7 STORMWATER AND DRAINAGE

7.1 Introduction

The purpose of Council's stormwater engineering standards is to provide design guidance and minimum standards for the design and construction of stormwater management infrastructure.

Design and construction in accordance with the standards is intended to ensure that stormwater runoff is managed effectively and efficiently and avoids adverse impacts on the environment and people.

Effective stormwater management is important, because without it, inundation, property damage and nuisance ponding can occur. In addition the quality of water and habitats of aquatic environments like streams and estuaries can be degraded.

7.1.1 Objectives

In addition to its regional authority responsibilities, Council is responsible for all stormwater infrastructure assets under its control. Council must therefore ensure that they are designed, constructed and maintained to meet the following general objectives:

a) Stormwater generated by a 1% Annual Exceedance Probability (AEP) (1:100 year) storm event shall be accommodated within the secondary stormwater management system in a way that does not cause damage to or nuisance effects on people and property or cause degradation of aquatic and riparian habitats;

b) Stormwater generated by more frequent, but significant rainfall events (normally 5% AEP (1:20 year)) shall be accommodated within the primary stormwater management system in a way that does not cause damage to or nuisance effects on people and property or cause degradation of aquatic and riparian habitats;

c) Stormwater infrastructure is designed and constructed in a manner that results in a robust, durable network, and which is able to be efficiently maintained;

d) Lifecycle maintenance, including protection of amenity and ecological values where appropriate, are considered during stormwater infrastructure design resulting in a network with which is able to be efficiently maintained;

e) Stormwater is managed and disposed of in a way that protects or enhances water quality and aquatic, riparian and coastal habitats and environments

f) Stormwater infrastructure is designed and constructed in a way that retains or enhances the amenity values of the locality;

g) The stormwater infrastructure network is cost-effective and efficient in delivering the required levels of service over the entire life-cycle of the network;

h) The management of stormwater meets the needs and expectations of the community in terms of the LTP;

i) All stormwater discharges are consented, or the discharge can be accommodated within an existing consented system, in accordance with the TRMP.

j) All stormwater systems and stormwater infrastructure are constructed and managed in compliance with resource consent(s).

k) Greenways are to be utilised to create multi-functional areas that accommodate stormwater management, amenity, aesthetic and ecological benefits.

7.1.2 Design Methods

There are a variety of ways that the above may be achieved. Accepted design methods are generally guided by the New Zealand Standard for Land Development and Subdivision Infrastructure (NZS4404:2010) and by the accepted design standards set out in the following sections below and in the design guides within the TRMP.

However, in the Tasman District additional or alternative solutions may also be accepted, provided that they complement the existing infrastructure network and are appropriate to the site conditions.

Additional guidance may be obtained from the appropriate department and it is recommended that subdivision projects be discussed with staff as early as possible in the concept planning stage to assist in identifying well integrated stormwater designs that reflect best practice.

7.1.3 Key References

Table 7-1 sets out internal and external standards for the management of stormwater within this document.

These apply and must be taken into account in the design and construction of any stormwater management asset in the Tasman District.

Table 7-1: Documents relevant to management of stormwater

Number	Title
AS/NZS1260	uPVC Pipes and fittings for drain waste and vent applications
AS/NZS2032	Installation of PVC pipe systems
AS/NZS2566	Buried flexible pipelines – Structural design
AS/NZS4058	Pre-cast concrete pipes (pressure and non-pressure)
NZS3109	Concrete construction
NZS3121	Specification for water and aggregate for concrete
AS/NZS3725	Loads on buried concrete pipes
NZS4442	Welded steel pipes and fittings for water, sewage, and medium pressure gas
NZS7643	Code of practice for the installation of unplasticised PVC pipe systems
	Building Act
E1/VM1	Building Act – soakage testing - Verification Method E1/VM1
	New Zealand Pipe Inspection Manual 3rd edition
TRMP	Tasman Resource Management Plan - including design guides
	Best Practice Guidelines for Waterway Crossings, TDC, 2009

