maintenance and operations, as well as amenity, recreation and ecological values;

c) A network that manages stormwater flows to a standard that minimises people and property from harm or damage and nuisance effects, especially from risk to safety, health and well-being;

d) A management approach that aims to improve water quality;

e) Devices and design solutions that are robust, durable and easily maintained;

f) A whole-of-life operations, maintenance and replacement or renewal programme that is clearly described, costed, and can be afforded;

g) A stormwater system design that takes into account the foreseeable demands of future development;

h) A resilient network infrastructure that performs well against the risk of geotechnical, seismic, flood hazards and coastal hazards (erosion and inundation);

i) A design that maintains or improves values associated with freshwater resources, including riparian management and in-stream habitat values;

j) Stormwater assets that have high amenity value, and shared use of open-space areas where practicable and agreed to by Reserves and Facilities Manager;

k) A network that maintains a high visual amenity that enhances the value of adjoining property and neighbourhood values as a whole.

All performance outcomes are also subject to the applicable Resource Management Plan objectives and policies and appropriate bylaws, which take precedence over the requirements of the Nelson Tasman Land Development Manual (NTLDM).

5.2 Referenced Documents

5.2.1 Resource Management Plans

The requirements set out in this chapter address matters that are specific to Council asset creation or activities that may have an impact on an asset. They are subject to the Nelson City and Tasman District Resource Management Plans as well as relevant National Environmental Standards and National Policy Statement: Freshwater Management.

5.2.2 Building Code

Stormwater is also regulated within the Building Act and NZ Building Code (NZBC). As part of the building consent application process, stormwater run-off must be addressed by providing appropriate plans and specifications that demonstrate compliance with the performance requirements of NZBC clause E1, "Surface Water". The information required includes, but is not limited to, the size, fall (gradient) and setting out of the drainage, details of surface water sumps (eg. for drainage of a driveway surface), and provision of access points.

5.2.3 External Standards

In addition to the standards of this document, the standards set out in Table 5-1 also apply unless specified otherwise. Where an Act or National Standards document is referenced, this shall be the current version including any associated amendments.

Table 5-1 Minimum Standards for Stormwater Design, Materials, Construction and Maintenance

Number/Source	Title
NZS4404	Land development and subdivision
AS/NZS1254	PVC pipes and fittings for stormwater and surface water applications
AS/NZS1260	uPVC Pipes and fittings for drain waste and vent applications
NZS7643	Code of Practice for the installation of un-plasticised PVC pipe systems
AS/NZS2032	Installation of PVC pipe systems
AS/NZS2566	Part 1:1998 Buried flexible pipelines – Structural design and Supp 1 Commentary Part 2 – Buried flexible pipelines - Installation
NZS3109	Concrete construction
NZS3121	Water and aggregate for concrete
AS/NZS3725	Design for installation of buried concrete pipes
AS/NZS4058	Pre-cast concrete pipes (pressure and non-pressure)
NZS4442	Welded steel pipes and fittings for water, sewage, and medium pressure gas
Ministry of Business, Innovation & Employment	NZ Building Code – E1 and B2 and associated acceptable solutions and verification methods

Table 5-2 sets out additional and related documents which may be useful references for designers.

Table 5-2 Useful references for Stormwater Design, Materials, Construction and Maintenance

Author / Organisation	Title
Auckland Council	Stormwater management devices in the Auckland region. Auckland Council guideline document, GD2017/001 (GD01)
Auckland Council	Water Sensitive Design for Stormwater, March 2015 Guideline Document 2015/004
Auckland Council	Technical Report TR2013/018: Hydraulic Energy Management - inlet and outlet design for treatment devices
Auckland Council	Technical Report TR2013/040: Stormwater Disposal via Soakage
NIWA	New Zealand Fish Passage Guidelines, for structures up to 4 metres, April 2018
Hamilton City Council	Three Waters Management Practice Notes, Hamilton City Council, HCC01- HCC07
Hamilton City Council	Guidelines – Soak up your Stormwater
Ministry for Primary Industries (MPI)	National Plant Pest Accord (NPPA) List
NZTA	SP/M/022: 2013 - Bridge Manual
NZTA	F2:2013 - Specification for Pipe Subsoil Drain Construction
Water New Zealand	NZ Pipe Inspection Manual 3rd Edition
New Zealand Society of Large Dams (NZSOLD)	Dam safety Guidelines 2015
Christchurch City Council	Waterways, Wetlands and Drainage Guide
Nelson City Council	Nelson City Council/Department of Conservation Living Heritage - Growing Native Plants in Nelson
Tasman District Council	Tasman District Council Native Plant Restoration Lists
Nelson City Council/Tasman District Council	Calculating minimum ground and floor levels for subdivision and new buildings, Tasman District Council and Nelson City Council, Inundation Practice Note 2019.
Nelson City Council/ Tasman District Council	Wetland Practice Note for Nelson City and Tasman District Council 2019 Bioretention Practice Note for Nelson City and Tasman District Council 2019
Landcare	Applying Low Impact Design and Water Sensitive Design in Nelson Tasman, June 2016
Tasman District Council website	Te Tau Ihu Mahi Tuna – Nelson/North Marlborough Eel Management Plan

STANDARDS

5.3 Design Approach

This section outlines the main components of any stormwater network, and applied principles that underpin Council's approach to stormwater management.

Mandatory Matters

The following matters are requirements for the design of stormwater management:

5.3.1 Stormwater effects

5.3.1.1 Development effects resulting in changes to stormwater run-off and land drainage patterns shall be managed in accordance with provisions of the applicable Resource Management Plan.

5.3.1.2 The design of the total stormwater management approach shall address: adverse effects on water quality; streambank erosion and degradation of stream health; and, increased flood risks.

5.3.1.3 The design of the stormwater system shall take into account the variable size and character of storm events, and the differences in environmental effects associated with this, in accordance with Stormwater control points along the rainfall spectrum (adapted from Clayton & Schuler, 1996 and Auckland Council TR035/2013) Table 5-2 and Table 5-3.

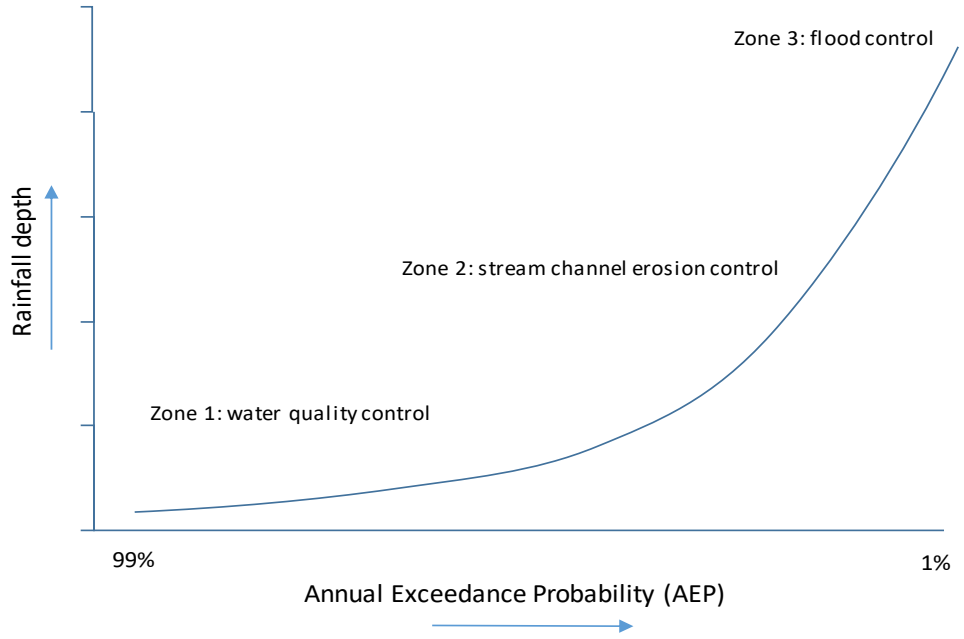


Figure 5-1 Stormwater control points along the rainfall spectrum (adapted from Clayton & Schuler, 1996 and Auckland Council TR035/2013).

Note:

The distribution of rainfall events can be divided into three classes by recurrence interval. The first class has the most frequent rainfall events, which are targeted for water quality control and ground water recharge. Storms in zones two and three are water quantity storms, for which the control objectives are channel erosion and flood control (adapted from Clayton & Schuler, 1996).

5.3.1.4 Table 5-3 sets out the minimum requirements that shall be met to mitigate adverse effects of stormwater discharges.

Table 5-3 Effects of Stormwater Discharges

	Effects on the receiving environment	Resulting from	Required Mitigation
Zone 1	Water quality	Urban land uses such as roading, parking, industrial zones and certain building materials generate contaminants that are picked up by stormwater runoff and accumulate in freshwater and marine water receiving environments	Treatment of stormwater runoff in accordance with Section 5.4.7 and 5.4.8.
Zone 2	Streambank erosion and degradation of stream health	An increase in impervious surface leads to increased runoff volumes and flow velocities during frequently occurring rainfall events. Impervious surface also leads to reduced groundwater recharge and base flows during dry periods.	Infiltration and slowing down flow velocities in accordance with Section 5.4.9 – 5.4.11.
Zone 3	Increased risk of downstream flooding	An increase in impervious surface leads to increased peak flows and flow velocities	Provide detention in accordance with Section 5.4.12 – 5.4.15.

5.3.2 Water sensitive design

5.3.2.1 The design of the stormwater management system shall be consistent with water sensitive design (WSD), using natural processes and soil media to provide sustainable stormwater management.

5.3.2.2 The design shall aim to:

a) Protect and enhance the values and functions of natural ecosystems;

b) Address stormwater effects as close to source as possible;

c) Mimic natural systems and processes for stormwater management;

d) Support inter-disciplinary planning and design where practicable and;

e) WSD principles shall be considered during the initial design and planning.

Note:

Effective implementation of WSD principles requires more planning and design input than traditional piped stormwater systems. Good planning and design early in the development process maximises the cost effectiveness of WSD. Further guidance on the implementation of WSD is available in the Auckland Council guideline document GD2015/004 (Water Sensitive Design for Stormwater).

Good Practice

5.3.2.3 From the outset, the project team should include a wide range of stakeholders and partners who will be responsible for ensuring the development meets multiple objectives and outcomes.

5.3.2.4 Development concepts should be discussed with Council throughout the design process starting at the design concept stage.

5.3.2.5 The following process should be followed:

a) Step 1: Project scoping;
   i. Identify stakeholders
   ii. Early consultation with Council
   iii. Define objectives and outcomes.

b) Step 2: Understanding the site's constraints and opportunities;
   i. Geology, slopes, groundwater, hydrology, zoning, vegetation, cultural values, etc
   ii. Minimise site disturbance, earthworks and compaction
   iii. Limit impervious surface
   iv. Preserve and utilise existing hydrology.

c) Step 3: Define stormwater mitigation requirements;
   i. Identify detention, treatment and stream protection requirements
   ii. Identify stormwater management solutions and location
   iii. Identify potential combined functions.

d) Step 4: Device design;
   i. Determine device sizing and footprint of potential stormwater solutions
   ii. Undertake life cycle costing
   iii. Iterations and refinements
   iv. Design preferred stormwater management solution.

5.3.3 WSD device design

5.3.3.1 The types of water sensitive devices that could be considered for use include:

a) Wetlands;
b) Vegetated and grassed swales;
c) Bioretention (i.e. raingardens, tree pits, infiltration basins);
d) Rainwater tanks;
e) Permeable paving;
f) Green roofs.

5.3.3.2 The design of WSD devices should be guided by any of the following guidance documents:

a) Stormwater management devices in the Auckland region. Auckland Council guideline document, GD2017/001 (GD01);

b) Hamilton City Council Three Waters Practice Notes: HCC01 to HCC07;

c) Nelson City Council/ Tasman District Council, Bioretention and wetland Practice Notes, version 1, June 2019.

5.3.3.3 WSD Design Principles

a) Surface permeability affecting on-site infiltration should be maximised to reduce runoff and optimise groundwater recharge and impervious surfaces should be minimised;

b) Existing drainage patterns and topographic features, including subsoil features of drainage, should be retained where possible, and restored if degraded through previous development. Stormwater management methods should mimic natural drainage processes where practicable;

c) Earthworks should be minimised to reduce the potential for erosion, soil compaction and loss of topsoil;

d) A treatment train approach to stormwater quality should be considered to target specific contaminants of concern. A treatment train may include combinations of on-site mitigation, minimising site disturbance, re-vegetation, instream and riparian habitat restoration, and communal off-site stormwater treatment;

e) Council may require further details about any device or method used in the proposed stormwater design, including whole-of-life cost implications.

5.3.4 Catchment Planning

5.3.4.1 Stormwater management shall be carried out on a holistic catchment or sub-catchment wide basis, rather than for the specific site area only. This includes consideration of topography, existing natural drainage patterns, downstream flooding, soils, vegetation, built development, freshwater resources, stormwater network infrastructure and natural values.

5.3.4.2 The stormwater management design shall integrate multiple design factors such as, land-use, roads, access-ways, parks and reserves, ecology, amenity and any other land value associated with the development within the catchment.

5.3.4.3 Where a proposed development is in an area covered by a catchment management plan, this shall be considered in the designs. Access to these documents will be made available on the Council's website.

5.3.4.4 Any catchment management planning issues, including non-compliance with the catchment management plan, shall be discussed with the Council.

5.3.5 Safety in Design

5.3.5.1 The design of all stormwater assets shall consider health and safety risks throughout the life of the asset and shall help to promote the safety of Council employees, contractors and the public.

5.3.5.2 Designers of structures are required to consider all aspects of risk during all phases of the asset life, including design, construction, operation and decommissioning and provide a written assessment with the engineering plans. Operational risks shall be considered during both normal use and in extreme storm events.

5.3.5.3 Designers shall ensure that all practicable measures are included in the design to facilitate safe working conditions in and around the asset. As these assets will generally be developed in urban areas, careful consideration is also needed in design and construction with respect to how the public may interact with the asset, to ensure public safety. A written assessment shall be provided with the engineering plans.

5.3.6 Durability

5.3.6.1 All stormwater systems shall be designed and constructed for their ultimate asset life.

5.3.6.2 Designers shall provide whole-of-life costs including capital, maintenance and rehabilitation costs. It is recognised that the durability of individual components may vary, and this should be accounted for in the whole of life cost.

5.3.7 Ownership and access

5.3.7.1 The stormwater system shall generally be in public ownership and on publicly owned land.

5.3.7.2 Ownership of the stormwater network shall be defined as follows:

a) Private drain – drain serving one property;

b) Common private drain – drain serving two to five properties;

c) Public drain – drain serving six properties or more and/or covered by easement in gross or is within road reserve.

5.3.7.3 In planning the layout of stormwater reticulation through private property consideration shall be given to preserving access to the pipelines for:

a) Maintenance purposes;

b) Preserving the route for relaying the reticulation in the future;

c) Avoiding likely positions for buildings, garages, carports and retaining walls; and

d) Located on the northern side of dwellings.

5.3.7.4 The alignments of stormwater flow paths on private property shall be:

a) Within ROWs or driveways;

b) Outside probable building envelopes;

c) Clear of obstructions;

d) Adjacent to boundaries – but no closer than 0.6m to outside edge of the pipe or structure;

e) Parallel to boundaries.

5.3.8 Easements for stormwater reticulation

5.3.8.1 Where as part of a subdivision or development existing and/or proposed public stormwater reticulation will be located in private property an easement shall be required in favour of the Council.

5.3.8.2 The width of easement shall be centred on the centre line of the reticulation and calculated as the general easement width of 3m, plus the diameter of the pipe and the pipe depth of the excavation. (Or at the discretion of the Engineering Manager)

5.3.8.3 The standard wording required on the Easement Document shall be:
"Memorandum Easement in Gross shall be provided in favour of the respective Council to drain stormwater in a pipe and for secondary flow paths and to provide unrestricted access along the line of the pipe for maintenance and renewal work."

5.4 System Design

This section outlines stormwater system design requirements relating to the key components of the total system and the capacity of them.

Mandatory Requirements

The following matters are mandatory requirements for the design of the stormwater system.

5.4.1 System Components

5.4.1.1 The design of the stormwater system shall convey rainfall runoff from the point of interception to the point of discharge to receiving waters or soakage areas.

5.4.1.2 The stormwater system consists of a combination of:

a) Natural systems such as streams (ephemeral, intermittent and permanent) and overland flow paths; and

b) Built systems such as constructed channels and drains, piped networks, manholes, inlets/ outlets, stormwater quality treatment devices (i.e. wetlands, swales, raingardens etc), detention dams, diversion devices, and pump stations.

5.4.2 Primary Stormwater System

5.4.2.1 The primary stormwater systems include both open and closed conduits and shall be designed to cater for the flows generated by the event specified in the design standards in Section 5.4.6 below.

5.4.2.2 The location of primary systems shall be aligned with natural flow paths as far as possible.

5.4.3 Secondary Stormwater System

5.4.3.1 The secondary system (flowpath) is the route taken by stormwater when the primary system is unable to cope either because of blockages or because the hydraulic capacity of the primary system is exceeded by a larger-than design storm.

5.4.3.2 The secondary stormwater system shall consist of ponding areas and overland flow paths with sufficient capacity to transfer the flows generated by the event specified in the design standards in Section 5.4.6 below.

5.4.3.3 Secondary flow paths from upstream properties shall be maintained during development processes.

5.4.3.4 The effects of flows in excess of the design capacity shall be considered and minimised as far as practically possible.

5.4.3.5 For infill and brownfields development where it is unrealistic to provide adequate secondary flow path arrangements through existing downstream urban areas, detention arrangements will be required to supplement available routes in accordance with Table 5-9.

5.4.3.6 Flow paths are to be:

a) Aligned with natural flow paths wherever possible;

b) Via roads, public walkways or right of ways wherever possible;

c) Kept clear of proposed building sites;

d) Protected by legal easements in favour of Council;

e) Subject to an encumbrance placed on the title of the land which prohibits ground reshaping and the erection of any barriers to the secondary flows;

f) Appropriately formed and/or hardened to make their presence obvious and durable;

g) Designed for public safety.

5.4.3.7 Where roads are designed as part of a secondary flow path, adequate access and egress shall be provided to affected properties without compromising the required flow capacity and in accordance with relevant freeboard requirements.

5.4.3.8 The existing constructed or natural flow paths shall be retained as far as practical. Any alteration of the existing stormwater system shall result in no detrimental impacts to either upstream or downstream properties.

5.4.3.9 Secondary systems shall be located on public land where possible. However, creation of an overland flow path is not to be considered as justification for the land it passes through to be vested in the Council.

5.4.3.10 Where open drains or secondary flowpaths cross private property these will be protected by:

a) Legal easements in favour of Council and;

b) Consent notice on the title (top of bank to top of bank) to protect the drain or flowpath from development.

5.4.3.11 The developer shall identify on the engineering plans the location of flowpaths until the point that the flows meet an existing watercourse or discharge point.

5.4.3.12 Public safety shall be incorporated into any design. Where secondary flow paths traverse pedestrian or vehicular accessways or public carriageways, the guidelines is that the expected flow does not exceed the below thresholds:

Pedestrian safety	$d_{flow} \times v_{ave} < 0.3\ m^2/s$
Vehicle safety	The height of the total energy line (water level + energy head) shall not exceed 300 mm above roadway surface at the low point of the cross section. Flow along the road should not exceed $d_{flow} \times v_{ave} < 0.3\ m^2/s$, except with specific floodway design and additional protection.

Where:

d_{flow} = flow depth in the channel adjacent to the kerb, eg, measured from the invert of the channel (m).

v_{ave} = average flow velocity of the flow (m/s).

Note:

- A maximum depth is required for vehicle safety because small cars can float in depths exceeding 300mm.

- Any sites that do not comply with the above thresholds require approval from the Engineering Manager and shall be clearly identified on engineering plans.

5.4.3.13 Freeboard shall be provided for secondary flowpaths in accordance with 5.4.5.5.

5.4.3.14 Secondary flowpaths shall not be piped due to the risk of blockages. Piping may only be used where no other option exists and are subject to specific approval of the Engineering Manager.

5.4.4 Debris flow

5.4.4.1 Steep (25°-40°) gully catchments shall be assessed by a Chartered Engineer and experienced professional for the risks of debris flows and determining appropriate lateral separation and building freeboard.

5.4.4.2 The design debris flow path shall be based on a 500-year ARI rainfall event. Where these impact on a development site, they shall be shown on engineering plans.

5.4.5 Freeboards

5.4.5.1 Freeboard shall be provided for as a provision for flood level design estimate imprecision, construction tolerances and natural phenomena (eg. waves, debris, aggradations, channel transition and bend effects) not explicitly included in the calculations.

5.4.5.2 The minimum freeboard from the hydraulic grade level of the primary system to the finished ground level shall be 250mm (including for open channels, streams and rivers where the freeboard from the top water level to the top of bank will be 250mm). These figures are a subset of the total freeboard to building platforms as per Table 5-4.

On new subdivisions lot/section, levels (where practicable) shall have the minimum finished ground level being greater than the crown level of the road to which the pipe storm water from the allotment is drained.

5.4.5.3 The minimum freeboard height above the 1% AEP top water level shall be determined as per Table 5-4. The minimum freeboard shall be measured from the top water level to the building platform level or the underside of the floor joists or underside of the floor slab, whichever is applicable.

5.4.5.4 For areas subject to freshwater and tidal inundation, guidance on determining the top water level can be found in the Inundation Practice Note: Calculating minimum ground and floor levels for subdivision and new buildings, Tasman District Council and Nelson City Council, 2019.

Table 5-4 Minimum freeboard requirements

Type of Structure	Freeboard height above 1% AEP top water level
Non-habitable residential buildings and detached garages	0.2m
Commercial and industrial buildings	0.3m
Habitable dwelling (including attached garages)	0.5m
Major community facilities related to supply of electricity, telecommunications, water supply or wastewater disposal	0.6m
Bridges and buildings over watercourses (freeboard to underside of structure)	0.6m

Note:

i) Structures need to comply with freeboard requirements of the NZ building code and those may be separate from and in addition to freeboard requirements in Table 5-4.

ii) Specific freeboard requirements apply to areas that are at risk of coastal inundation and shall be in accordance with Inundation Practice Note: Calculating minimum ground and floor levels for subdivision and new buildings, Tasman District Council and Nelson City Council, March 2019.

iii) Any proposed deviation from the freeboard requirements in Table 5-4 shall be approved by the Engineering Manager.

5.4.5.5 The minimum freeboard for secondary flow paths shall be as per NZ Building Code section 4.3.1 of E1/VM:

5.4.5.6 The floor level shall be set at the height of the secondary flow generated by the 1% AEP flood event plus an allowance for freeboard. The freeboard shall be:

a) 500mm where surface water has a depth of 100mm or more and extends from the building directly to a road or carpark, other than a carpark for a single dwelling.

b) 150mm for all other cases

Note:

The 500mm freeboard allows for waves generated by vehicles. Such waves will not be sustained unless there is at least 100mm depth of water and an unobstructed path from the point where the wave is generated to the building.

5.4.6 Design Standards

5.4.6.1 The design of the stormwater system shall cater for the design storms of at least the Annual Exceedance Probability (AEP) as shown in Table 5-5.

Table 5-5 Stormwater System Design Capacity Requirements Nelson

	Nelson City Council	Tasman District Council
Primary systems: stormwater - pipes culverts and open channels	6.67% AEP + climate change (15-year ARI)	10% AEP + climate change (10-year ARI)
Flood Management - streams and rivers	1%AEP + climate change (100-year ARI)	1% AEP + climate change (100-year ARI)
Secondary systems	1% AEP + climate change (100-year ARI)	1% AEP + climate change (100-year ARI)
Dam spillway failure and freeboard sensitivity analysis	Probable Maximum Precipitation (PMP).	

5.4.6.2 Primary and secondary systems shall be designed taking into account the effects of climate change as expected in 2090 based on climate change scenario RPC 8.5 (Representative Concentration Pathway).

5.4.6.3 It is the discretion of the Engineering Manager to require a higher or lower design standard than the standards set out in Table 5-5 in certain occasions or for specific locations. The Engineering Manager will inform designers of any specific requirements outside the above standards. (eg. where the downstream network has a greater design capacity)

5.4.7 Stormwater Quality

5.4.7.1 The effects of development on stormwater quality associated with urban land uses such as roading, parking, industrial zones and certain building materials shall be mitigated.

5.4.7.2 Quality control shall mitigate the effects of contaminants that are picked up by stormwater runoff and accumulate in fresh water and marine water receiving environments. The main contaminants of concern include sediment (total suspended solids), heavy metals (Zinc, Copper, and Lead), and hydrocarbons (oils and grease).

5.4.8 Stormwater Treatment Requirements (water quality)

5.4.8.1 Stormwater treatment shall be provided within greenfield, infill and brownfield developments, including any re-development of roads and parking areas that meet the treatment requirement in 5.4.8.2.

Note:
Redevelopment of roads and parking areas is defined as works that involve the reconstruction and redesign of the road carriageway or parking area to allow for an increased capacity. It does not include isolated maintenance or restoration works such as resurfacing.

5.4.8.2 Stormwater treatment is required for all stormwater runoff that originates from a high contaminant generating surface, including:

a) All State Highways, Arterial and Principal roads;

b) Collector roads with an actual or forecast average annual daily traffic (AADT) of greater than 5,000 at full development;

c) Parking areas, exposed to rainfall, greater than 1,000m2 total surface area or more than 50 (AADT), including access ways;

d) All roads and paved areas (including metaled surfaces) within new industrial and commercial developments;

e) Service stations;

f) Unpainted or treated building materials such as copper or zinc roofing.

5.4.8.3 Stormwater treatment is not required for runoff from the following surfaces:

a) Local access roads and cul-de-sacs within residential developments with AADT less than 5000 at full development;

b) Parking areas smaller than 1,000m^2 or less than 50 AADT;

c) Footpaths and cycle paths;

d) Metaled roads;

e) Patios;

f) Sport fields;

g) Any pervious surface, including pervious pavement.

5.4.8.4 Treatment devices shall be sized to treat first flush only in accordance with Table 5-6.

Table 5-6 First Flush Requirements

Device type	First flush treatment requirement
Volume based treatment device	25mm of rainfall depth from the total area of high contaminant generating surface
Flow based treatment devices	10mm/hour of runoff from the total area of high contaminant generating surface.

5.4.8.5 Source control shall always be considered and implemented in combination with required stormwater treatment.

5.4.8.6 Appropriate stormwater treatment shall be selected based on water sensitive design principles and designed for on specific land use, associated contaminants of concern and site constraints. Any treatment device shall be designed in accordance with one of the following accepted guidance documents:

a) Stormwater management devices in the Auckland region. Auckland Council Guideline Document, GD2017/001 (GD01);

b) Hamilton City Council, Three Waters Management practice notes HCC01 – HCC07;

c) Nelson City Council/Tasman District Council, Bioretention and Wetland Practice Notes, 2019.

5.4.8.7 Areas with increased risk for oil and or petroleum spills, such as service stations and truck stops shall be designed in accordance with: Ministry for the Environment (MfE) – Environmental Guidelines for Water Discharges from Petroleum Sites in New Zealand, December 1998, ref no. ME300.

5.4.8.8 Proprietary devices are only allowed when water sensitive design solutions are demonstrated not to be feasible.

5.4.8.9 Proprietary devices shall be designed in accordance with the manufacturer's specification and proven to be able to achieve the same outcome as devices designed in accordance with any of the accepted guidance documents.

5.4.8.10 In general, the use of proprietary treatment systems in greenfield developments shall not be accepted for vesting in Council ownership.

5.4.8.11 A cost benefit analysis, including whole-of-life costs and Council's written approval is required for all devices before vesting.

Good Practice

5.4.8.12 Selection and design of appropriate stormwater management devices, including their location should be based on a whole of catchment analysis and aimed at combining multiple functions to achieve the best environmental outcome (i.e. water quality treatment, detention, infiltration, ecology and amenity values)

5.4.8.13 Enhanced water quality treatment is considered good practice and can be achieved through:

- Designing for treatment of contaminants in addition to the key contaminants of concern (5.4.7.2), including temperature increases, nutrients, gross pollutants and some household contaminants.
- Designing for treatment of runoff from surfaces in addition to high contaminant generating surfaces (5.4.8.2) such as lower hierarchy roads (< 5,000 AADT) and small carparks (<1,000m^2), driveways and patios.
- Implementation of catchment devices such as wetlands.
- Education and increased awareness through signage.

5.4.9 Stream Bank Erosion Control and Stream Health

5.4.9.1 Existing freshwater resources, such as streams and wetlands shall be maintained or enhanced through development. This shall include riparian and in-stream habitat values. Any effects from development on streams and stream health shall be avoided as far as practicable.

5.4.9.2 Rock lining or other artificial lining, including the use of geotextiles to manage streambank erosion, is not considered appropriate mitigation of effects and shall be avoided when possible. Appropriate erosion and scour protection may still be required at specific locations, such as steep catchments and stormwater outlets.

Note:
Design considerations for soft engineering are site-specific and their implementation should be carefully considered on a case-by-case basis.

5.4.9.3 The effects from development and stormwater discharge on stream bank erosion and stream health shall be mitigated through a combination of:

a) Infiltration of stormwater into the ground and;

b) Extended detention.

5.4.10 Infiltration requirements (base flows)

Infiltration is an integral part of natural drainage processes and shall be integrated into the design of the stormwater system. Infiltration reduces stormwater runoff and contributes to groundwater recharge and

base flows in streams. Infiltration of stormwater for greenfield, infill and brownfield developments shall be provided in accordance with Table 5-7 below.

Table 5-7 Infiltration Requirements

Situation	Infiltration requirements
Development, greenfield, infill or brownfield that creates no additional impervious area or where impervious surface is reduced.	None required.
Development, greenfield, infill or brownfield, located outside groundwater recharge zones*.	None required.
Development, greenfield, infill or brownfield, creating additional impervious surface greater than 50m^2 and is located within groundwater recharge zones*.	A minimum of 5 mm of runoff from the newly created impervious surfaces* shall be infiltrated within 24 hours to offset the loss of the initial abstraction of 5 mm of rainfall that uncompacted pre-development pervious areas have. *If at the time of consent application, the total newly created impervious surface is unknown, the developer should take into account an estimated total new impervious surface, based on the anticipated future use of the site and maximum allowable coverage percentage under the relevant zoning rules.

Note:

* Recharge zones are defined as:

i) Areas that are identified as having low risk for slope stability issues;

ii) Areas with a permeability rate of at least 5mm/hr (as determined through permeability test method described in in E1/VM1 Section 9.0); and

iii) Areas with a seasonal high ground water table no less than one meter below the surface.

5.4.10.1 Where infiltration is proposed in excess of the 5mm, this is encouraged provided that suitability of the site is proven through permeability testing and the infiltration system is designed with an overflow into the primary stormwater network in accordance with 5.5.15.

5.4.11 Extended detention requirements (stream bank erosion)

Extended detention is required to detain and slow down flows from frequently occurring storm events. Extended detention of stormwater for greenfield, infill and brownfield developments shall be provided in accordance with Table 5-8 below.

Table 5-8 Extended Detention Requirements

Situation	Extended detention requirements
Development, greenfield, infill or brownfield, which does not create a direct discharge into a stream or open drain.	None required.
Development, greenfield, infill or brownfield, creating additional impervious surface greater than 50m2 and a new and direct discharge point into a stream or open drain (lined or unlined).	Implement extended detention according to the following: i) Provide storage of the extended detention volume (EDV) that is the equivalent of a 50% AEP event with a two-hour duration, slowly release over 24-hours. ii) Any volume that is infiltrated on site may be subtracted from the extended detention volume.

5.4.12 Stormwater Quantity Control

5.4.12.1 The effects of development on stormwater flows and flooding associated with increased levels of impervious surface shall be mitigated.

5.4.13 Detention requirements (Flooding)

5.4.13.1 Stormwater runoff shall be detained to mitigate the effects of any additional volume or peak discharge rate that would otherwise result from the development.

5.4.13.2 Detention for greenfield, infill and brownfield developments shall be provided in accordance with Table 5-9.

Table 5-9 Detention Requirements Summary

Situation	Detention requirements
Development, greenfield, infill or brownfield that generates no additional impervious area.	None required.
Development, greenfield, infill or brownfield, where the downstream network has sufficient capacity for the increased flows (based on maximum probable development of the catchment) and/or where there are no existing flood risks that would be increased as a result of the development.	None required. (Network capacity to be confirmed by Council where known).
Greenfield development that results in additional impervious surface, where the downstream receiving network has insufficient capacity for the increased flow (based on maximum probable development of the catchment) and/or where there are known flood risks downstream.	Provide detention so that post development peak flows shall not exceed pre-development peak flows for the 10% AEP (10-year ARI) and 1% AEP (100-year ARI).
Brownfield and infill development that results in additional impervious surface, greater than 50m^2 where the downstream receiving network has insufficient capacity for the increased flow (based on maximum probable development of the catchment) and/or where there are known flood risks downstream.	50 litres/m^2 of additional impervious area. Minimum 20mm orifice for detention up to 5000 litres. Otherwise drain in no less than 24 hours

5.4.14 Detention tanks

5.4.14.1 Detention tanks shall be designed in accordance with one of the following accepted guidance documents:

a) Stormwater management devices in the Auckland region. Auckland Council Guideline Document, GD2017/001 section C5.0.

b) Hamilton City Council, Three Waters Management practice note, HCC06.

5.4.14.2 Where detention tanks are to be used to meet detention requirements, these shall be placed above ground to allow for easy inspection and maintenance (i.e. clearance of blockages), unless performance criteria can be met otherwise and design is approved by the Engineering Manager.

5.4.15 Detention basins, ponds and wetlands

5.4.15.1 Detention basins, ponds and wetlands shall be designed in accordance with the following guidance: *Stormwater management devices in the Auckland region. Auckland Council* Guideline Document, GD2017/001 sections C8.0 and C9.0.

5.4.15.2 Where detention is formed by a dam structure, a design and construction certificate shall be provided for each structure by a suitably experienced Chartered Professional Engineer stating that the dam has been designed and constructed in accordance with the appropriate requirements NZSOLD Dam Safety Guidelines 2015 and under the Building Code.

5.4.15.3 The spillway shall be capable of passing the Probable Maximum Precipitation (that the catchment would discharge into the structure) without risk of overtopping the structure or eroding the spillway.

5.4.15.4 Detention basins, ponds and wetlands shall comply with the requirements of Chapter 10 Parks and Reserves and shall be subject to the approval of the Engineering Manager prior to vesting.

5.4.15.5 Detention basin design shall mitigate any actual or potential adverse effects by addressing the following points:

a) Side slope stability and safety considerations;

b) Ease of access and maintenance, including mowing and silt cleanout;

c) Shape and contour for amenity value;

d) The effectiveness of the inlet and outlet structure;

e) Secondary overflow options;

f) Dam or bank failure;

g) Silt traps;

h) Fish passage, habitats and birdlife enhancements;

i) Road frontage of not less than 30m width;

j) Pedestrian links to other reserves;

k) Safety fencing;

l) Vegetation islands, shading.

5.4.15.6 An all-weather access track shall be provided from legal road reserve to the basin, forebay and intake structures. The track shall be no steeper than 1-in-7 (steeper gradients up to 1-in-5 may

be permitted if provided with permanent sealed surface), have a physical width of not less than 3.0m and be provided with stormwater control.

Good Practice

5.4.15.7 Where on-site detention tanks are to be used, these can be designed as dual-purpose tanks with the lower two-thirds of a tank being used for stormwater reuse and the top one-third of the tank for detention. Guidance on reuse and dual-purpose tanks is provided in:

a) Stormwater management devices in the Auckland region. Auckland Council Guideline Document, GD2017/001 section C5.0.

b) Hamilton City Council, Three Waters Management practice note, HCC05.

5.4.15.8 Large communal detention structures have the potential to address multiple values at a catchment wide scale such as water quality, ecology and amenity. Because of these additional values, wetlands are preferred over ponds and dry detention basins.

5.4.16 Runoff calculations

5.4.16.1 The determination of design stormwater runoff lies with the designer of the proposed network. Calculation of runoff for design shall be determined using an appropriate, recognised, fit for purpose design methodology. The process shall be undertaken or overseen by a suitably qualified and experienced person.

5.4.16.2 All underlying assumptions used in the calculations shall be provided for review and approval

5.4.16.3 The Rational Method shall be accepted for runoff calculation from catchments smaller than 10 ha. For larger or complex catchments or where significant detention elements are incorporated in the design, runoff shall be determined using an appropriate hydrological and/or hydraulic model to the approval of council.

5.4.16.4 The Rational Method formula is: Q = CIA x 2.78.

a) Q = runoff.

b) C = runoff coefficient.

c) I = rainfall intensity.

d) A = area of catchment.

5.4.16.5 Appropriate runoff coefficients shall be used in accordance with the Building Code Clause E1 Surface Water, verification method 1, table 1.

5.4.16.6 Calculation of the time of concentration may be made explicitly, through the use of manual calculations, or via a hydrological / hydraulic model. Designers shall refer to Section 2.3 of Building Code Verification Method E1/VM1 for guidance in the calculation of the time of concentration. Note the time of concentration should be no less than 10 minutes.

5.4.16.7 Runoff methodologies developed for specific areas, such as Auckland Council's TP108, may not be appropriate and require approval from the Engineering Manager before being utilised. In all cases all underlying assumptions used in the calculations shall be stated.

5.4.17 Rainfall Data

5.4.17.1 Rainfall Intensity or rainfall depths for system design shall be sought from the NIWA HIRDS website (with allowance for climate change based on RCP8.5 scenario in year 2090. Copies of the data shall be submitted with design calculations.

5.4.17.2 In large or flat catchments, the critical rainfall intensity is likely to vary for different sections of the system and should be determined using the time of concentration at the particular point being considered.

5.4.18 Climate change

5.4.18.1 The stormwater system shall account for climate change, which is projected to alter the intensity and frequency of significant rainfall events.

5.4.18.2 Hydrological calculations shall be carried out with allowances for climate change effects, using a temperature increase of 2.6 degrees by 2090 (based on RCP 8.5).

5.4.18.3 In low-lying coastal areas mean sea levels will also affect rivers, streams and stormwater outfalls. The performance of stormwater systems in these areas shall take into account higher predicted sea levels.

5.4.19 Seismic Design and Liquefaction

5.4.19.1 All pipes and structures shall be designed with adequate flexibility and provisions to minimise risk of damage during earthquakes.

5.4.19.2 Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures (such as reservoirs, pump stations, bridges, and buildings) in natural or made ground.

5.4.19.3 In liquefiable prone areas, a geotechnical investigation will be required. The geotechnical investigation will need to assess the potential of the ground to liquefy under seismic loading and assess the likely effects of liquefaction on buried infrastructure. The assessment will be conducted in accordance with New Zealand Geotechnical Science guidance: Guideline for the identification, assessment and mitigation of liquefaction hazards.

5.4.19.4 In areas where there is a potential for liquefaction to impact upon buried infrastructure the network must be designed with special provisions to minimise the risk of damage during an earthquake.

5.5 Design Solutions

The following standards relate to the design of specific solutions used in the management of stormwater.

Mandatory Matters

These standards are requirements for the design of specific stormwater management solutions.

5.5.1 Open Channel Design

5.5.1.1 Open channels in stormwater systems shall be considered as receiving environments protected under the Resource Management Plans (regardless of modification).

5.5.1.2 The following functions shall be addressed in the design of open channels:

a) Secondary flow corridors to carry the 1% AEP flows;

b) Recreational spaces for the community;

c) Habitat for aquatic flora and fauna to promote biodiversity;

d) Open channels shall be designed with appropriate riparian vegetation cover and incorporate natural features such as meanders, ponds and riffles, native plants, shading, fish passage and refuge, invertebrate and bird habitat;

e) The design shall include maintenance access without compromise of the riparian and in-stream ecological values. Additional land will be required to avoid this compromise;

f) The design of open channels based on Manning's Formula calculations is acceptable unless unusual circumstances exist. Full details of the associated assumptions and calculations shall be presented to Council.

Mannings formula is $Q = (AR^{2/3} S^{1/2}) / n^*$
where:
Q = flow m^3/s
R = hydraulic radius (m)
S = slope of surface
A = water section area, m^2.
*n = roughness coefficient

5.5.1.3 Capacity calculations for open channels shall include consideration of future vegetation enhancement potential, making allowance for mature riparian vegetation and natural stream bed and banks in the determination of appropriate Manning's n values (minimum of 0.055).

5.5.1.4 Where open channel systems (including artificially formed drains) are to be incorporated in the stormwater drainage system, they shall be located within a Local Purpose (Utility) Reserve of sufficient width to contain the full design flood flow together with freeboard and access track.

5.5.1.5 Within urban development sites, where natural open channel areas form part of the consented stormwater drainage system they shall be cleared of all unsuitable plant growth and replanted to an appropriately approved landscape design (See Section 10.6.3 Riparian Plantings).

Good Practice

5.5.1.6 In greenfield and brownfield situations where there are existing hardened channels, culverts or piped streams, consideration should be made for day-lighting the stream and the restoration of natural channel meanders to be incorporated in the subdivision lay out.

5.5.1.7 The stream bed and banks should be designed as an integrated part of development in order to gain ecological, aesthetic, amenity and recreational benefits.

5.5.1.8 Council may require an independent assessment by a suitably qualified aquatic ecologist.

5.5.1.9 The following design criteria should be considered for aquatic habitat in streams:

a) Overhanging vegetation: planting of riparian margins should be aimed at achieving 70% shading of a wetted width of three metres or less after 20 years of tree growth.

b) Meander patterns: the radii and wavelength of stream bends need to be appropriate to the location and simulate natural streams in a similar setting.

c) Bank shape: allow for variety in steeper bank shapes and flatter beach bars as deposition zones for sediment.

d) Water depth: allow for variety of water depths with deep pools and shallower sections such as rapids and riffles.

e) Substrate: Sufficient gravel thickness, cobble and woody debris are essential components for healthy streams.

f) Flood plain: Flat benches that are designed to flood in high flows may also provide for other functions such as spawning sites and capturing sediment that would otherwise clog the channel.

5.5.2 Piping of natural watercourses

5.5.2.1 New piping and modification of natural watercourses shall be avoided.

5.5.2.2 All continuously flowing, intermittent and ephemeral water courses shall be retained as natural drainage features unless exceptional circumstances exist. The design and layout of a development will therefore need to account for retained water courses, including access and maintenance requirements.

5.5.2.3 Where piping of watercourses is justified, due to for example the ongoing maintenance requirements or access restrictions. The following shall apply:

a) Resource consent will be required.

b) Pipes shall be used or subsoil drains (Type B) shall be laid at the invert level of the pipe and connected to manholes, to ensure groundwater levels are not forced to rise. Where pipe routes differ from the original stream course, sufficient protection from seepage in the original stream bed shall be provided.

c) Secondary overland flow paths shall be provided as per Section 5.4.

5.5.2.4 Where a perennial or intermittent watercourse is replaced with a pipe, allowance shall be made for fish passage, including velocity considerations, and provision of an in-stream environment for pipes longer than 15m consisting of a 100mm to 150mm thick gravel layer.

5.5.2.5 The flow velocities shall be limited to the values in Table 5-12. As a minimum, pipes shall be increased one pipe size above that normally required and shall be embedded such that the invert is 50mm below the stream bed and the pipe maintains the same grade as the bed upstream and downstream of the pipe.

5.5.2.6 Fish recovery by a DoC permitted operator is required for ponds, watercourses and drainage channels that are filled in over a surface area of 50m^2 or more.

5.5.3 Piped Reticulation

5.5.3.1 Pipe capacity shall meet the appropriate design capacity from Table 5-5.

5.5.3.2 In urban areas, pipes shall be aligned within public areas such as road reserves wherever possible and not be placed where buildings will be place on top.

5.5.3.3 In rural areas, the public piped stormwater system shall be aligned in public areas and natural and private stormwater infrastructure shall maintain its current alignment as far as possible.

5.5.3.4 Pipes in roads shall be aligned parallel to kerb lines within the carriageway to minimise interaction with other services. Adequate clearance from other services and kerb lines shall be maintained to allow for:

a) Excavation on existing services.

b) The future renewal of the assets.

c) The provision of additional future services.

5.5.3.5 In curved roads, pipes shall generally follow the road alignment in straight lines between manholes on such alignment that they do not occupy the full carriageway width.

5.5.3.6 Diagonal crossings of other roads and services, including kerb lines and boundaries or fence lines, at acute angles less than 45 degrees, shall be avoided wherever possible.

5.5.3.7 Pipe sizes and grades shall be calculated using standard hydraulic formulae (Manning, Colebrook-White).

5.5.3.8 A pipe roughness equivalent to one of those shown in Table 5-10 shall be adopted to account for velocity head within the pipeline, gravel and grit deposits and other site variables such as construction performance and pipeline deterioration with age. Losses due to bends, manholes and sumps shall be incorporated into the design of pipe systems.

Table 5-10 Pipe Roughness

Method	Pipe Roughness
Mannings formula	n = 0.013
Colebrook-White formula	ks = 1.5mm up to 450mm pipe ks = 0.6 for over 450mm pipes

5.5.3.9 In addition, appropriate allowances shall be made for changes in direction, inlet and outlet losses and obstacles Table 5-11 gives typical energy loss coefficients (k). In addition, changes in hydraulic grade line due to changes in velocity head which shall also be allowed for.

Table 5-11 Energy Loss

Energy loss he = k v^2/2g (h in metres, v in m/s)	
Type	**K**
Sharp pipe entry (from reservoir)	0.5
90° manhole (depending on radius)	0.5 to 1.0
Velocity head loss at outlet	1.0

5.5.3.10 Where a pipe gradient exceeds 1-in-10 (10% grade, 5.74 degrees) an allowance for the bulking of the flow due to air entrainment shall be made by multiplying the area of the pipe by $(1+kv^2/gR)$.

Where:

k = coefficient of entrainment (dimensionless)
= 0.004 for smooth pipes
= 0.008 for cast-in-situ concrete culverts

V = velocity (m/s)

R = hydraulic radius (m)

g = acceleration due to gravity (9.81 m/s)

5.5.3.11 All piped systems shall be designed to accept existin0g flows from above a proposed development and shall be of sufficient capacity to provide for the primary flow from maximum probable site development.

5.5.3.12 Piped stormwater systems should generally be designed to flow full or part full under gravity at design flows with pipes aligned soffit-to-soffit.

5.5.4 Pipe specifications

Table 5-12 sets out the minimum specifications for public stormwater pipe design.

Table 5-12 Minimum Specification for Public Stormwater Pipes

Aspect	Concrete pipe	uPVC pipe	PE Pipes
Permitted size	Minimum 300mm ID Thereafter in 75mm increments	Minimum DN 300mm ID Maximum DN 500mm ID	Various
Minimum standard	NZS4058	AS/NZS1254	AS/NZS2566
Material strength	Minimum Class 2 and in accordance with AS/NZS3725	Minimum SN 8 Specific design to AS/NZS2566 method for depth >5.0m, or traffic wheel loads >96 kN	Due to the various design applications that PE Pipes can be used in, strength, cover and bedding will be
Cover depth	Refer Table 5-13	Refer Table 5-13	
Joints	Rubber ring jointed		

Aspect	Concrete pipe	uPVC pipe	PE Pipes
Pipe capacity	Refer to Table 5-14		addressed on a case by case basis.
Flow velocity	Minimum 0.75m/s or 0.3m/s in culverts where native fish may be present Maximum 6.0m/s and 0.5m/s at average flow in culverts where native fish may be present		
Pipe location (in preference)	Road reserve		
Clearance from other services	Minimum 200mm vertical Minimum 500mm horizontal (lesser clearance on approval of the Engineering Manager)		
Gravel or silt traps may be required to be installed in low velocity flow situations.			

5.5.4.1 Except at intake structures, it will not be permitted to reduce the diameter of pipe even where changes in grade would produce the required capacity in a smaller diameter of the downstream pipe. This is due to the potential for debris/sticks which could enter the system to block at the reduced orifice.

5.5.5 Pipe cover

5.5.5.1 Pipe systems shall be designed to ensure the minimum cover over the barrel in accordance with Table 5-13. Generally deep pipelines exceeding 2.5m deep should be avoided. Over-depth pipelines are difficult to access for future maintenance and renewal works.

Table 5-13 Pipe Cover Requirements

Location of Pipe	Minimum Cover Required		
	Concrete Pipe	PVC Pipe	PE Pipe
Areas subject to highway traffic loading eg., within road carriageway	600mm	750mm	Due to the various design applications that PE Pipes can be used in, strength, cover and bedding will be addressed on a case by case basis.
Areas subject to light traffic loading outside road eg. ROWs, driveways, car parks and berms	450mm	600mm	
Areas never subject to traffic loading	300mm	450mm	

5.5.5.2 Where pipes with inadequate cover require concrete encasement or capping, the extent, thickness and strength of concrete shall be specified on the drawings.

5.5.5.3 To avoid reflective cracking of pavements and differential settlement, concrete encasement and capping shall not be permitted to penetrate the base course or pavement construction.

5.5.5.4 No concrete protection shall be placed around the pipe until the line has been inspected and approved to the satisfaction of Council.

5.5.5.5 Minimum pipe cover may be reduced subject to approval from the Engineering Manager in the following cases:

a) The appropriate class of concrete pipe is specified, and cover is according to the manufacturer's specification. Details of pipe class design shall be determined by use of the

pipe class software (http://www.cpaa.asn.au/General/design-software-pipeclass.html) and provided with engineering plans;

b) Or concrete pipes are concrete encased; or

c) PVC pipes are concrete capped.

d) PE pipes will require specific design on a case by case basis.

5.5.6 Pipe connections

5.5.6.1 Piped connections to each site shall meet the following:

a) In all subdivisions, a stormwater system of a minimum 100mm diameter shall be provided to at least 1.0m inside the boundary of each lot (or body of each lot if served by ROW). Note: The pipe end shall be painted green to denote that it is a stormwater pipe and each connection shall be marked by a 75mm x 25mm marker stake suitably identified.

b) On generally flat land, sloping at 1-in-50 or less, each connection shall be capable of serving the entire building area of the section by gravity.

c) On land steeper than 1-in-50 every effort shall be made to serve the entire section. Where this proves to be impossible and the servicing of the site is limited the area on each lot capable of being serviced shall be shown on the Engineering Drawing.

5.5.6.2 In infill situations, Bubble Up discharges may be accepted at the discretion of the Engineering Manager.

5.5.6.3 Kerb entry discharges are generally not permitted. However, where specific approval is given by Council for stormwater disposal via kerb entry, installation requirements will be supplied by staff on a case by case basis.

5.5.6.4 On-site requirements for stormwater management systems, such as special sumps and filters, shall be provided for in accordance with the Building Act and Building Code.

5.5.6.5 Inspection 'T's at lot boundaries will only be required when or where downstream capacity and pipe materials are compromised.

5.5.7 Manholes

5.5.7.1 Table 5-14 sets out the minimum specifications for manholes, mini-manholes and rodding points.

5.5.7.2 Prefabricated PVC or PE mini-manholes shall only be used on approval by Council.

5.5.7.3 Mini-manholes are not to be used in areas subject to vehicular traffic, except where formed in residential driveways or rights-of-ways open to light domestic vehicles. In this instance, they shall be located out of usually trafficked areas.

5.5.7.4 The use of rodding points shall be limited to changes in pipe grade or alignment, at the top of steep banks where installation of a manhole or mini-manhole would not be practicably feasible.

Table 5-14 Required Pipe Access Openings and Limiting Requirements

Aspect	Manholes	Mini-manholes	Rodding Point
Locations where pipe access shall be provided	Manholes to be provided at: - change in size - pipe junctions - at head of Council system - at abrupt changes of grade - 120m max spacing	Mini manholes may be provided at private connections, out of areas subject to heavy traffic loading.	Rodding point may be used at change in grade or alignment on steep sections where manhole would not be practicably feasible.
Maximum pipe size	Up to 450mm pipe = 1050 mm manhole Up to 750mm pipe = 1350 mm manhole Up to 1050mm pipe = 1500 mm manhole 1200+mm pipe = manhole of 1.5 x pipe diameter*	225mm ID	225mm ID
Maximum depth	2.5m	1.0m for public pipe	2.5m
Minimum fall through manhole	50mm	50mm	
Maximum deflection angle	90° for pipe to 375mm 60° for pipe >375mm	45°	90°
Approved materials	Concrete**	PVC, PE Concrete	uPVC
Standard Drawing	513	604	609 - 610

*Factory-made “T” manholes will be permitted for pipes of 1350mm diameter and over, subject to the approval of Council.

Design shall be generally consistent with Concrete Pipe Association of Australasia (CPAA) Guidance Note

5.5.8 Pumped stormwater systems

5.5.8.1 Stormwater pumping is not permitted, unless specifically approved by the Engineering Manager.

5.5.9 Non- pumped pressurised stormwater system

5.5.9.1 A non-pumped pressurised stormwater system shall be subject to the Engineering Manager’s approval.

5.5.9.2 Where a non-pumped pressurised stormwater system is deemed to be necessary the hydraulic grade line shall be plotted on the longitudinal section. Reduced levels and the hydraulic gradient shall be quoted for the entire length of the pipeline. In no cases shall the hydraulic grade line be above finished ground level.

5.5.9.3 Adequate provision shall be made in the design for air release to minimise dangerous pressures or excessive noise.

5.5.10 Inlets and outlets

5.5.10.1 Every inlet to a piped stormwater system shall be provided with a suitable inlet structure and grill.

5.5.10.2 The minimum height of headwall above the design stream flow shall be 300mm. Note: any drop height of 1.0m or more will need appropriate fall protection installed.

5.5.10.3 Stormwater outlets shall be designed in accordance with SD503 – SD505.

5.5.10.4 Structures are to be constructed in precast reinforced concrete and modified to provide an aesthetically pleasing appearance suitable to the particular site.

5.5.10.5 Structures are to be constructed to allow fish passage.

5.5.10.6 Refer to SD518 and SD519 for details of the Standard Sump. (For use as a minor intake only and where the risk of blockage is minimal.)

5.5.10.7 When designing inlets to culverts, debris screening may be required. The need for debris screens or grilles will be subject to specific design, taking into account the likelihood of debris flowing from the upstream catchment and potential impact on the culvert.

5.5.10.8 Culvert inlets are not generally screened for safety reasons. However, a risk assessment shall be undertaken on each culvert (and the surrounding catchment) to ascertain if a grille is required to prevent accidental entry to the culvert. If a grille is required, provision shall be made for the effects of debris build-up against that grille.

5.5.10.9 There shall be suitable access for maintenance personnel and for any mechanical plant required to remove debris build-up from the grille.

5.5.10.10 Pipeline and culverts requiring an inlet structure shall take account of the inherent hydraulic losses associated with flow transition to ensure the inlet is appropriately sized to convey the design flow without heading up and overtopping and blockage as per Section 5.5.13.

5.5.10.11 Modified intakes will be required at specific locations to provide additional protection to the pipe inlet against the risk of blockage by solids and floating debris. SD506 – SD510 provide details of general examples of deep trap sumps and railway iron trash racks and sump. Each case will require specific design to suit the site with regard to peak flows, secondary intakes, expected debris and access for maintenance. Final details shall be submitted to the Council for approval.

5.5.10.12 In the case of a temporary intake, the structure shall be adequate for the estimated period before the permanent extension. Temporary intakes and outlets shall be designed to cope with individual requirements including fish passage.

5.5.11 Outfall water levels

5.5.11.1 Where a pipeline or waterway discharges into a much larger system, the peak flows generally do not coincide. Backwater profiles should produce satisfactory water levels when assessed in accordance with method NZS4404 – clause 4.3.9.8.

5.5.12 Culverts

5.5.12.1 Culverts shall be of sufficient strength to support all designed superimposed loads in accordance with NZS/AS 3725 and culvert design manuals. Note – minimum 375mm diameter for rural access crossings.