Number	Title
	Parks and Reserves Management Plans
	TP124 (LID), TP10 (stormwater devices), TP131 (fish passage), TP109 (Dam safety).
	Tasman Restoration Planting Lists (for riparian planting)
	Culvert Manual CDP/706A Ministry of Works and Development (for short culverts)
	Te Tau Ihu Mahi Tuna (Nelson/North Marlborough Eel Management Plan)

7.2 Design Requirements

7.2.1 General

The design of every stormwater management system must be consistent with the following standards and conditions:

a) Runoff is minimised at source to avoid adverse impacts on downstream networks.

b) The stormwater discharge must be consistent with Chapter 36.4 of the TRMP, concerning discharges to land or water. Permitted activity standards and conditions must be met, or discharge consent obtained.

c) Stormwater flows from all impervious surfaces, especially roads, must be accommodated within the stormwater systems

d) The stormwater management system must be designed to accommodate both primary and secondary stormwater flows to a standard determined by the design parameters set out in Table 7.4

e) Both primary and secondary flow paths within the stormwater system must be physically defined and legally and physically protected from modification or development that may obstruct the stormwater flows or impede maintenance access.

f) The quality of the water discharged from the stormwater system must not contribute to a degradation of habitats or water quality within the receiving environments.

g) A flood risk assessment must be undertaken, taking into account historical information and appropriate field tests. The assessment shall address the proximity and nature of any river, stream or watercourse and associated flood plain(s), including identification of overland flow paths.

h) The capacity of culverts and watercourses upstream and downstream of the site must be determined, and the implications of future upgrades and flooding caused by debris or slip induced blockages, under capacity and/or overland flows must be considered and appropriately designed for.

i) Strategically important secondary flow paths shall be subject to specific design, which will take account of the safety of the public and operation of the flow path without undue nuisance. Factors which will dictate the secondary flow design are:

  i. The capacity of primary stormwater systems (both existing and proposed)

ii. The capacity of downstream surface water system(s), and the risk of blockage at any downstream intake(s).
iii. The necessity for a secondary intake structure and the relative flow distribution between primary and secondary intakes for a range of blockage scenarios.
iv. The protection of land from erosion or land instability.
v. The nature of the roading system and ability to drain once the storm has passed.

j) Downstream owners are required to accept stormwater which naturally falls and migrates from the upstream catchment.

k) The short- and long-term lifecycle maintenance requirements of all proposed stormwater systems shall be identified by the Designer. This information shall be provided at the time designs are submitted to Council. All designs shall allow for effective and efficient maintenance, which avoids or minimises impacts on ecological and amenity values of the stormwater system where relevant.

l) Greenways are utilised for appropriate open channel areas and are to be vested in Council (refer section 12).

m) Sufficient land is set aside and/or vested in areas of open channel to allow for flood management requirements and including allowance for mature riparian vegetation and natural stream bank and bed features. Suitable roughness coefficients are used in capacity calculations to ensure open channels can be retained long term in a healthy natural state.

7.2.2 Design Standard– allowance for climate change

The determination of these design standards has been guided by the required long-term levels of service for the stormwater network, taking into account possible changes in rainfall patterns in the future as indicated by climate change projections.

It is considered possible that changes in rainfall intensity and frequency will, for example, "degrade" the current 20-year ARI design standard to a 10-year ARI standard in 2100, and the 100yr ARI design standard to a 50yr ARI standard.

Therefore a 20-year ARI standard (5%AEP) has been adopted for conventional primary pipe networks and the 100yr ARI (1% AEP) has been adopted for overall system capacity, to a achieve a minimum level of service over asset life-spans.