5.5.12.2 Culverts shall have adequate wingwalls, headwalls, aprons, approved grills, traps and/or pits to prevent blockage, scouring and erosion.

5.5.12.3 Inlets shall be designed to ensure adequate intake capacity and provide headwalls no lower than maximum surcharge levels.

5.5.12.4 Any headwall above a drop of greater than 1m shall have barriers complying with the Building Code.

5.5.12.5 Sufficient erosion protection shall be provided in the event of flow over an embankment.

5.5.12.6 Culverts shall allow for fish passage designed in accordance with the NZ Fish Passage Guideline.

5.5.13 Culvert and Sump Blockage

5.5.13.1 For pipe sizing a blockage factor of 10% shall be allowed for culverts of less than 3.0m dimension.

5.5.13.2 System blockage shall be considered in the design of the system and documented for all designs and a secondary flow path shall be kept unobstructed at all times.

5.5.13.3 The secondary flow path design shall assume the total blockage of the culvert where it is less than 1500mm and 50% blockage of the culvert where it is greater than or equal to 1500mm.

5.5.13.4 The risk assessment for system blockage shall consider:

a) The likelihood of blockage given the availability of debris (including sand for tidal outlets);

b) The likelihood of debris transport given the flow path slope and catchment land use;

c) The size of openings that may block; and

d) The consequences of that blockage including floor level flooding, unsafe flows, excessive erosion, structural damage or damage to historical areas.

e) The risk assessment may require allowance for 100% blockage of pipes greater than 1500mm in some circumstances.

5.5.14 Sumps

5.5.14.1 Sumps shall be located to ensure that the total system design flow can enter the pipe system and that surface flows across intersections are minimised. In hill areas, the total system design flow will include run-off from any upslope hillsides that are not specifically drained. In many cases this will mean the use of closely spaced sumps or flow diverters to ensure that the flow to which the piped system is designed can actually get into the system.

5.5.14.2 Sumps shall be to Council standard in accordance with SD 515 – SD 525 and in accordance with the requirements of Table 5-15. Sumps in cycle facilities shall have cycle friendly grates.

5.5.14.3 The standard sump to be incorporated with all kerb and channel or mountable kerb and channel is the Back-Entry Sump as detailed on SD 515 – SD 517.

Table 5-15 Required Sump Locations and Limiting Requirements

Location	Standard Back Entry Sumps	Standard Back Entry Sumps with flow diverter	Double Back Entry Sump
Approved locations	At each tangent point of the channel on the upstream side of road intersections where the grade is flatter than 1-in-10 (10%, 5.74 degrees). At any low spot in a channel. Serving any right-of-way.	At each tangent point of the channel on the upstream side of road intersections where the grade is equal to or steeper than 1-in-10. Where the channel upslope of the sump is steeper than 1 in 10. Where area of the catchment warrants the provision of adequate stormwater entry.	Where the length of kerb and channel draining to a low point is excessive. At a low point at the head of a cul-de-sac or street where secondary flow paths flow through private property.
Minimum lateral pipe size	225mm ID	225mm ID	300mm ID
Standard Drawing	516 - 519		
Maximum depth	1300mm		
Maximum distance between sumps*	Standard kerb: 100m Mountable kerb: 60m (Subject to specific design on a case-by-case basis)		
Approved materials	Concrete		

Note: Closer spacing of sumps may be required depending on the rate of runoff expected. Sumps shall not be positioned at vehicle crossings or pram crossings.

5.5.14.4 Where a sump unavoidably coincides with a vehicle crossing (and back entry is not feasible) an additional standard (back entry) sump or flow diverter shall be constructed on the upstream side of the crossing and the pipe extended into the sump.

5.5.14.5 The tolerance for the location, alignment and level of a sump shall be as follows:

a) Lateral alignment of the sump top shall be within a maximum of plus or minus 10mm of the design line of the kerb and channel.

b) The skew of the sump top in relation to the kerb and channel alignment shall be within 10mm of being parallel.

c) The sump shall be placed within 20mm of being vertical and 20mm of the millimetres of the maximum depth.

d) The finished level of the sump shall ensure compliance with the tolerance requirements for kerb and channel finished level as per the Transportation section of this manual.

e) The vertical alignment of kerb and channel shall be designed to ensure that no low point requiring a standard sump will coincide with any kerb and channel curve of less than 50m radius (except at the turning heads of cul-de-sacs).

5.5.14.6 Sumps draining private right-of-ways can be provided with a minimum lateral pipe size of 150mm ID subject to suitable catchment design and a secondary flow path being directed to the road carriageway.

5.5.14.7 Sumps which are located in tidal areas or in areas subject to flooding may require non-return systems to prevent backflow up the line. Other designs will be assessed on a case-by-case basis.

5.5.14.8 Sump connections may be made to the stormwater pipe by use of saddle connections as long as the centreline of the lateral is no lower than the centreline of the larger pipe in accordance with SD 526.

5.5.15 Discharge to soakage

5.5.15.1 Where disposal of stormwater to soakage is proposed as the primary form of stormwater disposal or any soakage beyond the minimum recharge requirement of 5mm, then the following details are required and to be prepared by a suitably qualified geotechnical specialist. All details to be submitted to Council for review:

a) Detailed site-specific geotechnical investigation, including comprehensive soakage testing (in accordance with Auckland Council Technical Report TR2013/040: Stormwater Disposal via Soakage) across the proposed soakage areas.

b) An assessment of the predominant soakage paths and soakage rates, both vertical and horizontal that make up the soakage zone and confirm the extent of 'horizontal' soakage and the effects that this may cause on land stability, both of the current and future lot(s) and on any other adjacent property and or existing or future structures that are built or likely to be built within the soakage zone.

c) Specific documentation of the likely winter peak groundwater table level.

d) Detailed calculations, drawings and field soakage test results

e) Device design details for on-site stormwater disposal of primary and secondary flows

f) System blockage shall be considered in the design of the system and a secondary flowpath shall be kept unobstructed at all times.

g) Stormwater treatment shall be provided in accordance with 5.4.8.

5.5.15.2 For any development intended to include privately owned soakage systems, a consent notice or other appropriate legal instrument shall be included on titles.

5.5.15.3 Where a Public stormwater system is accessible from the site, the developer shall determine whether the system has sufficient capacity and enquire with Council whether there are any other known constraints.

5.5.15.4 Where there are capacity constraints on the existing public system the developer shall provide appropriate detention or remove all the downstream constraints.

5.5.15.5 Soakage shall not be constructed within flood plains and overland flow paths shall be provided in accordance with Section 5.4.3.

5.5.16 Access to stormwater features and surface cut-off drains

5.5.16.1 Access to Local Purpose (Utility) Reserves, intake and outlet structures, wetlands and other treatment devices and alongside open channels shall always be provided for maintenance and conform with the following requirements:

a) An all-weather access track for trucks and wheeled excavators.

b) Three (3) metres wide for travel able to be accessed by an 8.2t axle weight rigid vehicle for its entire length.

c) 4m minimum width where excavators will swivel to access the feature and providing sufficient space for operation of plant to work on the feature.

5.5.16.2 Where a feature is greater than 15m wide then access tracks will be required on both/all sides.

5.5.16.3 Narrow features (<15m wide) will require a 4m access track on one side and a 1.5m access corridor on the other between the top of bank and the edge of the Council Utility Reserve.

5.5.16.4 The access shall not compromise riparian or instream vegetation. Additional land area will be required where there would otherwise be a compromise.

5.5.16.5 Where possible, access tracks shall be placed on the east and south sides of narrow features to allow for additional tree planting on the western and northern sides for the purposes of shading.

5.5.16.6 Where the access track is greater than 50m in length, a turning area for an 8.2t rigid truck shall be provided in addition to the working area.

5.5.16.7 A permanent sealed access track with stormwater control shall at no point be steeper than 1-in-5 (11.3 degrees, 20% grade).

5.5.16.8 Unsealed or undrained tracks shall at no point be steeper than 1-in-7 (8.1 degrees, 14.4% grade).

5.5.16.9 Where the piped system is less than 300mm diameter the Engineering Manager may approve an access suitable for pedestrian only. Under no circumstances though, will approval be given for an access steeper than 1-in-2. An easement may be required to protect the access-way. (See also the Legal section on legal easements).

5.5.16.10 Drawings of the proposed access shall be submitted to Council for approval prior to commencing construction of the access.

5.5.16.11 Where located on private land, the access shall be covered by an easement or right-of-way in favour of Council from legal road reserve to the location of the structure.

5.5.16.12 To encourage the best use of these reserves they shall be linked wherever possible with other reserves and other public open spaces, to accommodate off road pedestrian and cycle access.

5.5.16.13 Access points for public use and maintenance shall be provided at regular intervals along the system together with footpath and pedestrian bridges, as may be defined in the resource consent.

5.5.16.14 The design and construction of any stormwater management practice shall take into consideration the future ownership, access and maintenance requirements and shall ensure that maintenance can be carried out with little or no disturbance to the surroundings or neighbouring properties.

5.5.16.15 Surface cut off drains may be required parallel and adjacent to the uphill boundaries of upper sections to protect them from surface water runoff. When required these shall be located within the lots that are to be protected and secured with easements in favour of the lots being protected. A consent notice shall be registered on the section outlining that the property owner is responsible for maintaining the cut-off drain.

5.6 Construction and Installation

Mandatory Matters

The following requirements are mandatory in respect of the installation of stormwater management systems.

5.6.1 General

5.6.1.1 The selection of materials and construction methods must ensure durability, robustness, and ease of maintenance.

5.6.2 Health and safety

5.6.2.1 The health and safety risks associated with a stormwater system and its construction shall be considered and include, but not be limited to, dangers of entrapment, engulfment and asphyxiation.

5.6.2.2 Any confined spaces within the public stormwater network shall only be accessed by an authorised and trained person. Contractors working for Council in or around the stormwater network shall submit for review a safe work methodology with supporting training evidence and an applied risk assessment relating to the intended work.

5.6.2.3 Prior to commencing any physical works on the public stormwater network involving physical access, all contractors shall meet the council's minimum health and safety requirements, have a current, Site-Specific Safety Plan (or safe work methodology) for the particular project, and have gained Engineering Approval if required. Where the Council is aware of an existing site-specific hazard, they will notify the Contractor of it.

5.6.3 Trenching

5.6.3.1 The minimum trench width shall be 300mm wider than the external diameter of the collar of the pipe being laid.

5.6.3.2 The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of bedding and pipe surround materials. See SD 801 and 802.

5.6.3.3 No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected for stability and accepted by a suitably experienced person.

5.6.3.4 A plate compactor shall be run over the trench floor to bind the surface and identify any obvious weak spots.

5.6.3.5 The contractor shall provide trench support to comply with the requirements of WorkSafe New Zealand. The contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.

5.6.3.6 Excavations shall be kept free of water during construction with sediment laden water treated.

5.6.3.7 In no circumstances shall stormwater or ground water be allowed to drain into any existing wastewater drain, and pipe ends shall be plugged to prevent such ingress.

5.6.3.8 Where the only reasonable solution is for a trench to cross an existing watercourse, drain, or gully, etc., then, the contractor shall strip all vegetation and organic material from the sides and bottom before placing foundations or backfill. Vegetation reinstatement shall be in accordance with an approved landscaping plan.

5.6.3.9 Silt traps shall be installed and maintained to prevent debris and suspended matter from entering waterbodies, groundwater, or the stormwater reticulation.

5.6.3.10 Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Developer or the contractor such deposits shall be cleared forthwith at the Developer's or the contractor's cost as the case may be.

5.6.3.11 The contractor or Developer shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

5.6.3.12 Where the bottom of an excavation is unable to provide a firm foundation with minimum bearing capacity of 50kPa (eg., clay soils that can easily be penetrated 40mm with a thumb or in sand or gravel that makes a footprint more than 10mm deep) at the required level without abrupt irregularities, engineering advice should be sought on how to provide a satisfactory foundation (see AS/NZS 2032, clause 5.3.6).

5.6.3.13 Where required, additional granular bedding material as specified in AS/NZS3725 for concrete pipes, or AS/NZS2566.2:2002 for PVC and other flexible pipe systems should be placed, compacted and re-inspected.

5.6.3.14 Where trench support extends below the invert of the pipeline or structure, special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

5.6.4 Bedding of pipes

5.6.4.1 Drainage Metal Bedding shall be in accordance with SD 614 – SD 615. (For concrete pipes, "Type H2" bedding in accordance with AS/NZS 3725:2007 shall be used.) Note: Includes bedding, haunch support and side support material as defined by NZS2566.2 and AS/NZS3725.

5.6.4.2 The bedding material shall be:

a) In a sand environment – sand.

b) For PVC and flexible pipes – NZTA M4 AP20 or as per AS/NZS2566, Appendix G.

c) For concrete pipes – NZTA M4 AP20 or as per AS/NZS3725, Table 6.

d) Specific design can be submitted for appraisal by Council on a case by case basis.

e) For PE pipes refer to the manufacturers bedding specifications.

5.6.4.3 Bedding shall be placed and raked-in so as to provide support for the pipe uniformly along the whole length of the barrel with chases provided for sockets, couplings and other appurtenances.

5.6.4.4 For PVC and flexible pipes, the bedding shall not be compacted, and the centre of the bedding shall not be walked on either during or after placement. For concrete pipes only, the centre strip of the bedding shall not be compacted (see SD614 – SD615).

5.6.4.5 The pipes shall be laid and brought to true alignment and level before installing the drainage metal haunching, side support and covering the pipes.

5.6.4.6 The drainage metal haunching and side support shall be placed uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances in a manner to ensure uniform density of side support (including haunch support) and overlay with no distortion, dislodgement or damage to the pipeline.

5.6.4.7 Following placement, the embedment material shall be compacted in layers to uniformly support the pipe. When choosing compaction equipment, the number of passes and the thickness of layer to be compacted, account shall be taken of the material to be compacted and the pipe to be installed.

5.6.4.8 Compaction equipment or methods that produce horizontal or vertical earth pressures that may cause damage to, or excessive distortion of, the pipe shall not be employed.

5.6.4.9 Drainage metal haunching and side support shall be compacted to the manufacturer's requirements. For public infrastructure, a minimum Clegg Impact Value of 25 shall be achieved at any point on any haunching constructed of AP20.

5.6.5 Pipe installation

5.6.5.1 To help with future identification the end caps and inside of the end of all new stormwater laterals must be painted with green acrylic paint and marked with a 75mm x 25mm ground treated marker stake suitably identified and partly painted green. (Note: wastewater laterals are to be marked red.)

5.6.5.2 A laser shall be used by the contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipe laying work where possible.

5.6.5.3 The maximum deviation in level of pipe invert when laid shall be 5mm from design level.

5.6.5.4 The maximum horizontal deviation from a straight line shall be 10mm.

5.6.5.5 Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.

5.6.5.6 Joints shall be flexible and watertight.

5.6.5.7 Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out. Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc., shall be thoroughly cleaned before jointing.

5.6.6 Manholes and access points

5.6.6.1 Manholes shall be constructed in accordance with SD511 and SD512.

5.6.6.2 All concrete manholes shall be made water tight by effective sealing of manhole section joints with mastic sealant and around pipe entries, where applicable, using epoxy mortar inside and out.

5.6.6.3 Connections to the manhole liner must be positioned so that the opening formed in the liner is no closer than 300mm to the riser joint.

5.6.6.4 The connection of PVC pipes to concrete structures, such as manholes and sumps, shall be with a PVC starter and finisher with a 'gritted' external surface.

5.6.6.5 All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole.

5.6.6.6 The channel through the manhole shall be formed from in-situ concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half circle invert with falls as specified in SD511 and SD512. Benching shall be steel float finished to give a regular smooth surface.

5.6.6.7 PE pipe connections to manholes will need specific design or the manhole may need to be PE also to get appropriate sealing of joints.

5.6.7 Concrete protection for pipes

5.6.7.1 At the discretion of the Engineering Manager, concrete pipes may require concrete surround under the following conditions:

a) In areas subject to vehicle traffic where the cover of the pipe barrel is, or will be, less than that required for the class of pipe as specified by the pipe manufacturer.

b) In areas other than those covered above, where the cover over the barrel of the pipe is or will be less than 300mm, irrespective of the type or class of pipe.

5.6.7.2 Flotation of the pipe during placement of concrete surround shall be prevented. PVC pipes shall not be concrete surrounded.

5.6.7.3 Where cover over PVC pipes is less than the minimum stated in Table 5-13 including temporarily under construction traffic, a concrete protection slab shall be constructed.

5.6.7.4 Reduced cover for PE pipes will require specific design and approval from the Engineering Manager or delegate.

5.6.8 Groundwater and trench stops

5.6.8.1 Where there is a possibility of migration of fines between the native soil and the pipe surround soil, the drainage metals shall be protected by an approved geotextile filter fabric that overlaps by at least 300mm.

5.6.8.2 A specific design is needed where permeable bedding is used. Water-stops and trench drainage will be constructed to prevent unwanted movement of groundwater along the trench and pipe bedding, see SD613 (Chapter 6).

5.6.8.3 Manholes can be considered to be water-stops provided they are constructed appropriately. Where water stops are required, they should be provided at the intervals shown in Table 5-16.

Table 5-16 Water Stop Spacing

Pipe Grade	Maximum Spacing
1 in 15, 6.5% grade 3.8 degrees or steeper	12m
1 in 25, 4% grade, 2.5 degrees	15m
1 in 50, 2% grade, 1.15 degrees	30m
1 in 100, 1% grade, 0.57 degrees	60m

Note – Intermediate grades (and spacing) are determined by interpolation.

5.6.8.4 Trenchless technology may be used in specific circumstances where approved by the Engineering Manager.

5.6.8.5 Trenchless technology may be preferable for alignments passing through or under:

a) Environmentally sensitive areas;

b) Built-up or congested areas to minimise disruption and reinstatement;

c) Major road crossings;

d) Significant vegetation;

e) Vehicle crossings and areas with high quality paving surface;

f) Where there is a large number of existing services;

g) 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.

5.6.8.6 For information on trenchless installation methods see Section 6.10 of the LDM.

5.6.9 Inspection and Testing

Mandatory Matters

Mandatory requirements for piped network inspections and testing are as follows.

5.6.10 General

5.6.10.1 Council requires inspection and testing of new pipes to help ensure that new infrastructure has been installed in accordance with this manual.

5.6.11 Closed-Circuit Television (CCTV) Inspection

5.6.11.1 All pipelines to be vested in Council ownership shall pass a closed-circuit television (CCTV) inspection, carried out at an appropriate time agreed by Council or at the completion of the works at the developer's costs.

5.6.11.2 A professional operator with proof of experience in operating such devices shall carry out the CCTV inspection using a pan and tilt camera, in accordance with the technical specifications of the NZ Pipe Inspection Manual (published by the New Zealand Water & Wastes Association).

5.6.11.3 The operator shall pan around every joint and check every lateral connection and defect.

5.6.11.4 The video footage in DVD format, and the accompanying CCTV log sheets for each stormwater length (as per the template in the NZ Pipe Inspection Manual), showing the features and condition of all inspected manhole lengths, shall be provided to Council accompanied by a report. Video footage supplied without log sheets and report will not be accepted.

5.6.11.5 All pipelines shall be free of debris and flushed within 24-hours prior to inspection. Inspections of non-cleaned pipelines are not acceptable.

5.6.11.6 A pipeline will fail its inspection if:

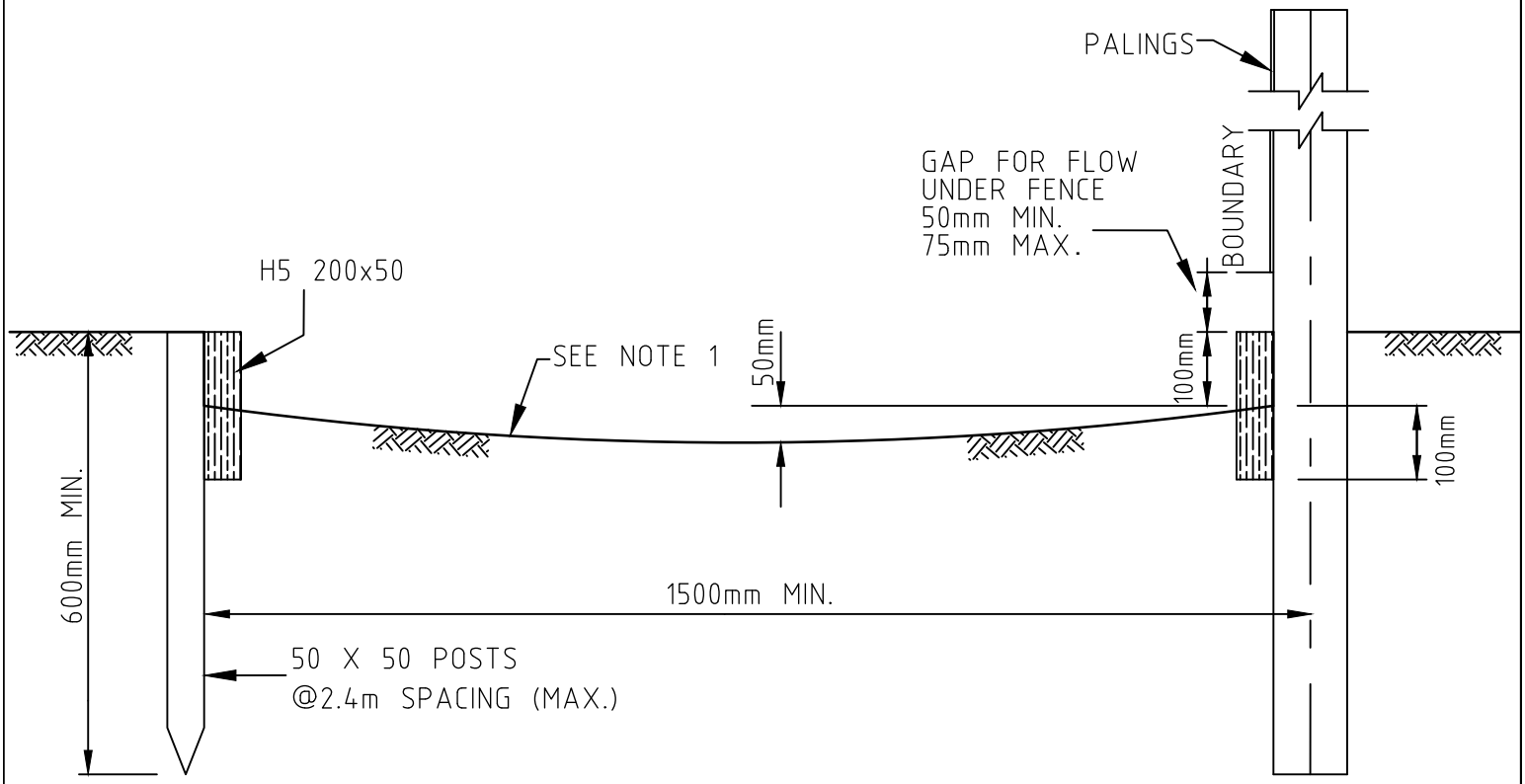
a) The pipe is horizontally misaligned or deformed by more than 5% of the pipe diameter.

b) The pipe has visible dips or ponding of water.

c) The pipe has visible defects, such as open or displaced joints, defective or protruding laterals, cracked barrels or similar defects.

5.6.12 Pressure Testing

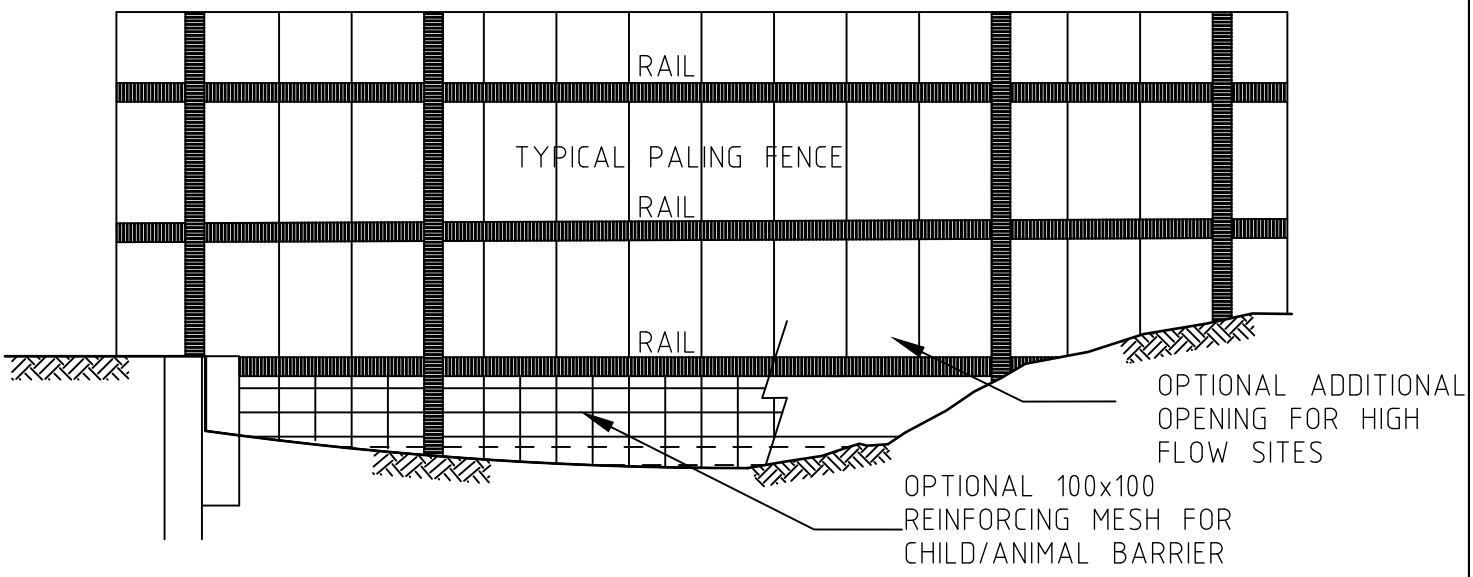
5.6.12.1 All plastic pipes and concrete pipes up to 300mm diameter shall generally be tested by the air testing procedure as outlined in the wastewater chapter refer Section 6.14 and/or as per NZS4404.



NOTES:

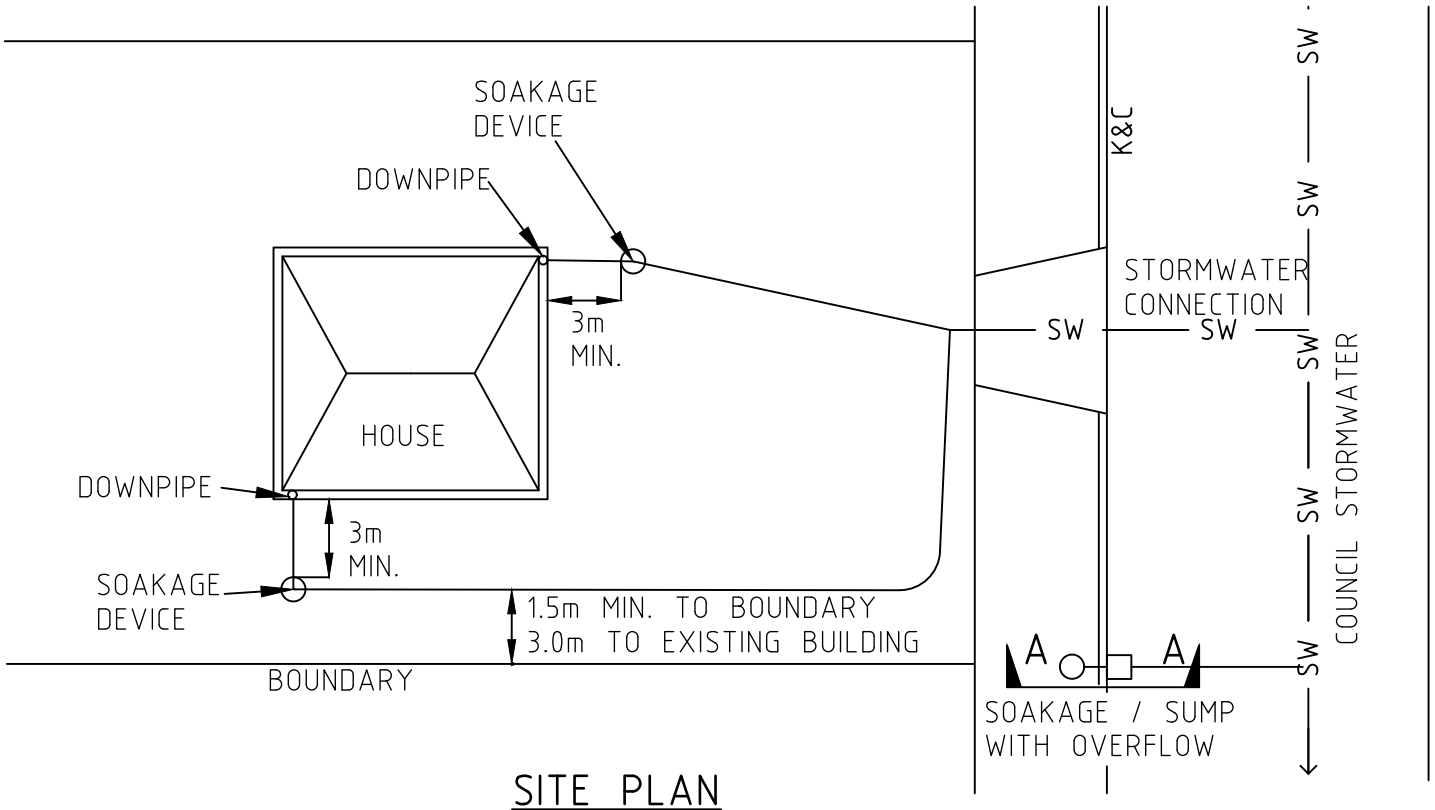
1. FOR 10 YEAR ARI FLOW VELOCITIES : <1.0m/s GRASS COVER IS SUFFICIENT
   : 1.0-1.5m/s REINFORCING MATTING IS REQUIRED
   : >1.5m/s ARMOURING IS REQUIRED

FLOW PATH DETAIL (NTS)

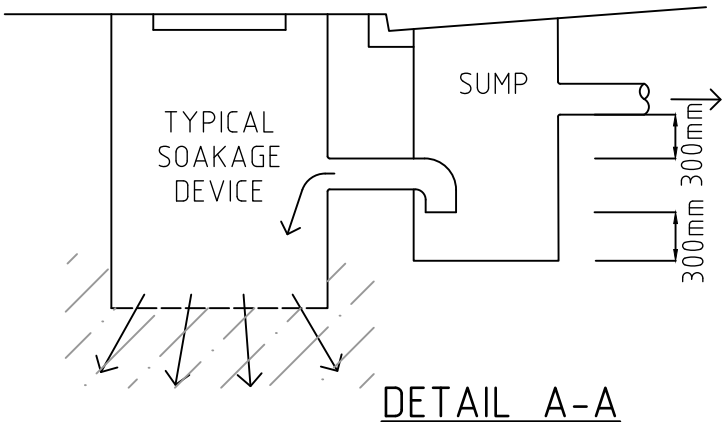


FENCE ACROSS SECONDARY FLOW PATH (NTS)

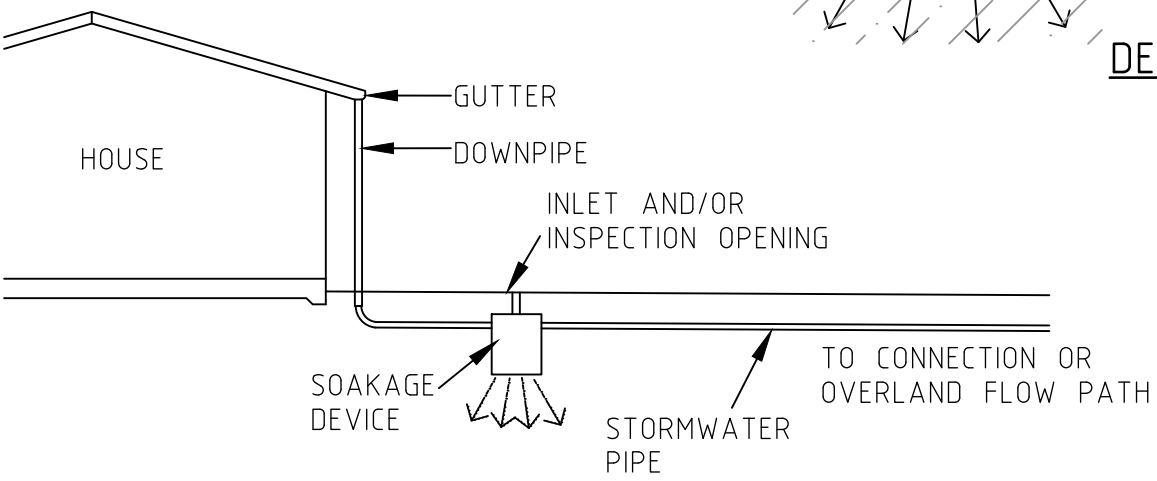
NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	SECONDARY FLOW PATH IN PRIVATE PROPERTY - GROUND / FENCE TREATMENT		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	501



SITE PLAN

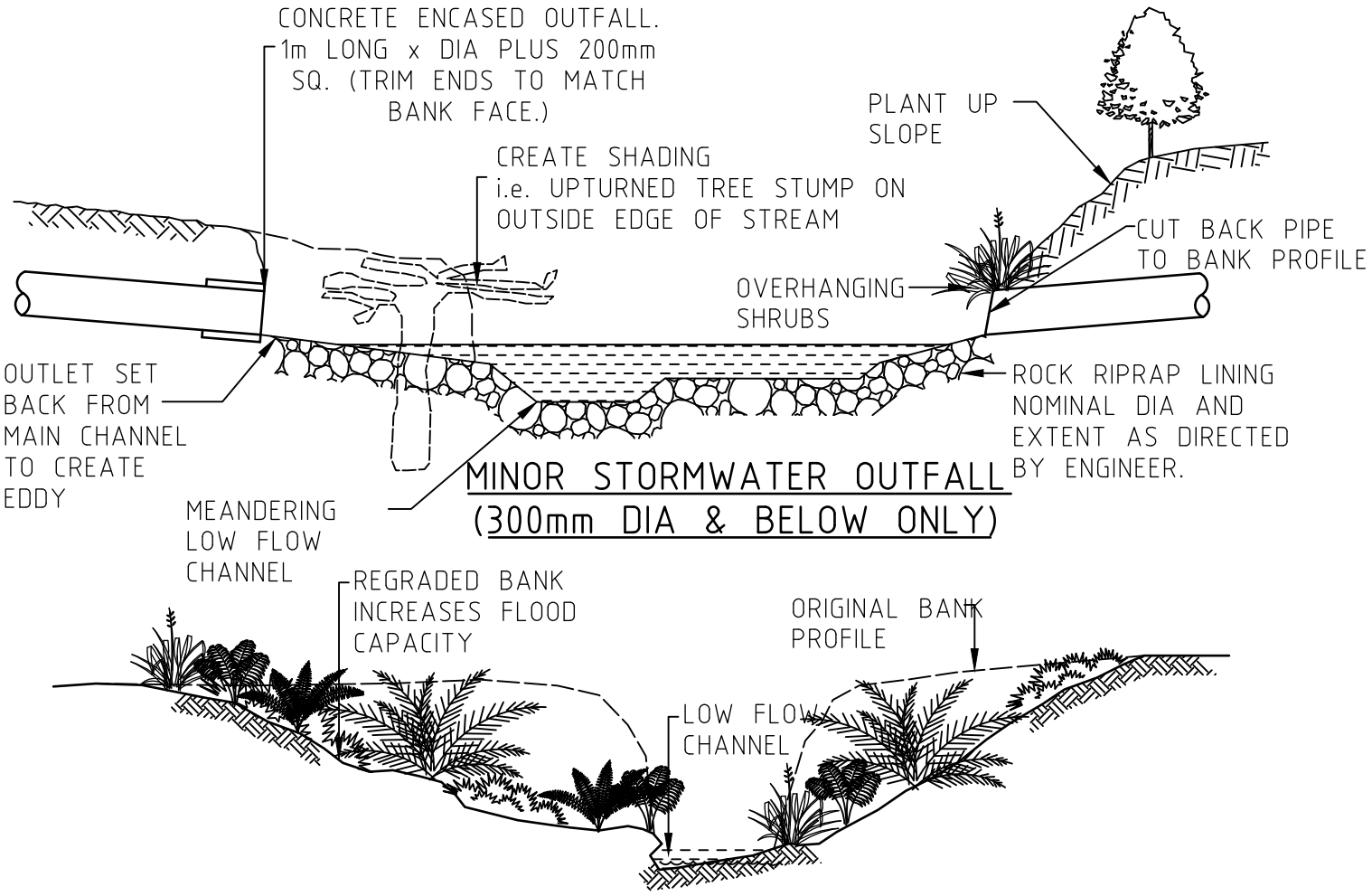


DETAIL A-A

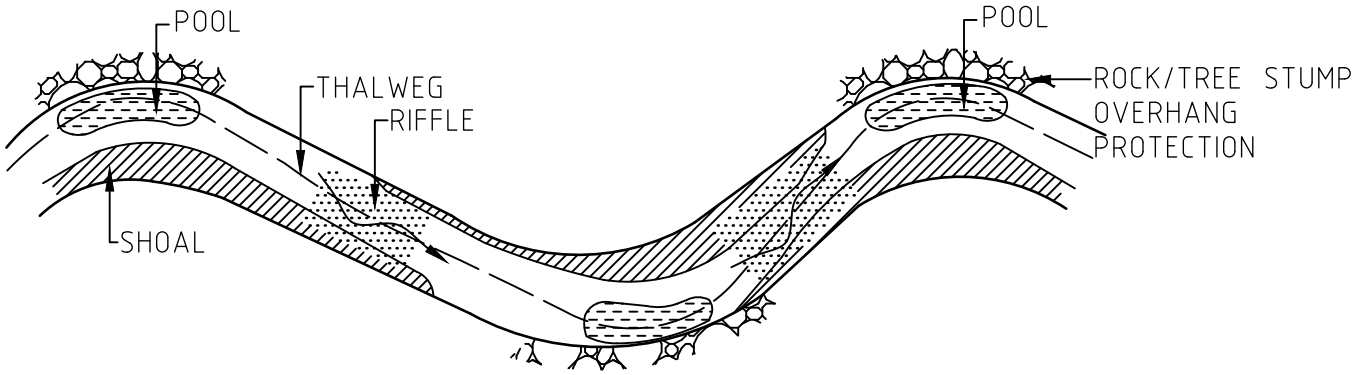


LONGITUDINAL SECTION

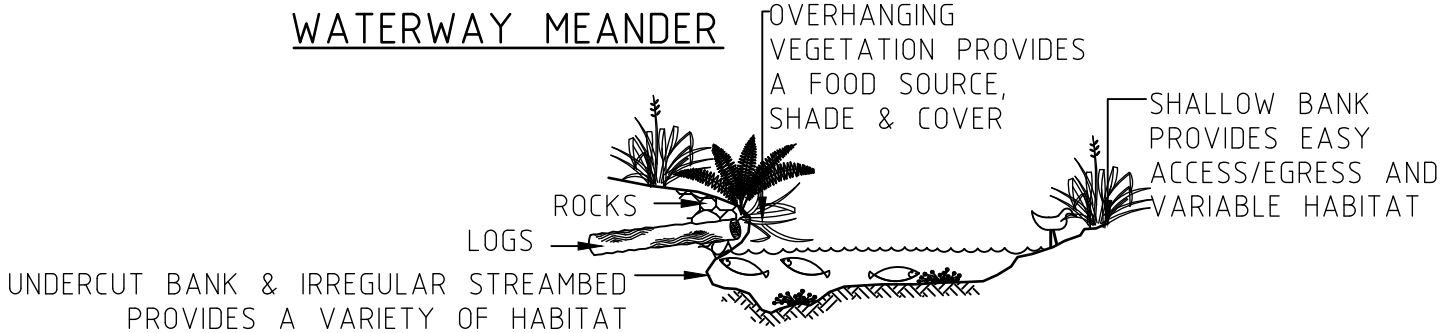
NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	DESIGN FOR MINIMUM GROUNDWATER RECHARGE AND SEASONAL SOAKAGE		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	502



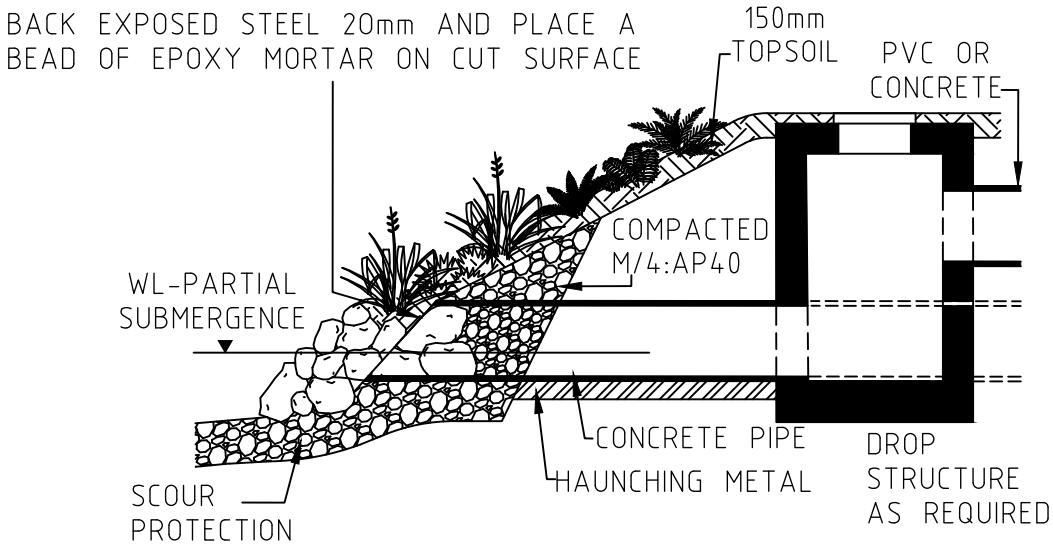
GENTLY SLOPING BANKS WILL BECOME INUNDATED DURING FLOOD FLOWS, ENABLING THE DISSIPATION OF FLOW ENERGY THAT WOULD OTHERWISE CONTRIBUTE TO CHANNEL DAMAGE. ENSURE FLOOD WATERWAY CAPACITY IS DESIGNED TO ACCOMMODATE MATURE VEGETATION.



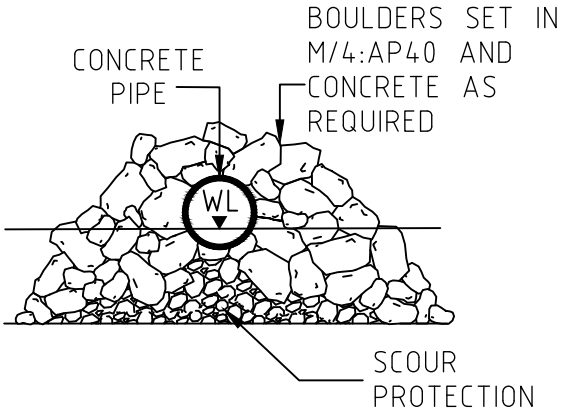
WATERWAY MEANDER



NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	OUTFALL DETAILS & DRAINAGE WATERWAY CONCEPTS		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	503



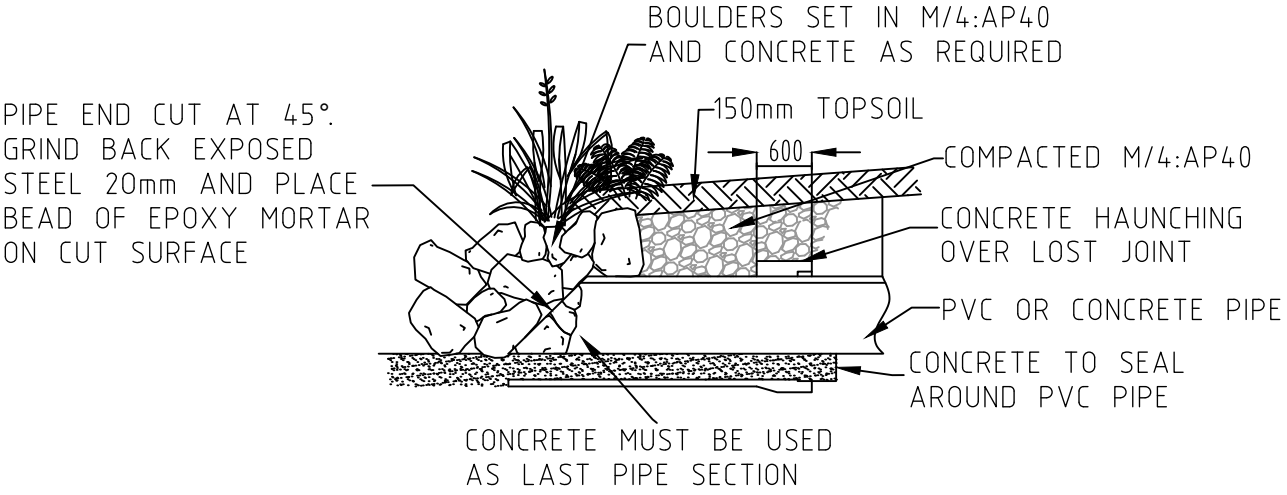
OUTFALL WITH DROP STRUCTURE



END VIEW

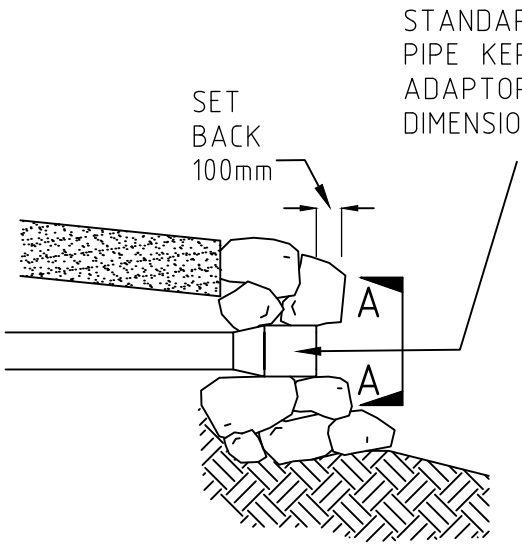
NOTES:

1. FISH PASSAGE TO BE PROVIDED FOR IN ALL OUTFALL DESIGNS WHERE REQUIRED

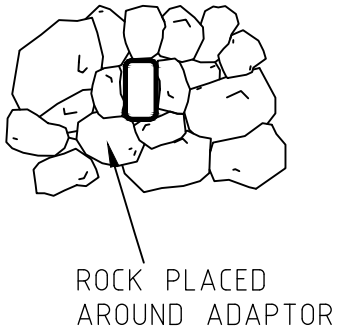


150-400mm DIAMETER OUTFALL

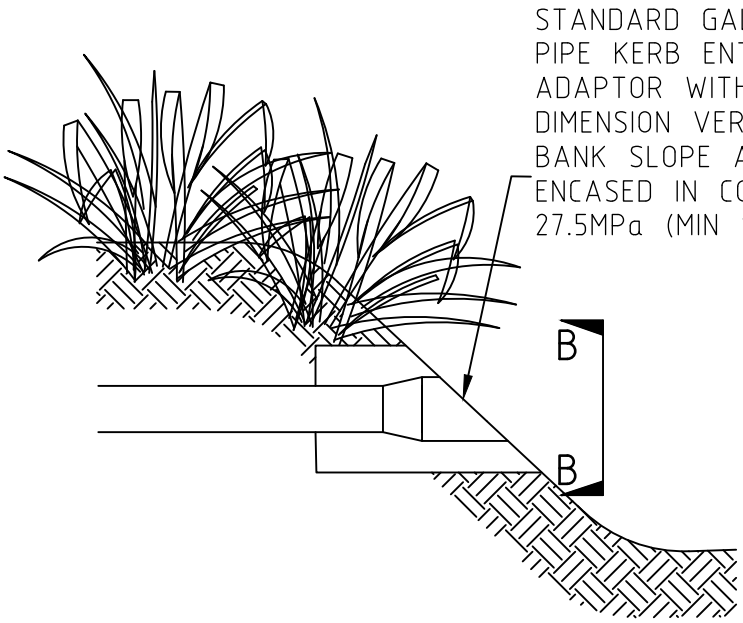
NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	150 - 400mmØ OUTFALL DETAILS & DRAINAGE WATERWAY CONCEPTS		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	504



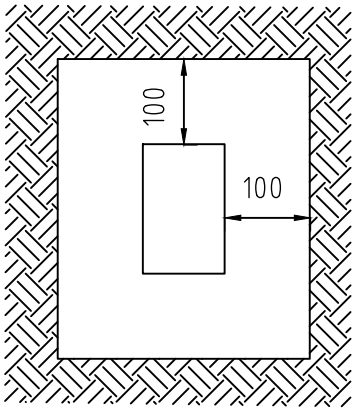
100mm OUTFALL THROUGH
ROCK RIP RAP



DETAIL A-A



100mm OUTFALL THROUGH
VEGETATED BANK



DETAIL B-B

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	100mmØ STORMWATER OUTLET TO STREAMS - DETAILS		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	505

NELSON CITY COUNCIL

GROUP MANAGER INFRASTRUCTURE, NELSON

TASMAN DISTRICT COUNCIL

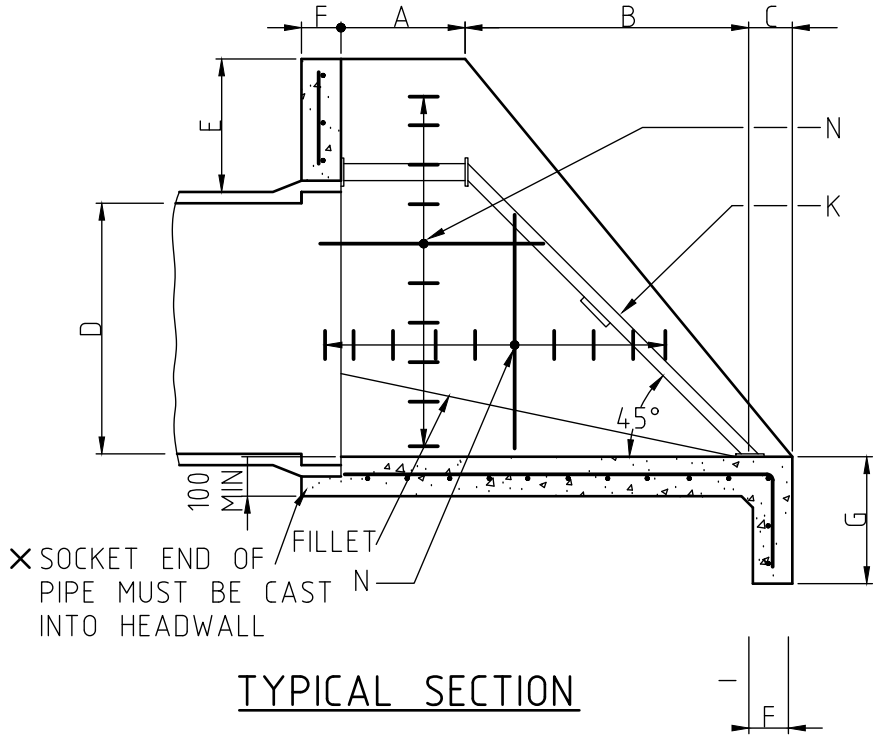
ENGINEERING SERVICES MANAGER, TASMAN

DATE 01/07/19

NELSON - TASMAN LAND DEVELOPMENT MANUAL

506

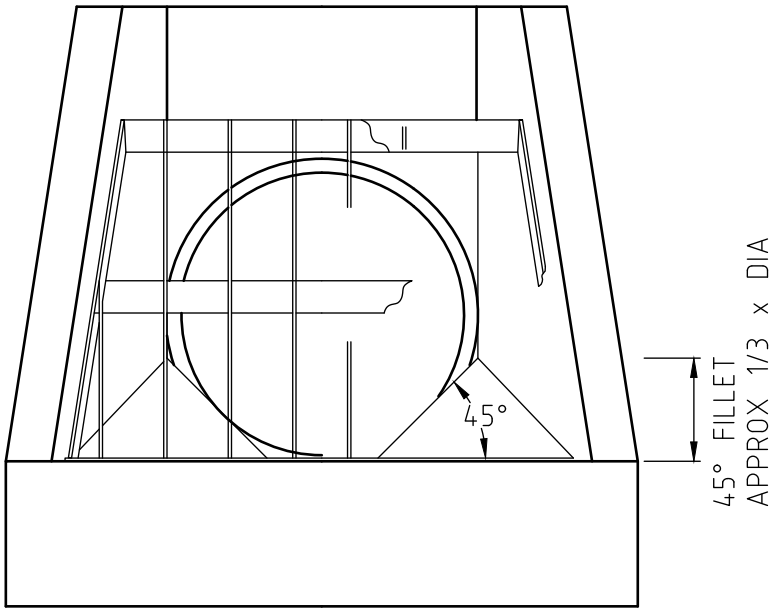
TYPICAL STORMWATER INTAKE STRUCTURE



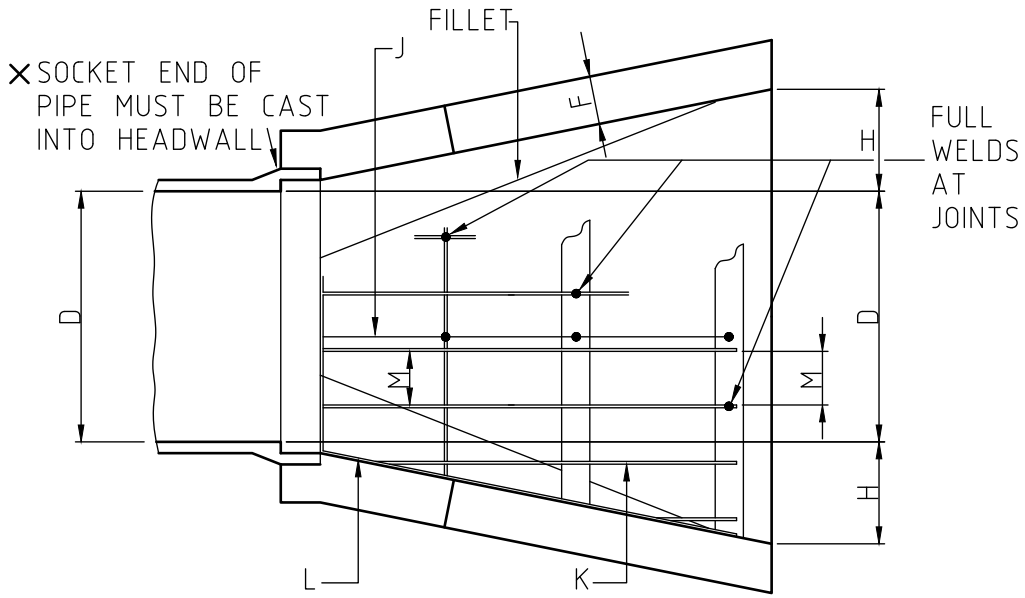
TYPICAL SECTION

NOTES

1. SEE DRAWING 507 FOR PIPE INLET SCHEDULE
2. SKEW AND/OR VERY STEEP APPROACH INLETS WILL REQUIRE DETAIL DESIGN BASED ON THIS STANDARD.
3. REINFORCING IS MINIMUM AND RETAINING WALL MUST BE DESIGNED FOR INDIVIDUAL CIRCUMSTANCES.
4. ALL REINFORCEMENT TO BE PLACED CENTRALLY IN WALLS AND FLOOR AND TO BE CONTINUOUS BETWEEN WALLS AND BETWEEN FLOOR AND WALLS.
5. AT LEAST 2 HORIZONTAL BARS TO BE PLACED OVER THE PIPE IN THE END WALL.
6. GRADE OF APRON TO BE NOT LESS THAN GRADE OF PIPE.
7. DIMENSIONS OF GRILL TO BE FULLY DETAILED FOR EACH CASE.
8. FULL HEADWALLS AND SIDEWALLS TO BE PROVIDED AS CASE REQUIRES IN ADDITION TO MINIMUM REQUIREMENT SHOWN.
9. THIS STANDARD SHOWS MINIMUM REQUIREMENTS : THE DETAILS OF CHANNEL APPROACH : DEPTH, STABILITY OF GROUND AND OTHER FACTORS IN EACH CASE MUST BE TAKEN INTO ACCOUNT IN THE DESIGN.
10. × SEE DRAWING 507 FOR ALTERNATIVE