7.2.3 Calculation of Runoff

The determination of the necessary capacity for the purpose of design should be based on the following design parameters:

a) Calculation of runoff for stormwater network design shall be determined using an appropriate, recognised, design methodology. In the first instance the determination of design flows lies with the Designer of the proposed network, however Council reserves the right to require adoption of Council calculations at the Engineering Manager's discretion.

b) For piped reticulation networks, calculation of runoff using the Rational Method will generally be accepted. Alternative runoff methodologies may be approved by the

Engineering Manager on application. In all cases all underlying assumptions used in the calculation must be stated.

c) The Rational Method formula is: $Q = CIA \times 2.78$
Where
Q = runoff in litres per second
C = runoff coefficient (See Table 7-4 below)
I = rainfall intensity in millimetres per hour
A = area of catchment in hectares

d) Fixed runoff models (such as the Rational Method) will not generally be accepted for detention dam design or inundation assessment.

e) In larger network design, or where the proposed works integrate into an existing stormwater network, the determination of design flows may be most efficiently determined using a hydrological or hydraulic model.

f) When the design process includes the use of a hydrological or hydraulic model, all underlying assumptions (such as runoff coefficients, time of concentration and catchment areas) must be clearly stated so that a manual check of calculations is possible. Council reserves the right to request a copy of the model for review.

The general requirements for the design of stormwater networks in Tasman District are shown in Tasman District Stormwater System Capacity Requirements
.

Table 7-2: Tasman District Stormwater System Capacity Requirements

Stormwater System Type	Primary System Capacity	Overall System Capacity
Conventional pipe system design	5% AEP (Q_{20}, 20 return period)	1% AEP (Q_{100} ,100 year return period)
Low impact design	5% AEP (Q_{20}, 20 return period) and to the Engineering Managers approval	2% AEP (Q_{100} ,100 year return period)
All water courses, streams and rivers*	1% AEP (Q_{100} ,100 return period)	
*Note section 7.5.4 below		

The minimum freeboard from the hydraulic grade line to the finished ground level (ie, channel edge, sump or manhole lid level) shall be 400mm. This information shall be included on the as-built drawings.

7.2.4 Rainfall Intensity

a) For urban stormwater design in the Waimea Plains (Richmond, Brightwater, Wakefield, Mapua) Table 7-3 shall be used.

g) b) In remaining areas the determination of design rainfall intensity for each site may be determined on a case-by-case by the Designer as an alternative to Table 7-3: Tasman District Design Rainfall Intensity for Richmond, Brightwater, Wakefield and Mapua (mm/hr)
Historical rainfall records and software such as HIRDS 3.0 are appropriate for this purpose.

Table 7-3: Tasman District Design Rainfall Intensity for Richmond, Brightwater, Wakefield and Mapua (mm/hr)

		Duration (minutes)							
Annual Exceedance Period (AEP)	**Return Period (years)**	**10**	**20**	**30**	**60**	**120**	**360 (6 hr)**	**720 (12 hr)**	**1440 (24 hr)**
20%	5	72	57	46	32	23	12	8	5
10%	10	90	69	54	38	27	14	9	5
5%	20	108	81	60	43	31	16	10	6
2%	50	132	93	70	49	37	19	12	7
1%	100	146	102	76	54	40	21	13	8

See TDC Drawing 712 for the 10 to 120-minute duration events.

7.2.5 Runoff Coefficient

The following standards apply to the calculation of run-off:

a) Determination of catchment run-off is the key basis for stormwater network design, and must be assessed carefully for each site. Designers are referred to Verification Method E1/VM1 of the Building Code for guidance on the determination of run-off coefficients. These coefficients are reproduced in Table 7-4.

b) In all cases the assumptions used (and the basis of these assumptions) in the calculation of run-off shall be clearly stated. Specifically, the calculation of impervious area and runoff coefficients shall be based on site specific data and account for the ultimate development of the site and upstream catchment.