TYPICAL ELEVATION



TYPICAL PLAN

NELSON CITY COUNCIL

GROUP MANAGER INFRASTRUCTURE, NELSON

TASMAN DISTRICT COUNCIL

ENGINEERING SERVICES MANAGER, TASMAN

DATE 01/07/19

NELSON - TASMAN LAND DEVELOPMENT MANUAL

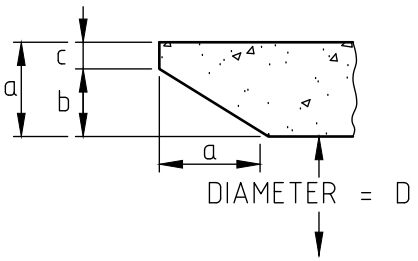
507

PIPE INLET DEBRIS GRILL SCHEDULE

PIPE INLET SCHEDULE

NOMINAL PIPE DIA	300	375	450	525	600	675	750	825	900	1075	1200	1350	1500	1575	1800
DETAIL A	300	300	300	300	400	400	400	400	400	600	600	700	700	800	800
B	500	500	600	700	800	800	900	1000	1100	1200	1400	1500	1700	1800	2000
C min	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
D	305	381	457	533	610	686	762	833	914	1067	1219	1372	1524	1600	1829
E min	300	300	450	450	450	450	450	450	450	450	450	450	450	450	450
F min	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
G min	400	400	400	400	500	500	500	500	500	600	600	600	600	600	600
H min	300	300	300	300	400	400	400	400	400	500	500	500	600	600	600
J	75x10 MS	75x10 MS	75x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS	100x10 MS
K	25x10 MS	25x10 MS	25x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS	50x10 MS
L	50x10 MS	50x10 MS	50x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS	75x10 MS
M	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
N	← 6mm dia bars at 150 crs EW or equivalent mesh. →									← 10mm dia bars at 150 crs EW or equivalent mesh →					
H.D BOLTS LINTEL	2x12 dia	2x12 dia	2x12 dia	2x12 dia	2x12 dia	2x12 dia	2x12 dia	2x12 dia	3x12 dia	3x12 dia	3x12 dia	4x12 dia	4x12 dia	4x12 dia	4x12 dia
H.D BOLTS APRON	3x12 dia	3x12 dia	3x12 dia	4x12 dia	4x12 dia	4x12 dia	4x12 dia	4x12 dia	5x12 dia	5x12 dia	5x12 dia	6x12 dia	6x12 dia	6x12 dia	6x12 dia

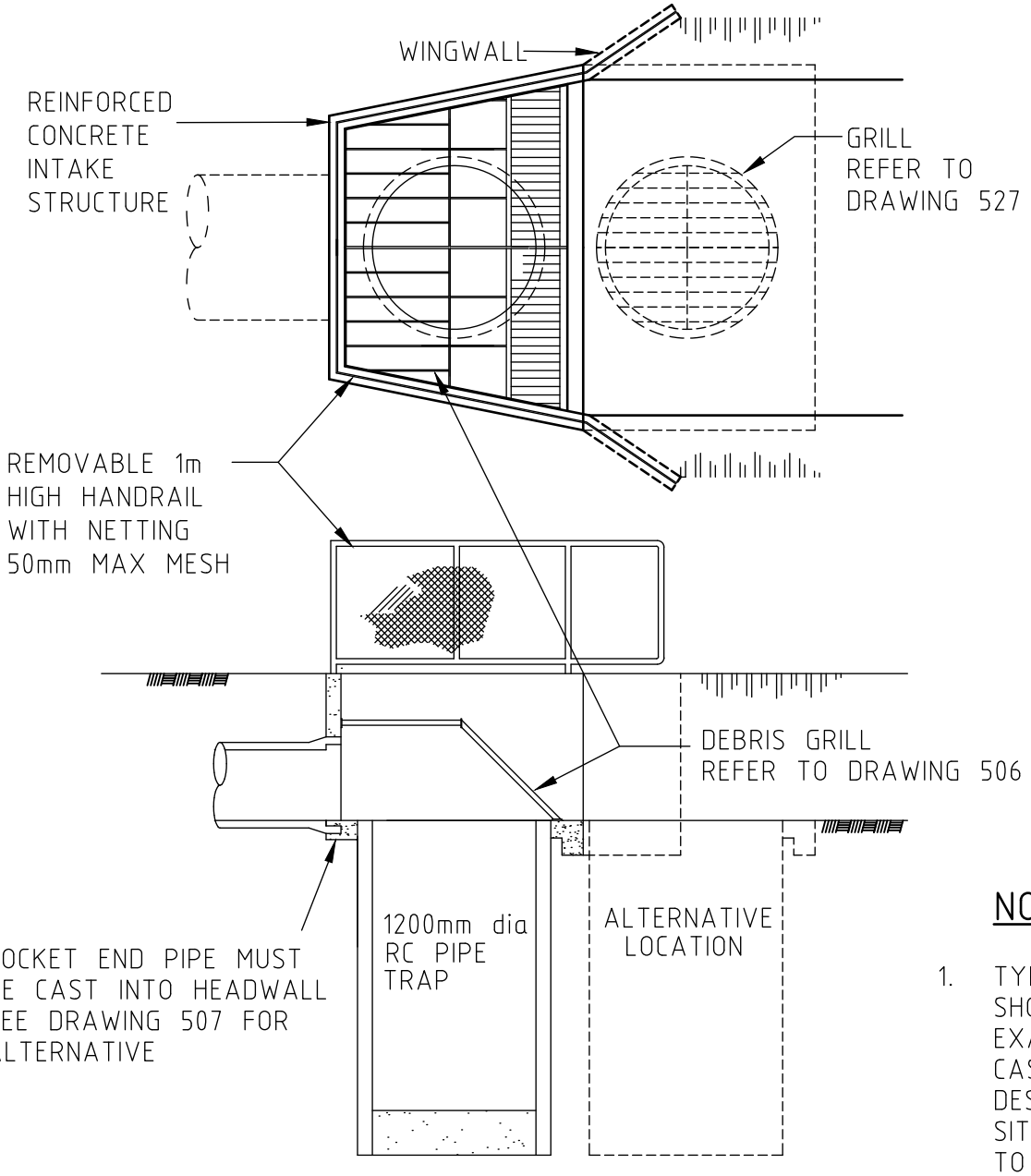
APPROVED PRECAST INLET STRUCTURES MAY BE USED



$\frac{b}{D}$	$\frac{a}{D}$	$\frac{c}{D}$	$\frac{d}{D}$	ENTRANCE TYPE
0.042	0.063	0.042	0.083	A

BEVELLED RING
MINIMUM 300°

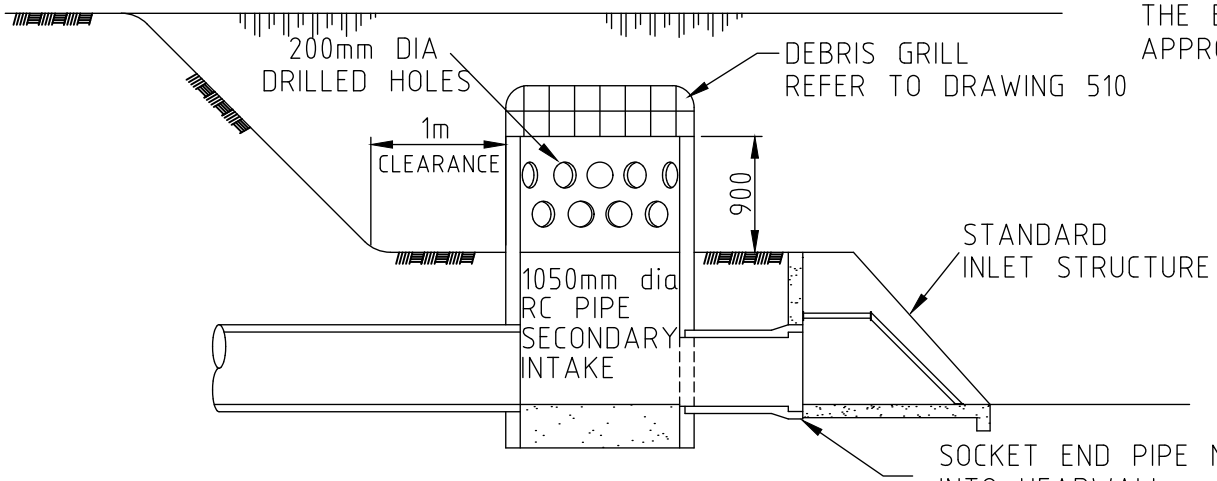
ALTERNATIVE TO SOCKET END OF PIPE



TYPE A: DEEP TRAP SUMP

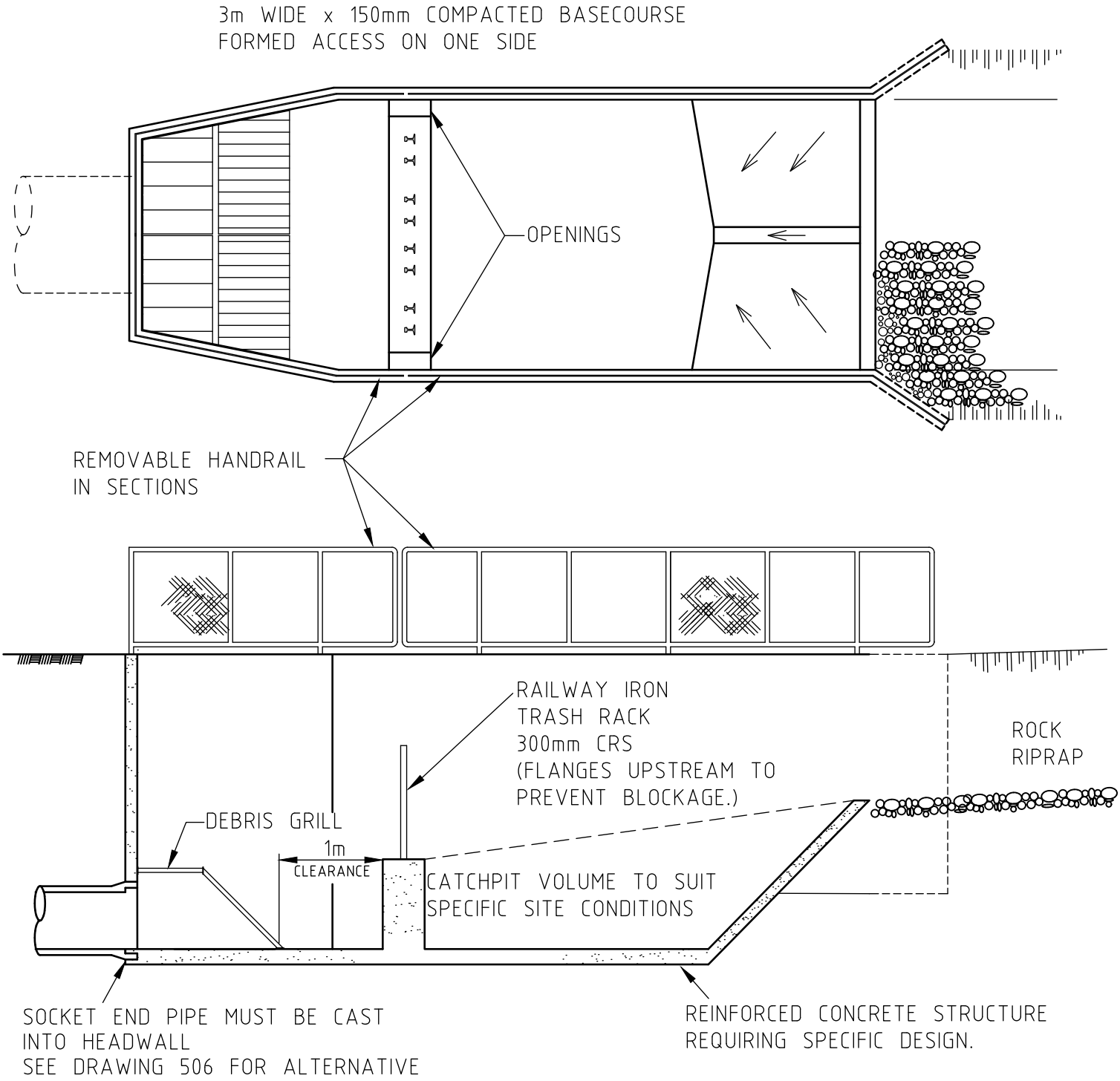
NOTES

1. TYPES A,B,C AS SHOWN ARE GENERAL EXAMPLES - EACH CASE WILL REQUIRE DESIGN TO SUIT THE SITE WITH REGARD TO PEAK FLOWS AND ANTICIPATED DEBRIS: FINAL DETAILS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL



TYPE C: SECONDARY INTAKE

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STORMWATER INTAKE STRUCTURES WITH DEBRIS TRAPS (TYPES A & C)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	508



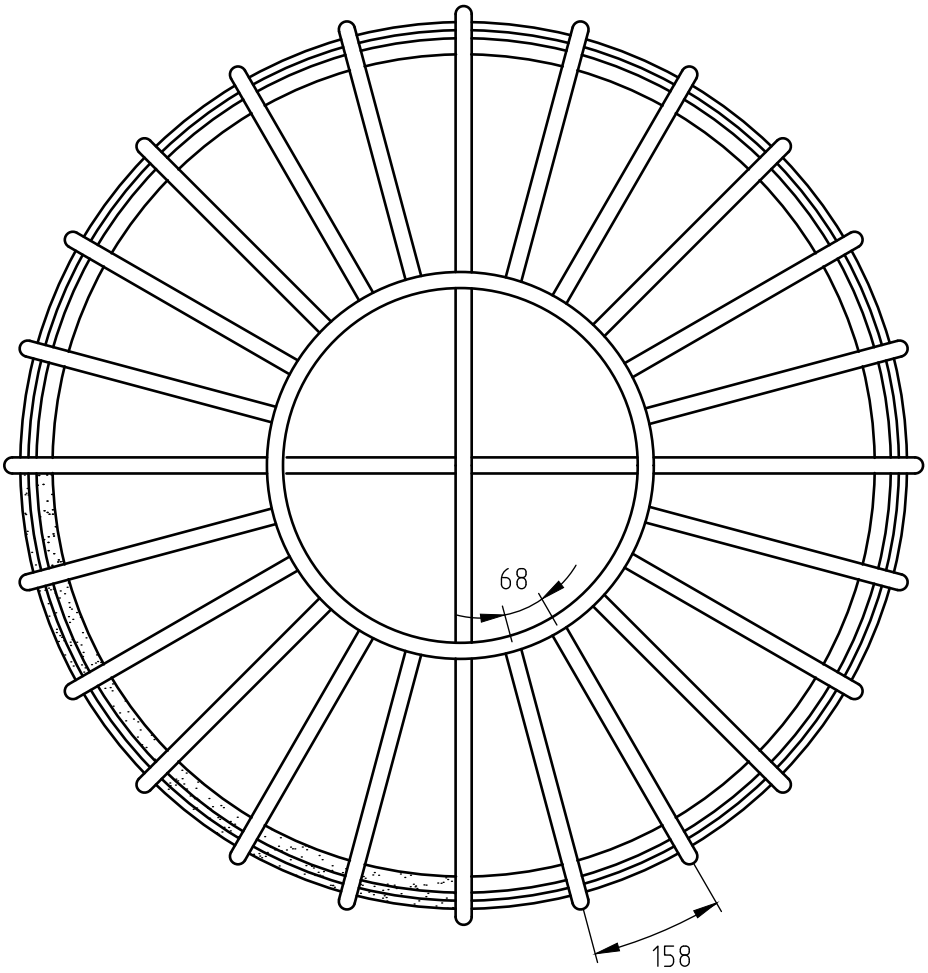
TYPE B: RAILWAY IRON TRASH RACK & CATCHPIT

NOTES

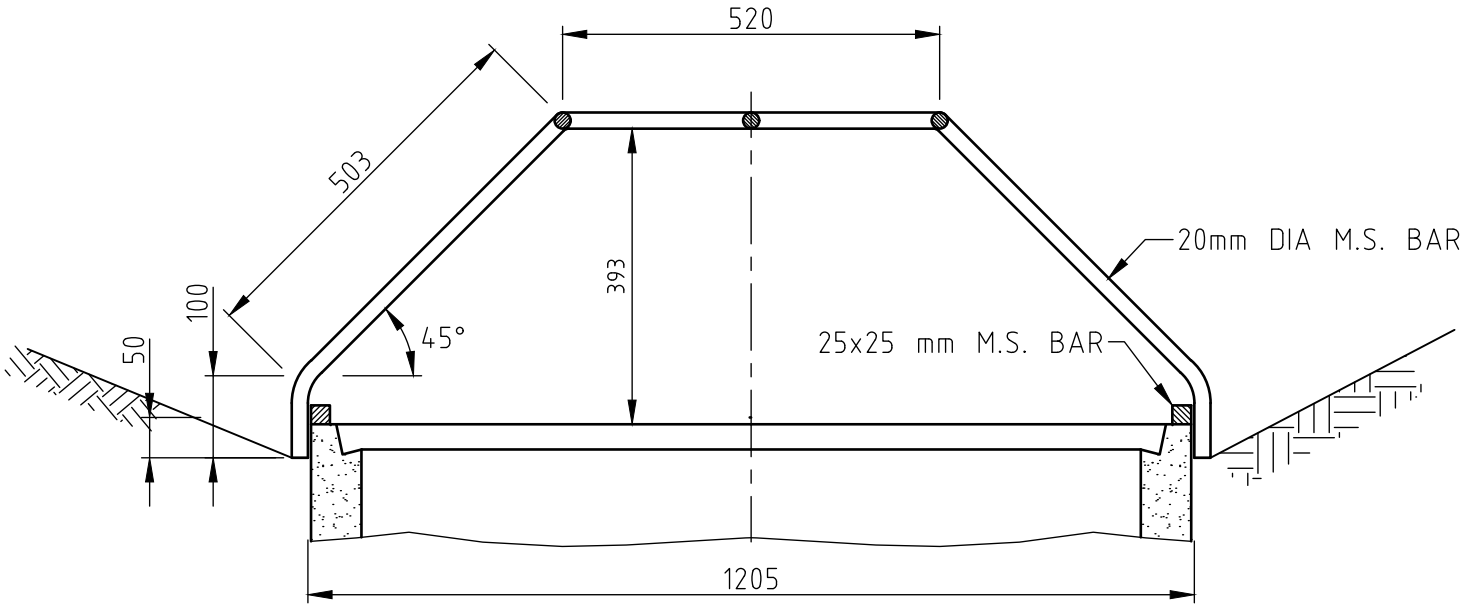
1. TYPES A,B,C AS SHOWN ARE GENERAL EXAMPLES - EACH CASE WILL REQUIRE DESIGN TO SUIT THE SITE WITH REGARD TO PEAK FLOWS AND ANTICIPATED DEBRIS: FINAL DETAILS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL

2. WHERE PROVISION FOR FISH PASSAGE IS REQUIRED BY COUNCIL, IT SHALL BE INCORPORATED INTO THE DESIGN

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STORMWATER INTAKE STRUCTURES WITH DEBRIS TRAPS (TYPE B)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	509



PLAN



SECTION

NOTES

1. DETAILS SHOWING THE FIXING DOWN OF THE GRILL TO THE MANHOLE LINER SHALL BE DETERMINED AT THE TIME OF DESIGN.

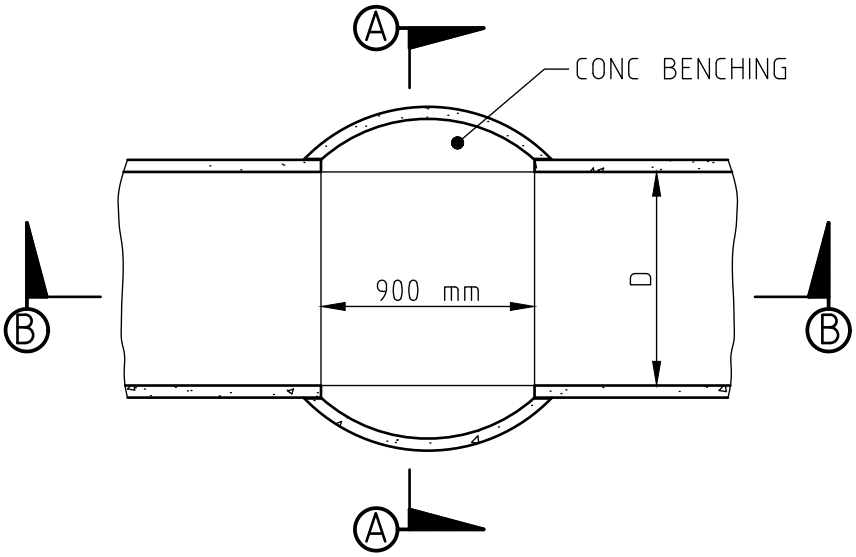
NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	SECONDARY INTAKE DEBRIS GRILL		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	510

NOTES

1. FOR PIPES OVER 1050 DIA, MANHOLES ARE TO BE A SPECIFIC DESIGN.
2. TABLE OF DIMENSIONS

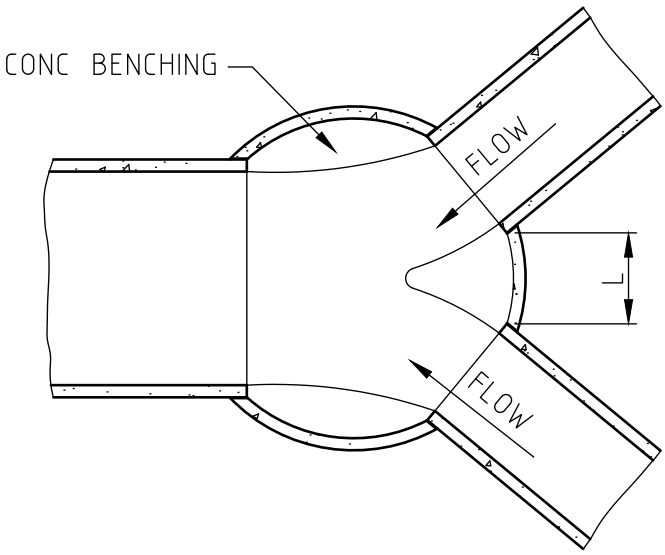
M.H(DIA)	L (MIN)	T (MIN)	D (MAX)
1500	500	200	1050
1350	400	200	750
1050	350	150	450

3. PRECAST CONCRETE MANHOLE RISERS SHALL COMPLY WITH THE REQUIREMENTS FOR CLASS 2 PRECAST CONCRETE PIPES TO AS/NZS 4058.
4. FOR MANHOLE FINISHING OFF DETAILS E.G. HAUNCHING, MAX. DEPTH OF LID, etc SEE DRAWINGS 601 & 602
5. SEE DRAWING 512 FOR SECTION VIEWS



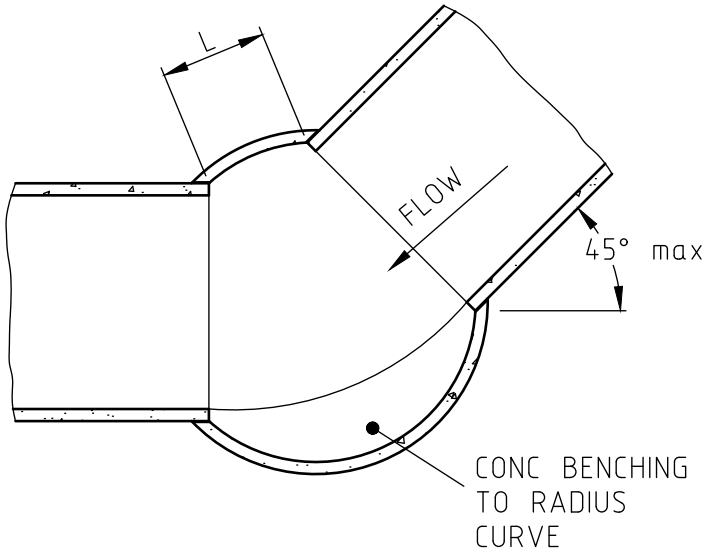
TYPE A

THROUGH CHANNEL
ONE PIPE DIA.



TYPE C

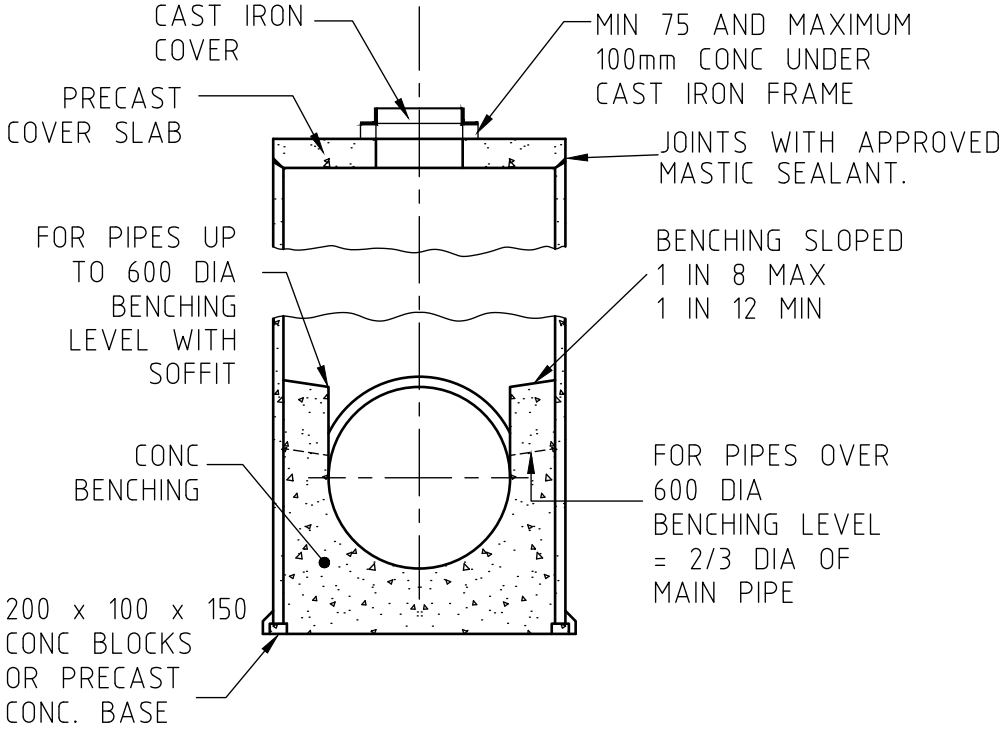
TYPICAL JUNCTION MANHOLE.



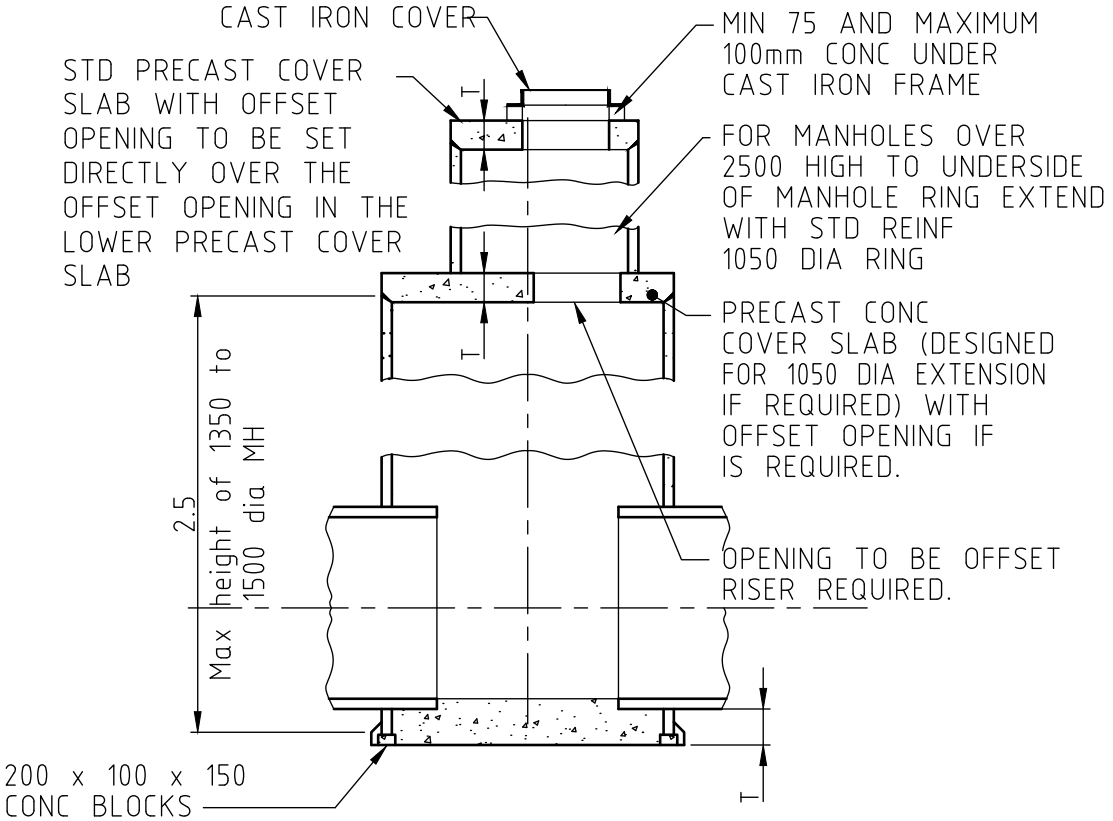
TYPE B

ANGLE CHANNEL
ONE PIPE DIA.

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STANDARD STORMWATER MANHOLE (1 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	511



TYPICAL SECTION A-A
SEE DRAWING 511



TYPICAL SECTION B-B
SEE DRAWING 511

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STANDARD STORMWATER MANHOLE - SECTIONS (2 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	512

NELSON CITY COUNCIL

GROUP MANAGER INFRASTRUCTURE, NELSON

TASMAN DISTRICT COUNCIL

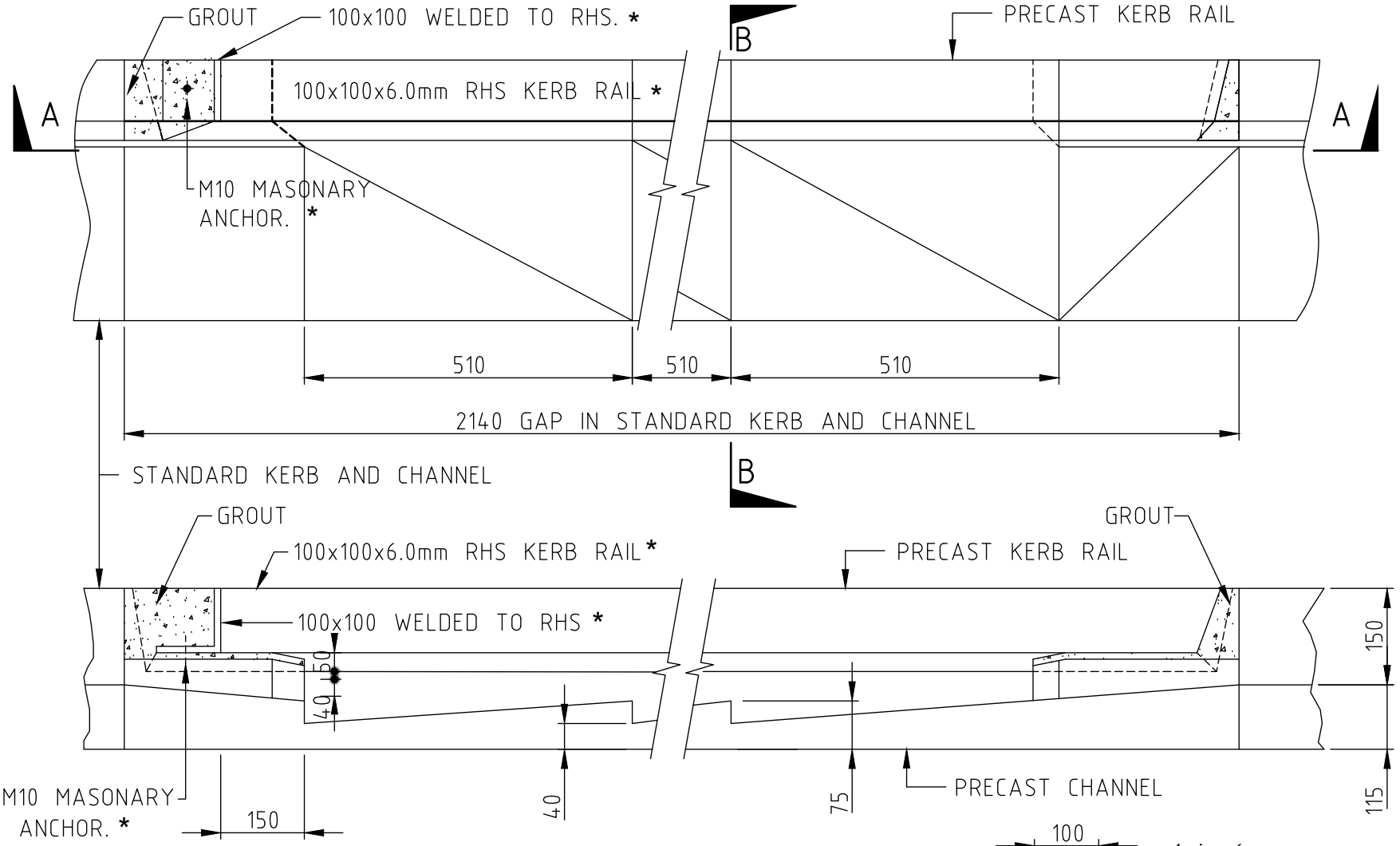
ENGINEERING SERVICES MANAGER, TASMAN

DATE 01/07/19

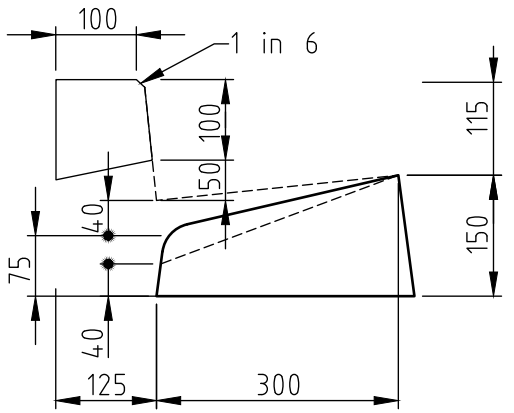
NELSON - TASMAN LAND DEVELOPMENT MANUAL

513

FLOW DIVERTER (1 OF 2)



SECTION A-A

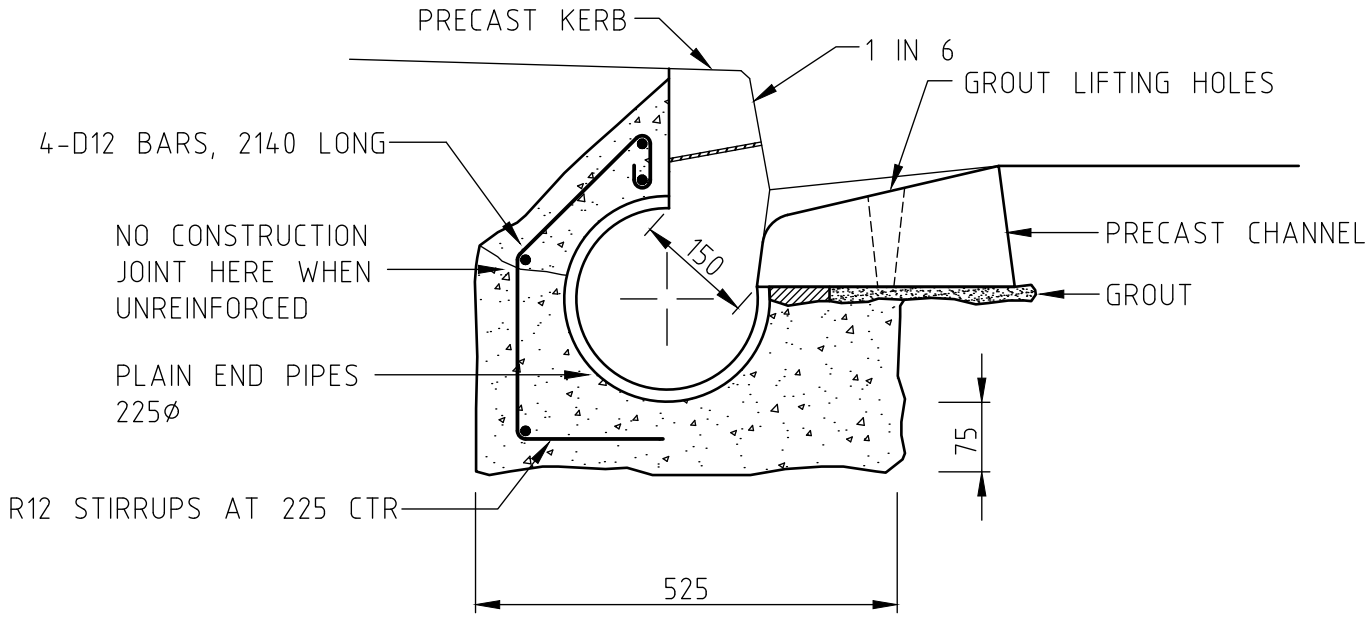


SECTION B-B

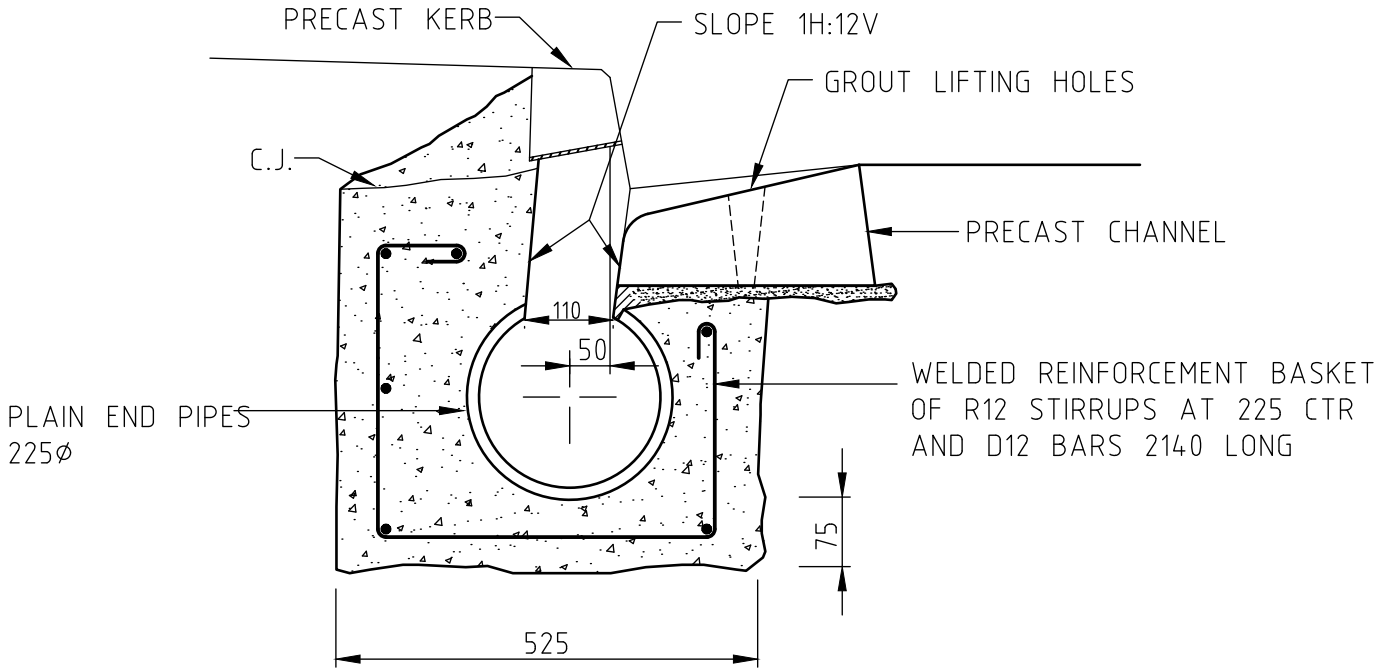
NOTES

1. * DENOTES STEEL RHS KERB RAIL DETAIL
2. STEEL RHS KERB RAIL TO BE USED AS DIRECTED BY THE COUNCIL

RIGHT HAND FLOW DIVERTER

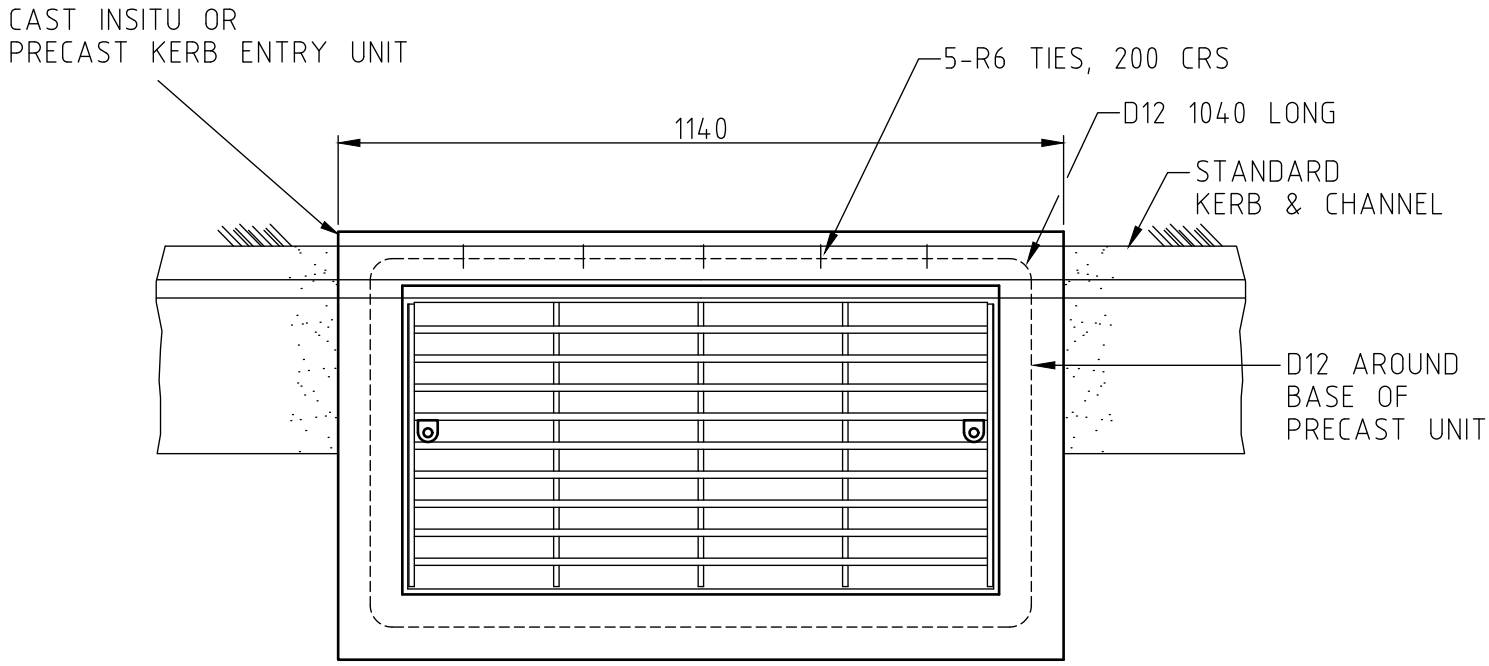


SPECIAL SHALLOW SECTION OF FLOW DIVERTER

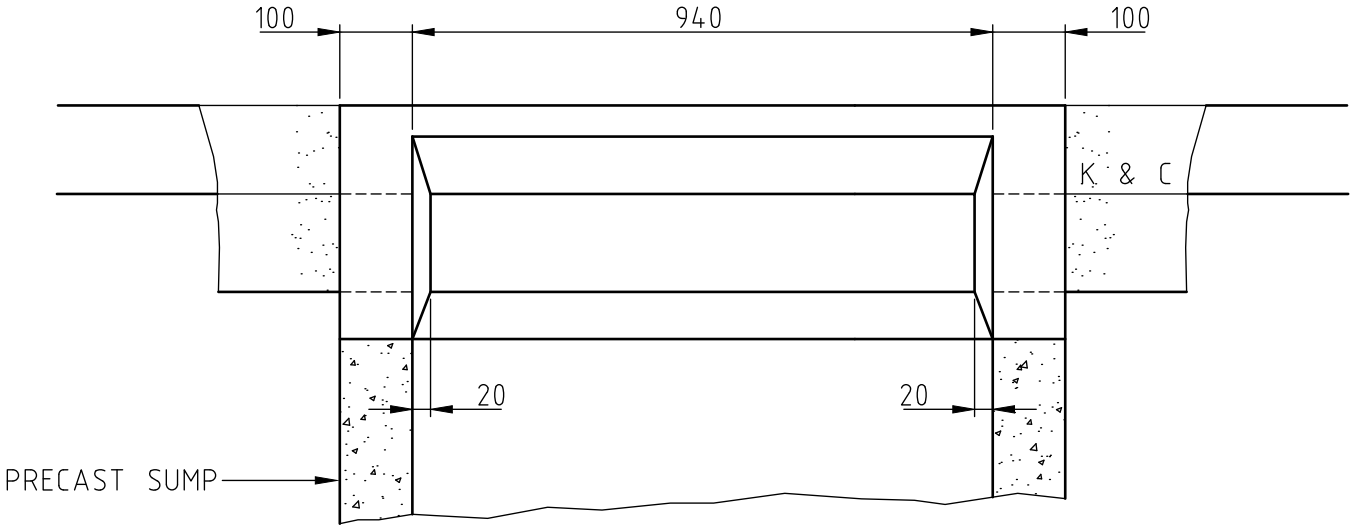


STANDARD INTAKE SECTION OF FLOW DIVERTER

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	INTAKE SECTION ON FLOW DIVERTER (2 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	514



PLAN



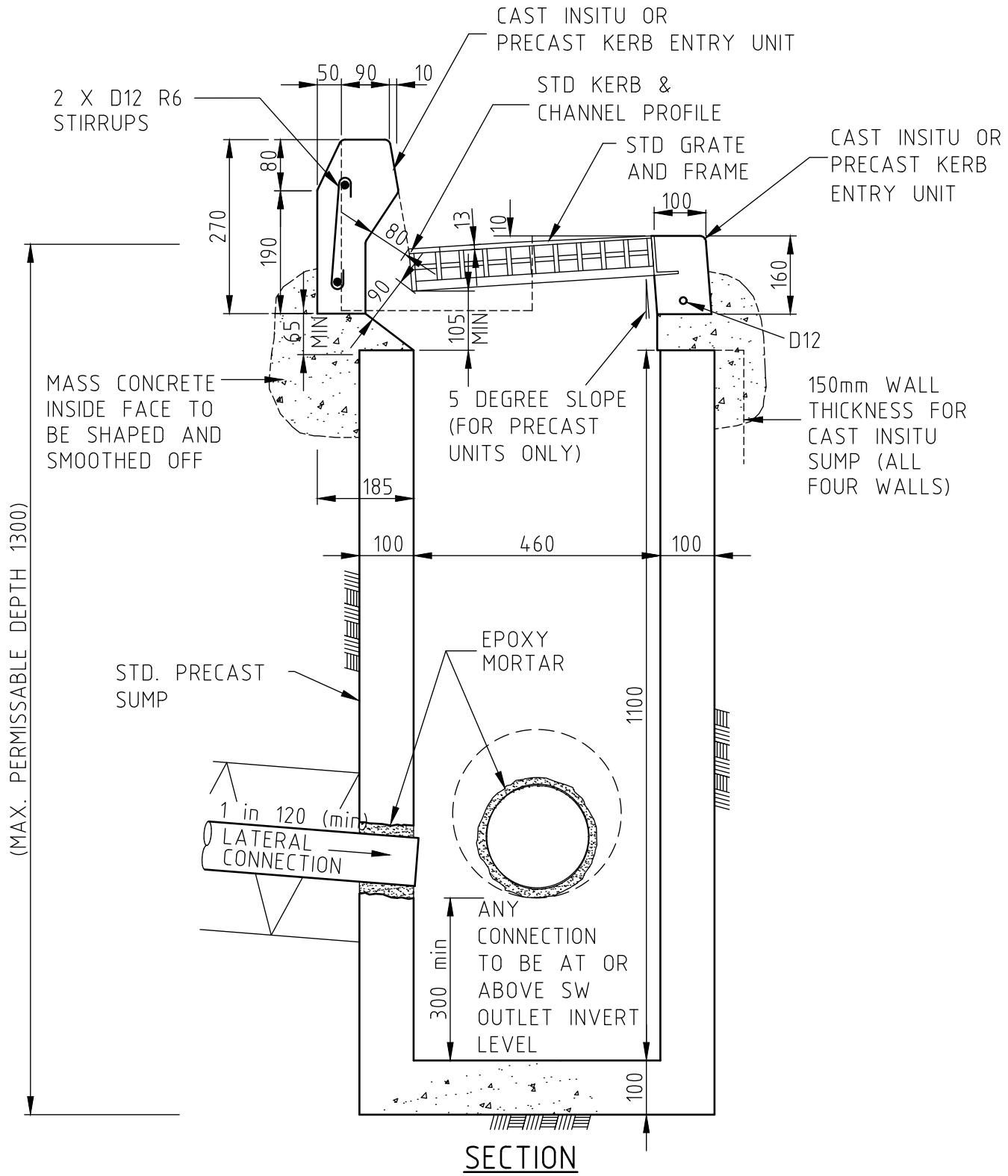
ELEVATION

GRATE AND FRAME NOT SHOWN

NOTES

1. SEE SHEET DRAWING 518 FOR DETAILS OF STD GRATING AND FRAME
2. INSITU CONCRETE TO BE 27.5 MPa AFTER 28 DAYS
3. NO REINFORCING REQUIRED FOR CAST INSITU BACK ENTRY UNIT
4. WHERE SUMP IS CONCRETED TO INTERCEPT K & C AT DISTINCT GRADE THE ENTRY UNIT SHALL BE INCLINED ON THE INSITU PAD EXTENDED OVER THE SUMP WALL WIDTH

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	BACK ENTRY SUMP IN STANDARD KERB & CHANNEL - PLAN & ELEVATION (1 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	515

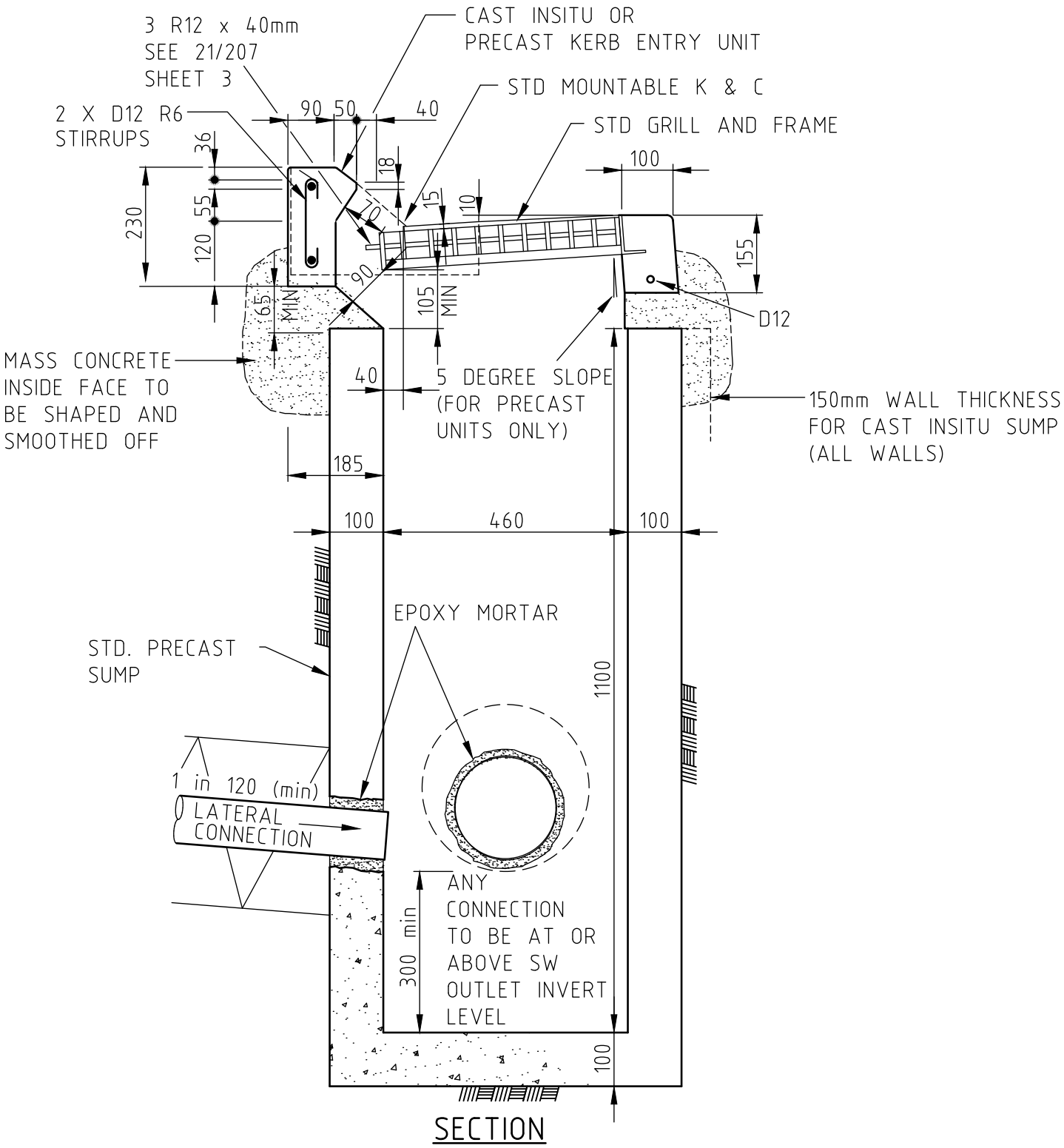


SECTION

NOTES

1. SEE SHEET DRAWING 518 FOR DETAILS OF STD GRATING AND FRAME
2. INSITU CONCRETE TO BE 27.5 MPa AFTER 28 DAYS
3. NO REINFORCING REQUIRED FOR CAST INSITU BACK ENTRY UNIT
4. WHERE SUMP IS CONCRETED TO INTERCEPT K & C AT DISTINCT GRADE THE ENTRY UNIT SHALL BE INCLINED ON THE INSITU PAD EXTENDED OVER THE SUMP WALL WIDTH

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	BACK ENTRY SUMP IN STANDARD KERB & CHANNEL - SECTION (2 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	516

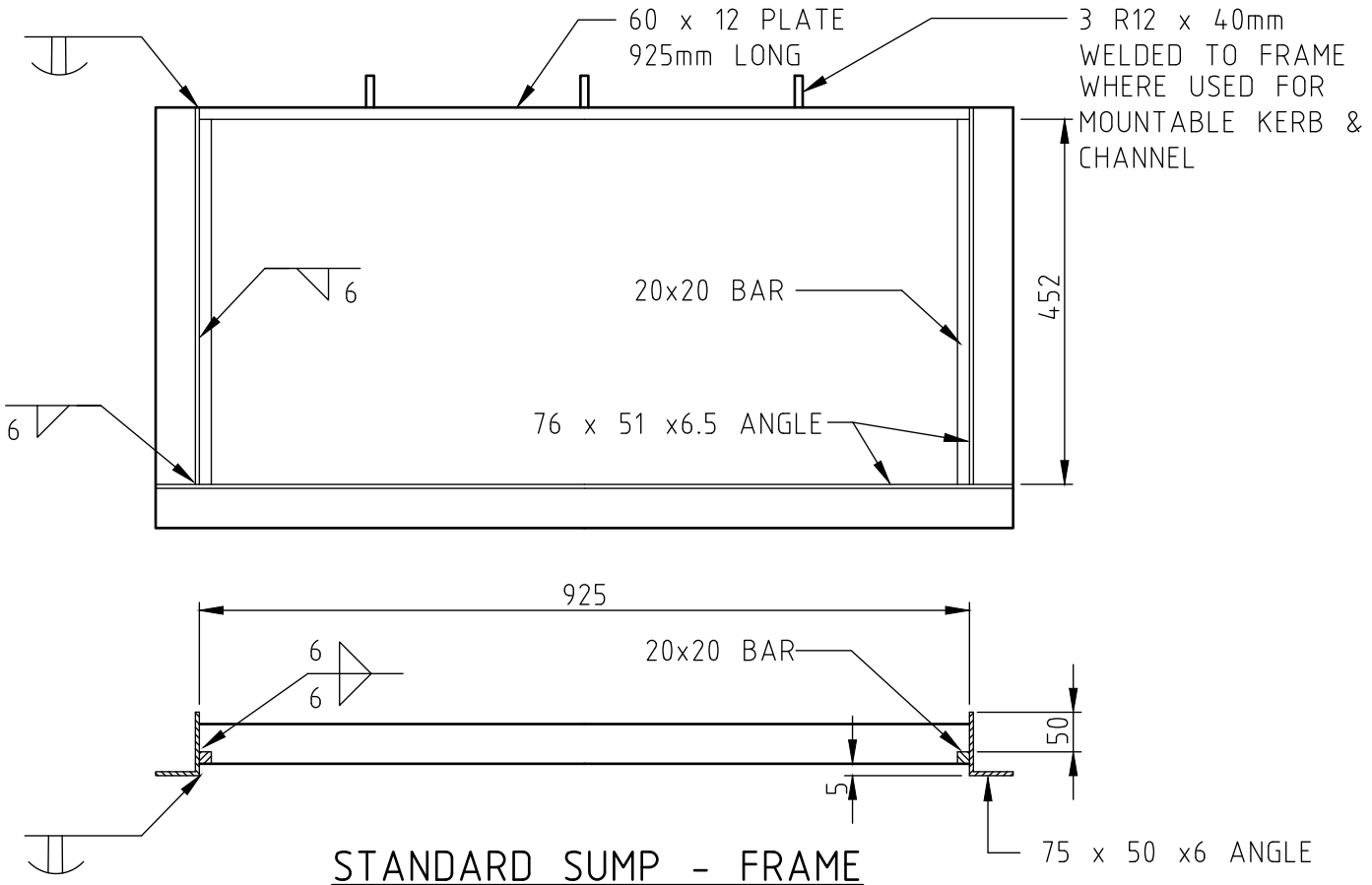


SECTION

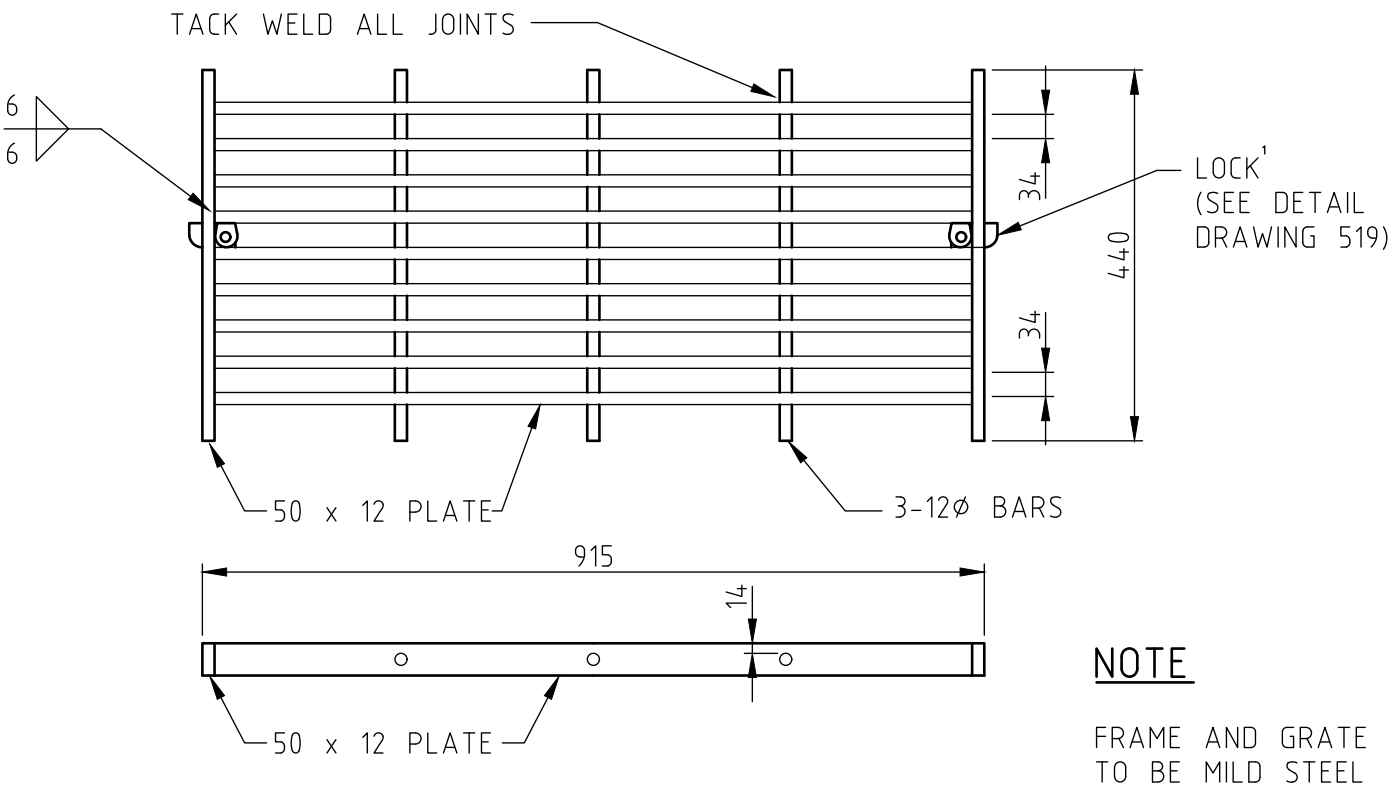
NOTES

1. SEE SHEET DRAWING 518 FOR DETAILS OF STD GRATING AND FRAME
2. INSITU CONCRETE TO BE 27.5 MPa AFTER 28 DAYS
3. NO REINFORCING REQUIRED FOR CAST INSITU BACK ENTRY UNIT
4. WHERE SUMP IS CONCRETED TO INTERCEPT K & C AT DISTINCT GRADE THE ENTRY UNIT SHALL BE INCLINED ON THE INSITU PAD EXTENDED OVER THE SUMP WALL WIDTH

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	BACK ENTRY SUMP IN STANDARD MOUNTABLE KERB & CHANNEL		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	517



STANDARD SUMP - FRAME

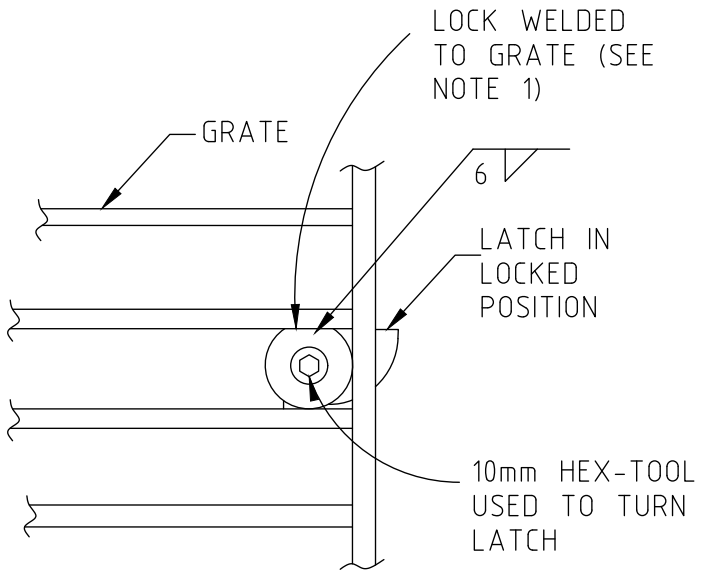


STANDARD SUMP - GRATING

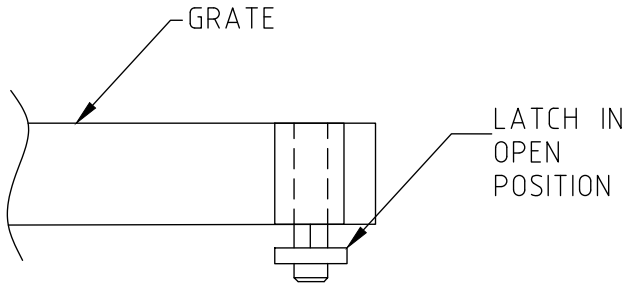
NOTE

FRAME AND GRATE
TO BE MILD STEEL

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STANDARD SUMP FRAME & GRATE (1 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	518



LOCK - PLAN VIEW



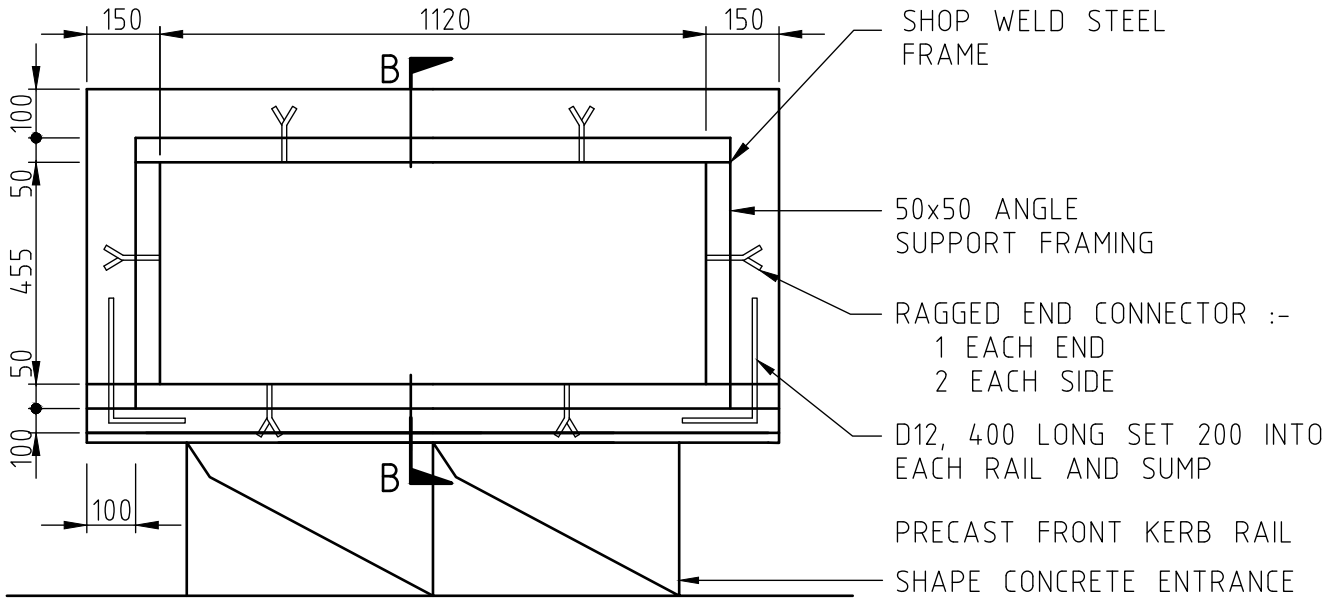
LOCK - ELEVATION

NOTES

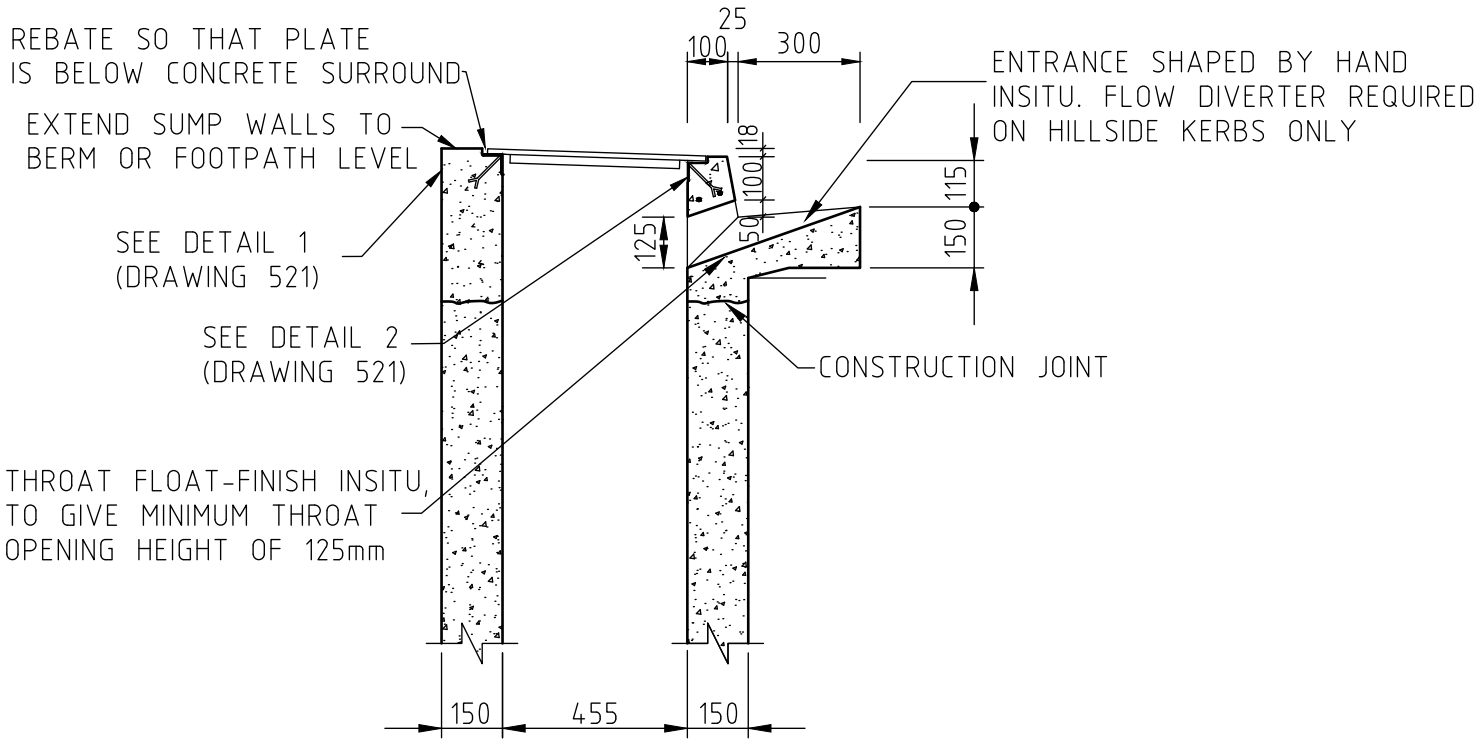
1. A LOCKING MECHANISM MUST BE INCORPORATED WITH ALL STANDARD SUMP GRATES.
   AN EXAMPLE OF A COUNCIL APPROVED LOCK IS THE "LOCK ASSEMBLY FOR USE WITH A GRATE" AS SHOWN ON THE NZ INTELLECTUAL PROPERTY OFFICE WEBSITE, CERTIFICATE OF REGISTRATION OF DESIGN NUMBER 418820.
   LOCKS OTHER THAN DETAILED ABOVE, MUST BE APPROVED BY COUNCIL BEFORE USE.

2. MARINE GREASE SHALL BE APPLIED TO ALL INTERNAL MOVING PARTS AFTER THE LOCK HAS BEEN FIXED TO THE GRATE

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	STANDARD SUMP - LOCK & TONGUE MECHANISM DETAIL (2 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	519



PLAN OF SUMP



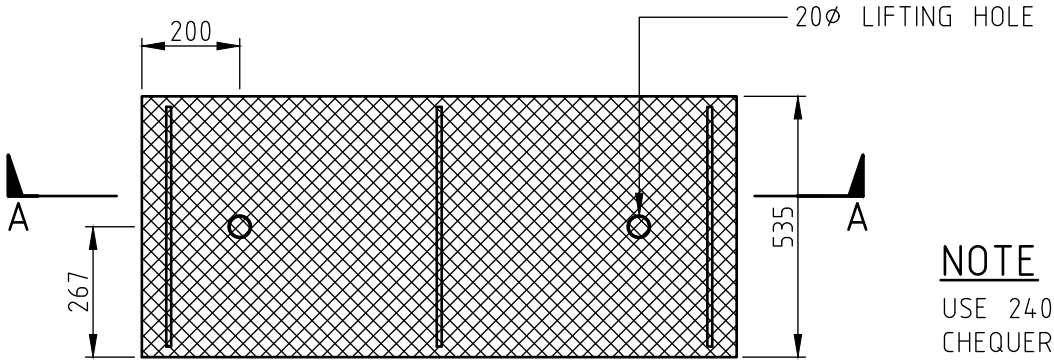
SECTION B-B

ELEVATION

NOTE

ALTERNATIVELY FOR VEHICLE LOADING 150mm THICK REINFORCED CONCRETE COVER SLAB WITH A PICTON TOP CAST IN MAY BE USED. THE REINFORCEMENT SHALL BE TO A SPECIFIC DESIGN.

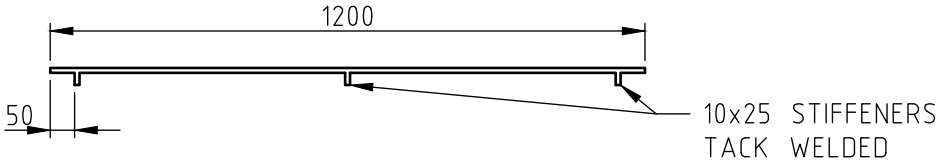
NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	BERM SUMP (1 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	520



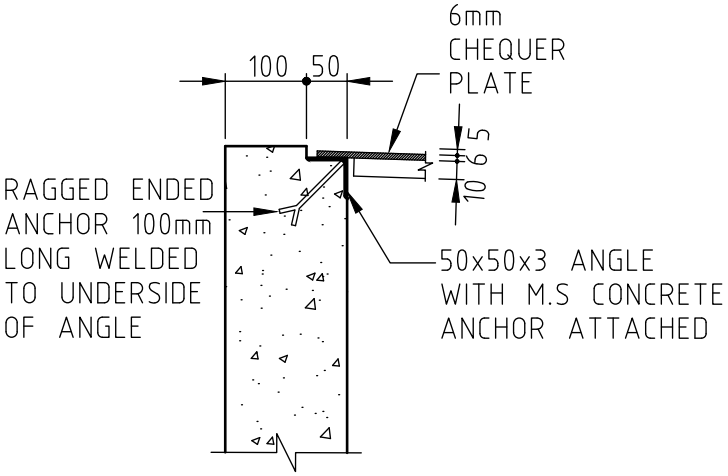
PLAN OF 6mm CHEQUER PLATE

NOTE

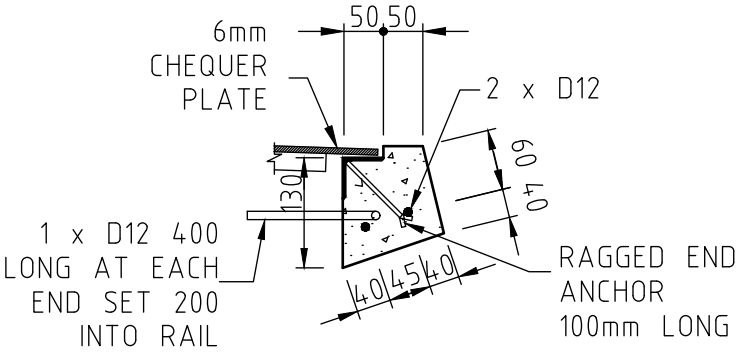
USE 2400x1200x6mm CHEQUER PLATE SHEET
CUT 4 SHEETS 535x1200
CUT 30 RAGGED ENDS 100x40 EACH



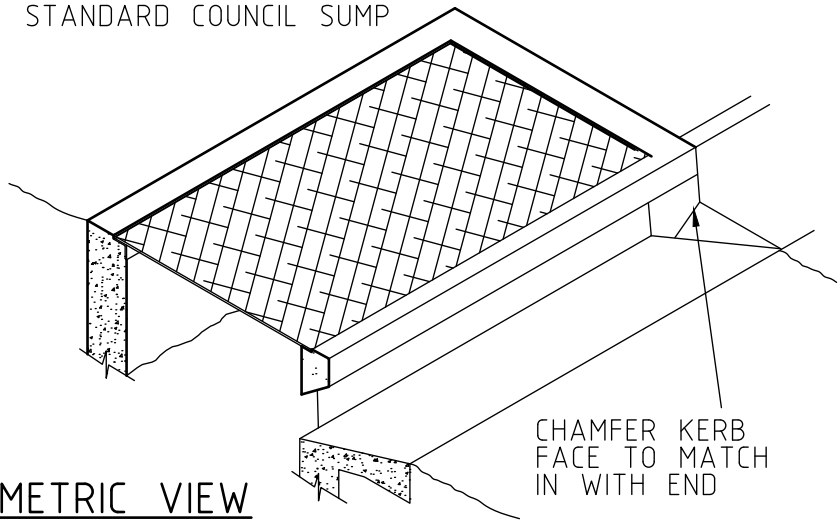
SECTION A-A



DETAIL 1

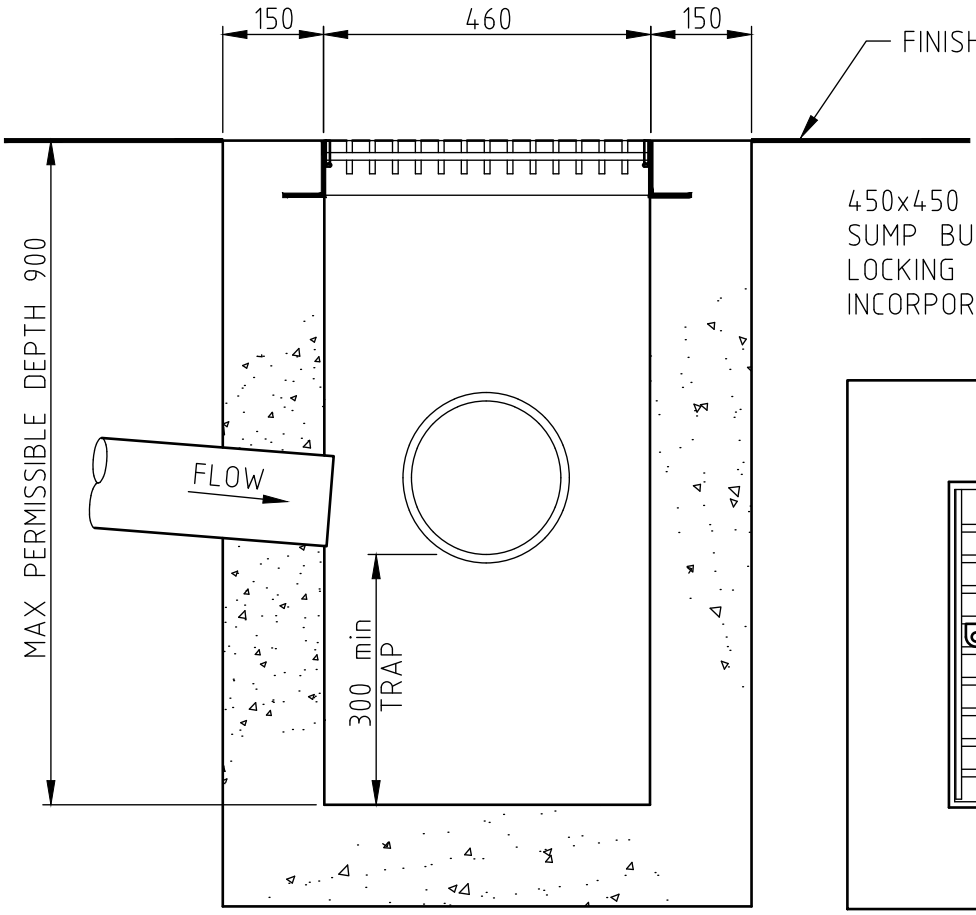


DETAIL 2



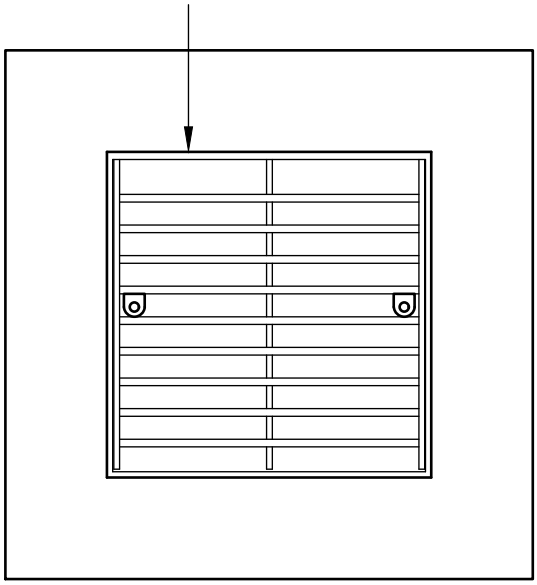
ISOMETRIC VIEW

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	BERM SUMP - DETAILS (2 OF 2)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	521



SECTION

450x450 GRATE SIMILAR TO STD. SUMP BUT MADE HALF SIZE. LOCKING MECHANISM SHALL BE INCORPORATED. SEE DRAWING 519

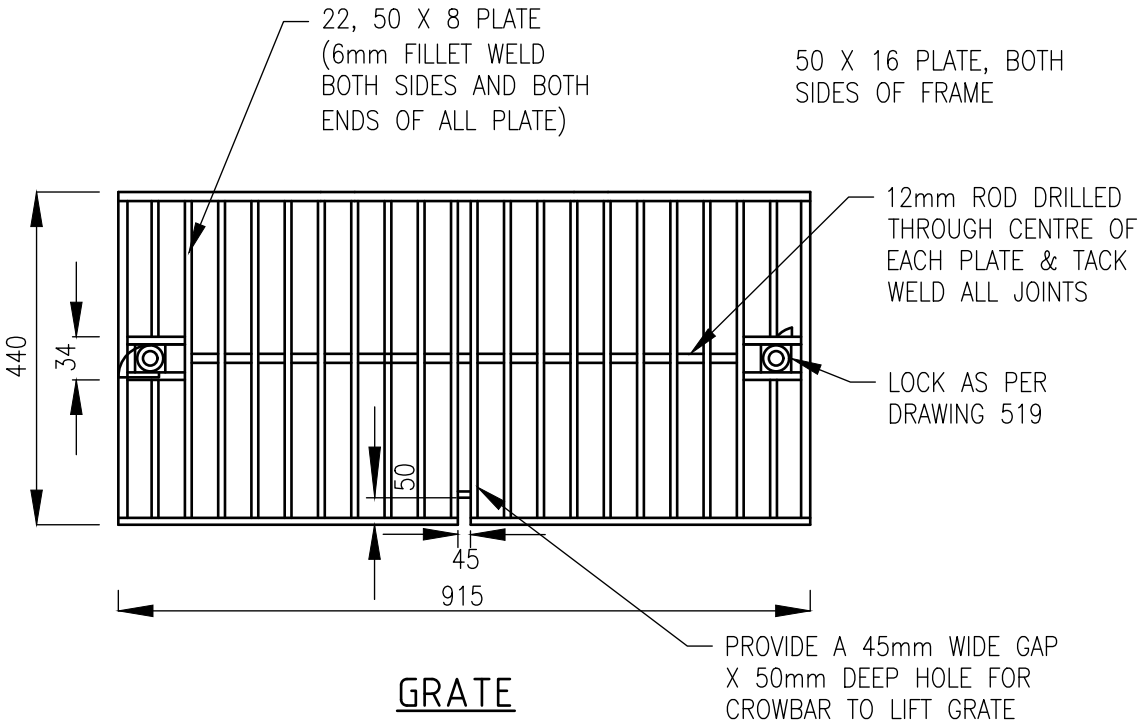


PLAN

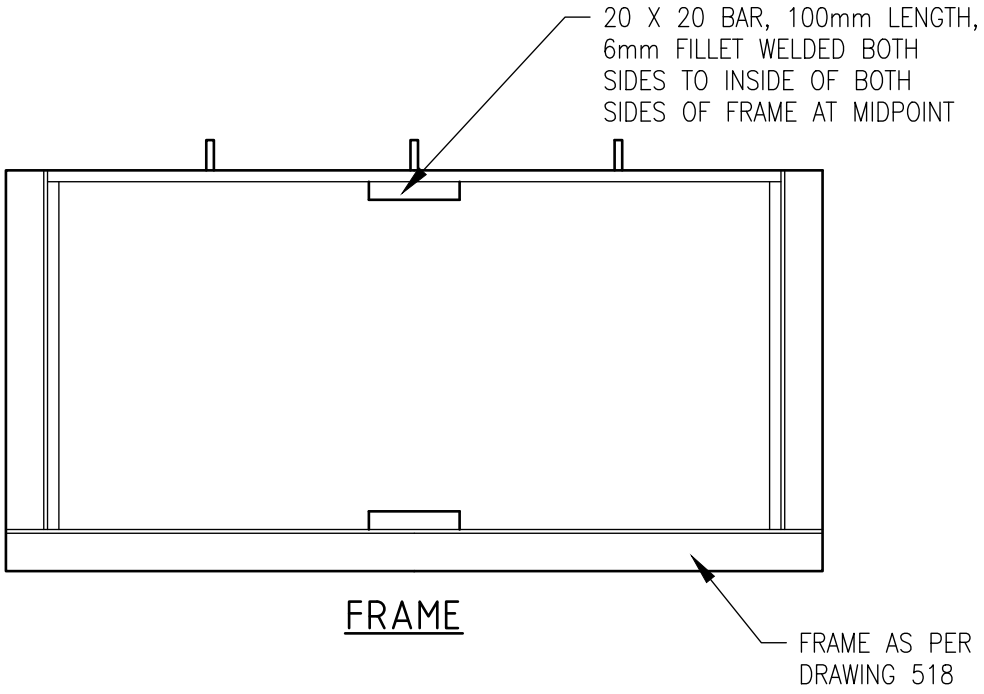
NOTE

WHERE PIPE DEPTH REQUIRES SUMP DEPTH IN EXCESS OF 900mm A STANDARD 940 x 460 mm SUMP SHALL BE PROVIDED.

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	YARD SUMP		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	522



GRATE

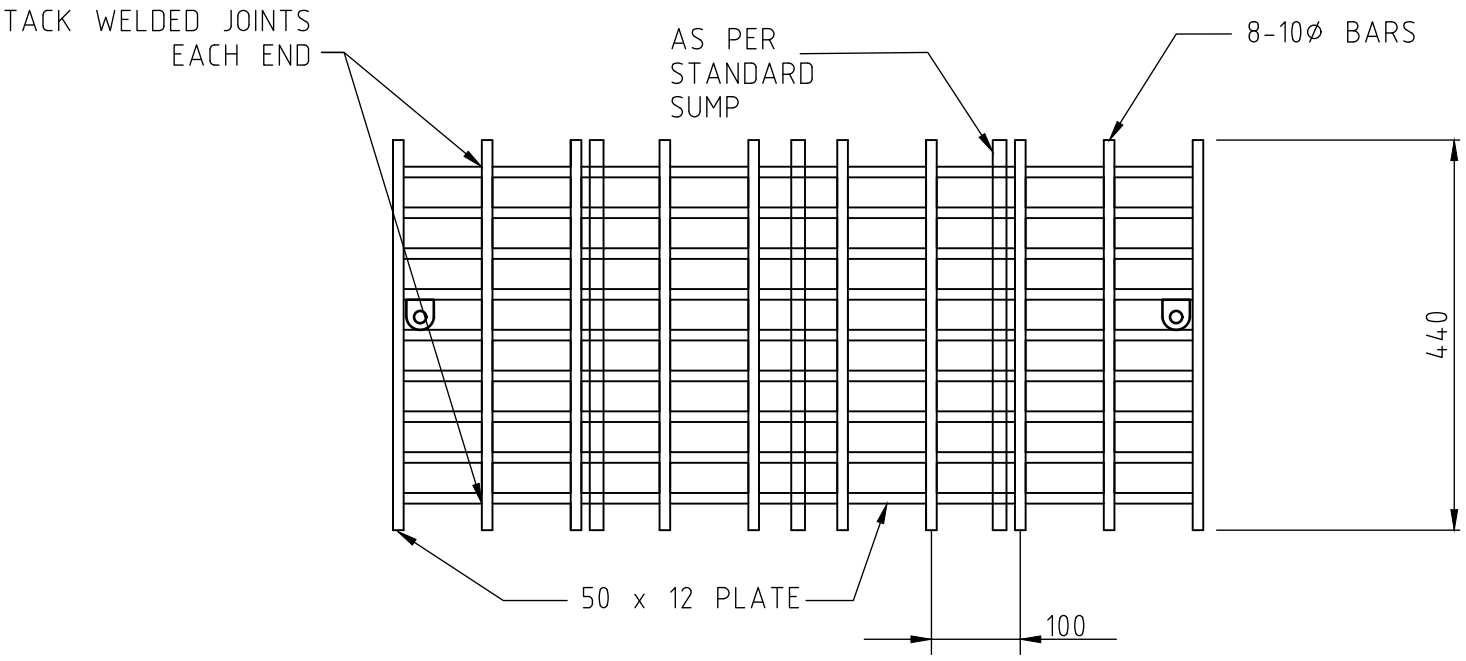


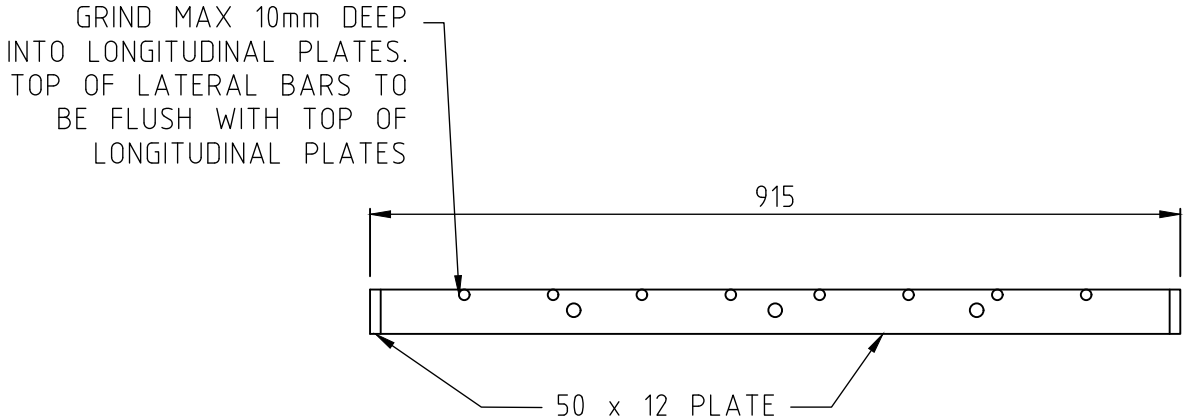
FRAME

NOTES

1. LOCATION OF CYCLE FRIENDLY SUMP GRATE AT COUNCIL'S DISCRETION
2. GRATE TO BE MILD STEEL
3. LOCKING MECHANISM SHALL BE INCORPORATED, SEE DRAWING 519
4. DRAWING NOT TO SCALE

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	CYCLE FRIENDLY SUMP GRATE		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	523



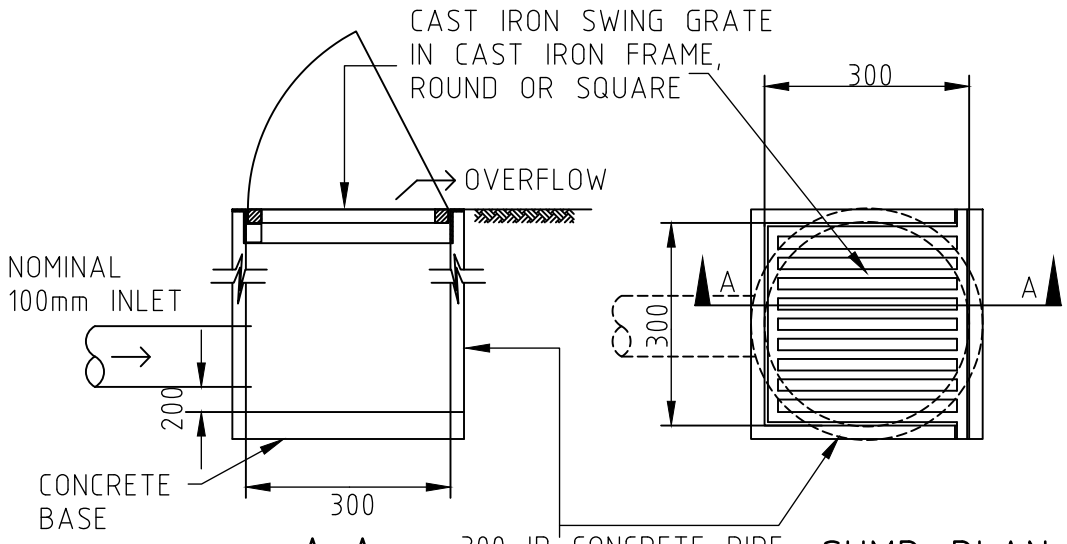


CYCLE FRIENDLY SUMP - GRATING

NOTES

1. LOCATION OF CYCLE FRIENDLY SUMP GRATE AT COUNCIL'S DISCRETION
2. THE SUMP GRATE IS A STANDARD SUMP GRATE AS PER DRAWING 518, WITH THE ADDITION OF LATERAL BARS
3. FRAME AND GRATE TO BE MILD STEEL

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	CYCLE FRIENDLY SUMP GRATE MODIFICATION OF STANDARD SUMP GRATE		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	524



A-A
N.T.S.

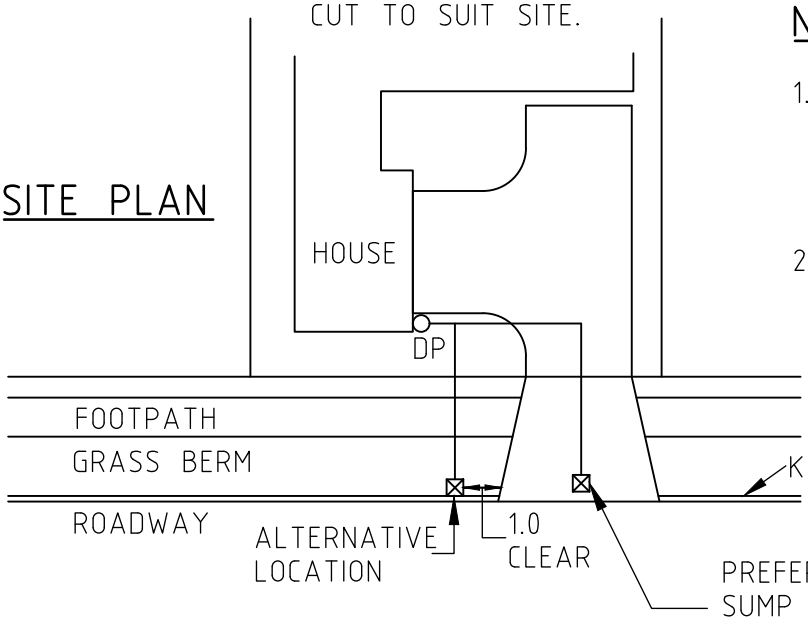
300 ID CONCRETE PIPE OR PIT. STANDARD 800MM DEEP, CAN BE CUT TO SUIT SITE.

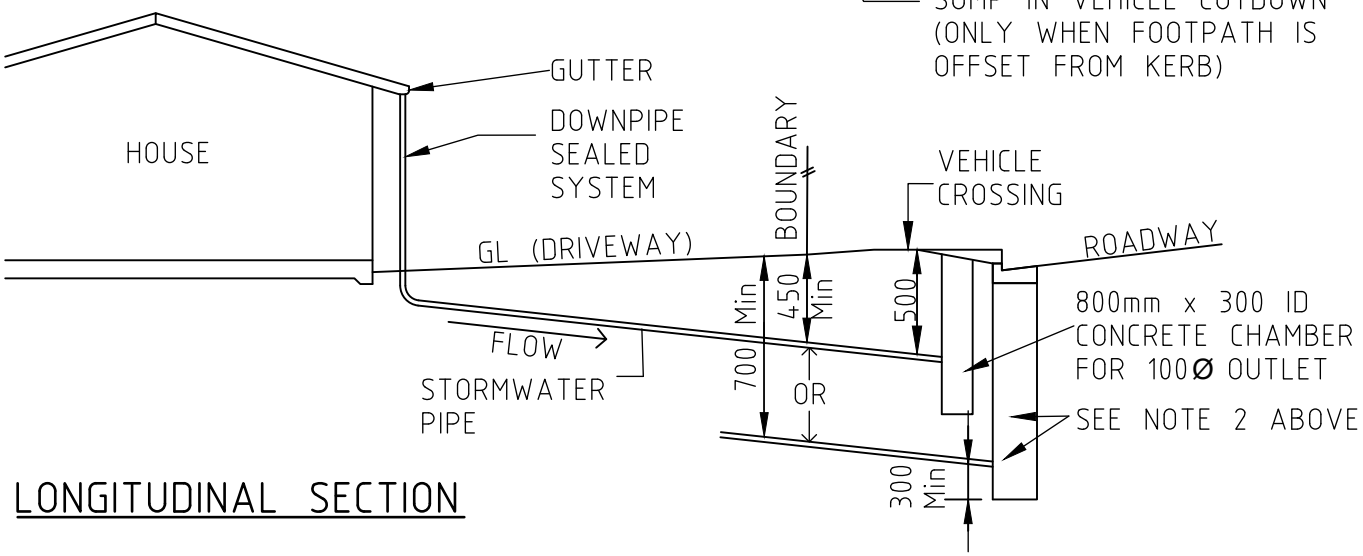
SUMP PLAN

NOTES:

1. FINISHED FLOOR LEVEL MUST NOT BE LESS THAN 150mm HIGHER THAN LID LEVEL OF SUMP
2. SUMP IN ROADWAY MAY BE PERMITTED WHERE NOT POSSIBLE TO POSITION IN DRIVEWAY OR BERM

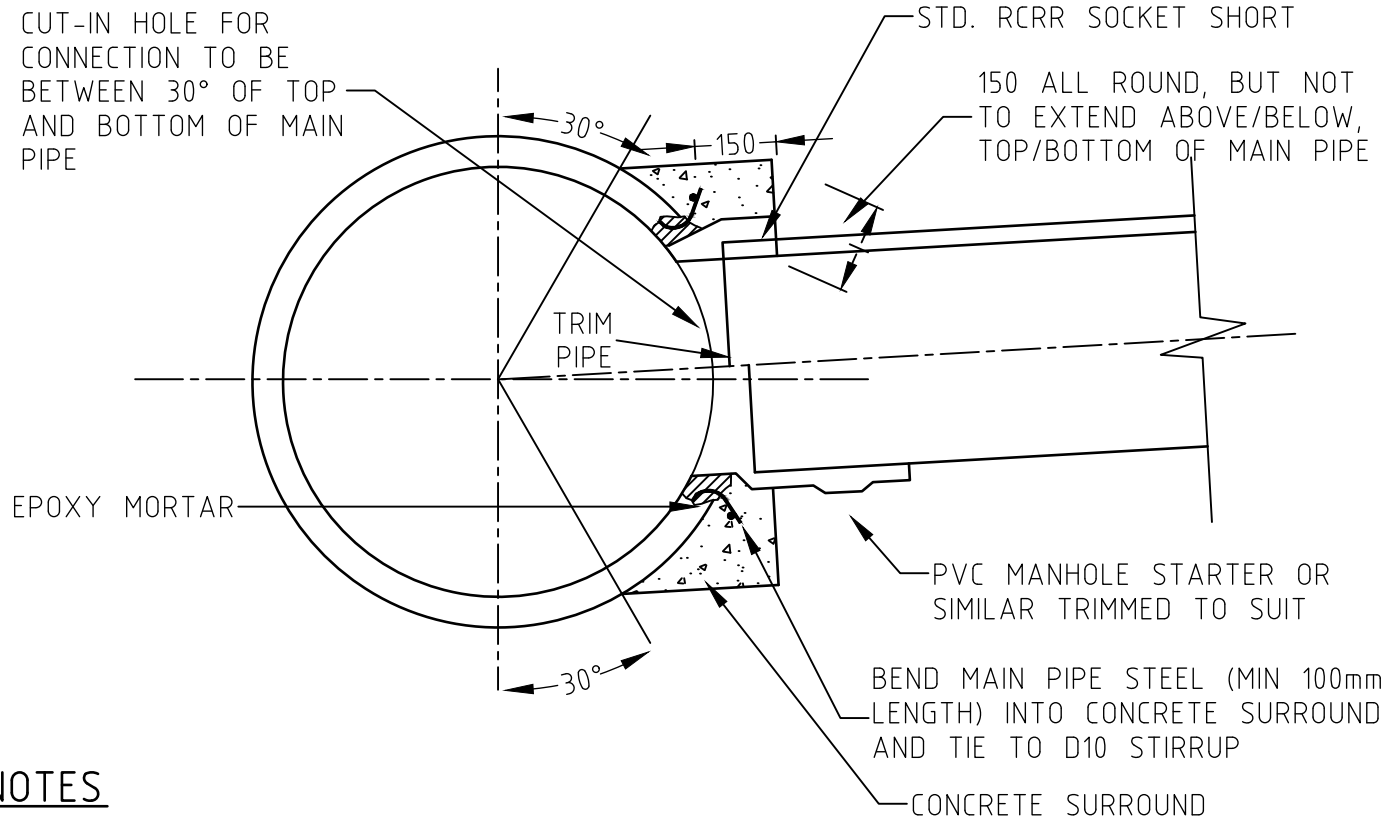
SITE PLAN





LONGITUDINAL SECTION

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	INFILL BUBBLE - UP SUMP (SEALED HOUSE DOWNPIPE CONNECTION ONLY)		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	525



NOTES

1. SPECIAL DESIGN REQUIRED FOR:
   MAIN PIPES OTHER THAN REINFORCED CONCRETE, MORE THAN ONE CONNECTION PER MAIN.
2. DIRECT CONNECTIONS OF THIS TYPE ARE NOT PERMITTED ON PLASTIC MAINS.
3. OUTSIDE EDGE OF MAIN PIPE CUT-IN HOLE SHALL BE NOT LESS THAN 300mm FROM COLLAR OR END OF PIPE.
4. MAXIMUM DIAMETER OF CUT-IN HOLE SHALL BE LESS THAN TWO THIRDS OF THE INTERNAL DIAMETER OF MAIN PIPE.
5. EPOXY MORTAR SHALL BE APPLIED STRICTLY ACCORDING TO THE MANUFACTURER'S RECOMMENDATION AND SHALL BE FULLY CURED BEFORE THE SURROUND IS POURED AND THE SIDELINE LAID.
6. MAIN PIPE SURFACE SHALL BE ROUGHENED AND GROUT COATED BEFORE CONCRETE SURROUND IS POURED.
7. DIRECT CONNECTIONS MUST BE APPROVED BY THE ENGINEER, AND NORMALLY SHALL ONLY BE USED WHERE THE SIDELINE IS LESS THAN 10m LONG, AND ACCESS FOR CLEANING THE SIDELINE IS EASILY OBTAINABLE AT THE UPSTREAM END. THAT IS THE SIDELINE SHALL TERMINATE WITH A MANHOLE, LHCE OR SUMP.
8. DIAMETER OF SIDELINE PIPE SHALL BE LESS THAN HALF THE INTERNAL DIAMETER OF THE MAIN PIPE.

SQUARE RADIAL DIRECT CONNECTIONS

NOMINAL SIDELINE DIAMETER	MINIMUM MAIN PIPE DIAMETER
100	225
150	375
200	450
225/250	525
300	675
375	825
450	975
525	1050
600/675	1350
750	1600
825/900	1800
975	1950
1050	2100

NELSON CITY COUNCIL

GROUP MANAGER INFRASTRUCTURE, NELSON

DIRECT CONNECTIONS TO STORMWATER PIPES

TASMAN DISTRICT COUNCIL

ENGINEERING SERVICES MANAGER, TASMAN

DATE 01/07/19

NELSON - TASMAN LAND DEVELOPMENT MANUAL

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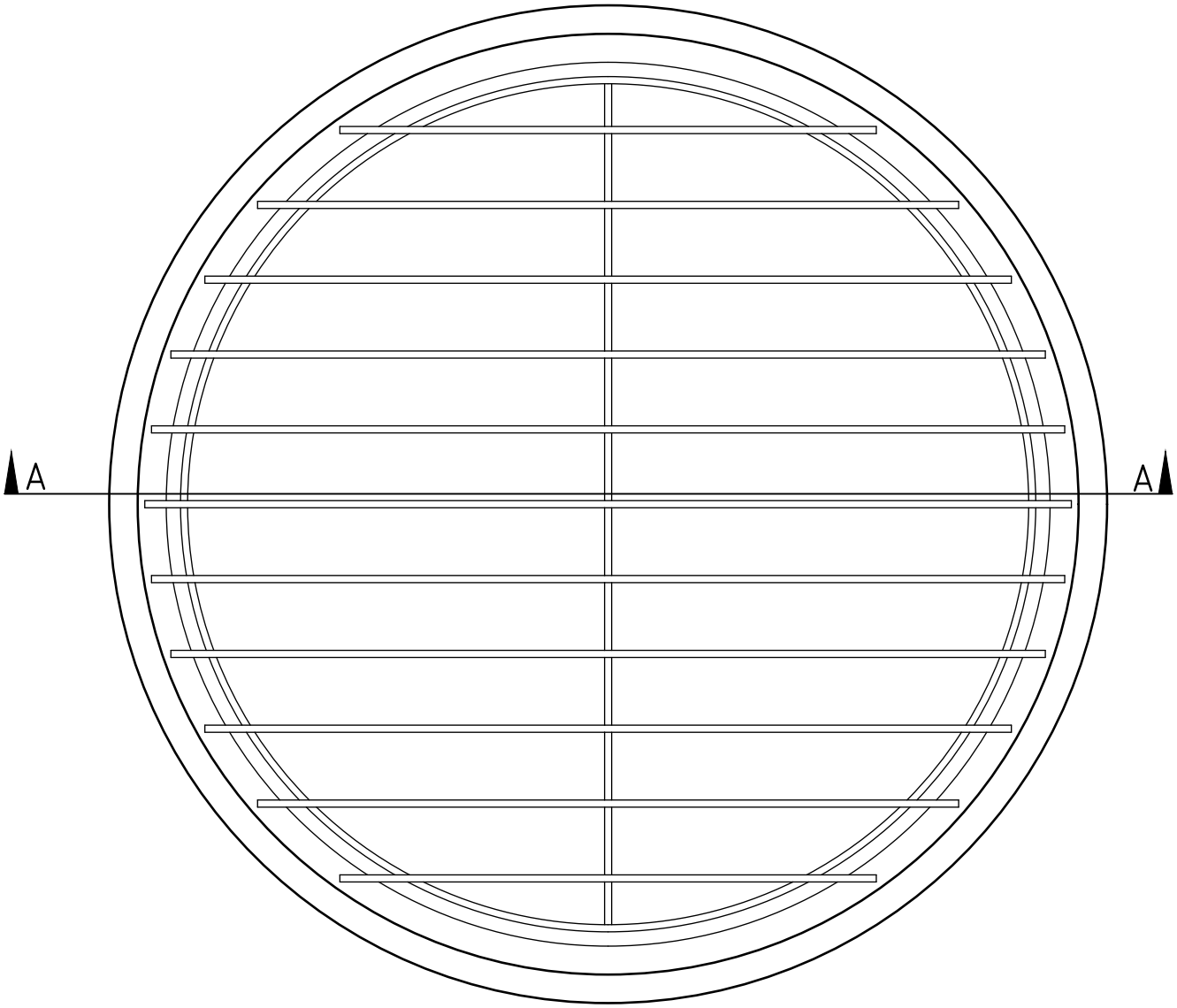
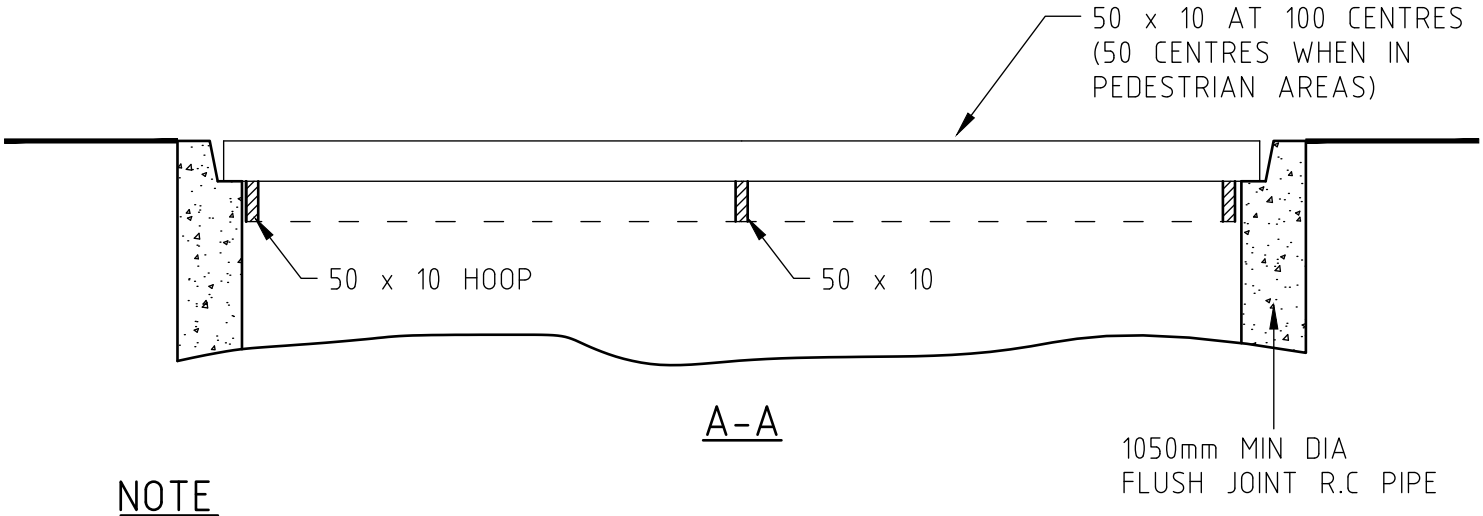


PLAN



A-A

NOTE

1. DETAILS SHOWING THE FIXING DOWN OF THE GRILL TO THE MANHOLE LINER SHALL BE DETERMINED AT THE TIME OF DESIGN.

NELSON CITY COUNCIL GROUP MANAGER INFRASTRUCTURE, NELSON	DEBRIS TRAP GRILL		
TASMAN DISTRICT COUNCIL ENGINEERING SERVICES MANAGER, TASMAN	DATE 01/07/19	NELSON - TASMAN LAND DEVELOPMENT MANUAL	527