Table 7-4: Recommended Runoff Coefficients for Design

Natural surface types	**C**	**Developed surface types**	**C**
Bare impermeable clay with no interception channels or run-off control.	0.70	Fully roofed and/or sealed developments.	0.90
		Steel and non-absorbent roof surfaces	0.90
Bare uncultivated soil of medium soakage.	0.60	Asphalt and concrete paved surfaces	0.85
Heavy clay soil types: – pasture and grass cover	 0.40	Near flat and slightly absorbent roof surfaces.	0.80
– bush and scrub cover – cultivated	0.35 0.30	Stone, brick and pre-cast concrete paving panels	
Medium soakage soil types: – pasture and scrub cover – bush and scrub cover	 0.30 0.25	– with sealed joints – with open joints Unsealed roads	0.80 0.60 0.50
– cultivated	0.20	Unsealed yards and similar surfaces	0.35
High soakage gravel, sandy and volcanic soil types: – pasture and scrub cover – bush and scrub cover	 0.20 0.15	**Slope correction factor** Slope 5-10%	 Adjustment factor subtracting 0.05
– cultivated	0.10	10-20%	no adjustment
Parks, playgrounds and reserves:		20% or steeper	adding 0.05

Natural surface types	C	Developed surface types	C
– mainly grassed – predominantly bush	0.30 0.25		

7.2.6 Time of Concentration

a) It is essential that the critical rainfall duration is determined for the design of each portion of the stormwater network. In large or flat catchments the critical rainfall intensity is likely to vary for different sections of the network and should be determined using the time of concentration at the particular point being considered.

b) The time of concentration shall be calculated in the determination of critical rainfall duration for a given network, and the assessment of this shall include the calculation of time of entry (including surface flow) and the time of pipe or channel flow (refer TDC Drawing 713).

c) Calculation of the time of concentration may be made explicitly, through the use of manual calculations, or via a hydrological/hydraulic model.

d) Designers are referred to Verification Method E1/VM1 of the Building Code for guidance in the calculation of the time of concentration.

e) Where the stormwater system includes detention facilities, Designers must consider the dynamic effects of attenuation through the facility to work out the critical duration this will cause and the greatest flooding during design storm events. Design of the area downstream of the detention facility will also be critical to mitigate erosion and downstream flooding.

7.3 Hydraulics

7.3.1 Pipelines (Gravity and Pressure)

Friction losses should be calculated in accordance with Pipe Manufacturers Hydraulic Design Charts. Appropriate allowances should be made for velocity head, inlet and outlet losses, and losses due to changes of direction and obstacles.

As a guide, the following table gives typical energy loss coefficients (k) (excluding changes in hydraulic grade line due to changes in velocity head which should also be allowed for).

Energy loss $h_e = K v^2/2g$ (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

7.3.2 Sumps – Collection of Water from Side-Channels

Head loss at sumps will depend partly on direction, depth and velocity of flow, and it should be ensured that side-channel water does not bypass sumps when velocities are high.

7.3.3 Sump Positions

Head loss through sump gratings in low sag positions should be calculated as follows, an allowance having been made for partial blockage:

	Head loss per sump (m)	Max. flow (m^3/s)	Head up at sump (m)
Single flat channel grating, ie standard TDC sump	$33 Q^2$ *	0.060	0.12
Single grating with back entry, ie standard TDC sump with back entry	$20 Q^2$ *	0.075	0.11

* Where Q is flow in m3/s

7.3.4 Open Channels

Mannings formula $Q = \frac{AR^{2/3} s^{1/2}}{n}$ is usually satisfactory,

Q	=	flow m^3 / s
R	=	hydraulic radius (m)
S	=	slope of surface
A	=	water section area, m^2

Appropriate mannings n values should be taken from NZS4404-2010.

Capacity calculations for open channels should include consideration of future enhancement potential, making allowance for mature riparian vegetation and natural stream bed and banks in the determination of appropriate Manning's n values. This is important even where enhancement is not part of a current works program, as it allows for future enhancement projects to occur without affecting flood capacity and ensures adequate land is secured at early stages to incorporate both flooding management and amenity and ecological requirements now and in the future.

Extra freeboard should be allowed in steep channels where roll waves can occur.

7.4 Kerb and channels ‑ maximum flows

Piping should be extended far enough up road catchments to limit the stormwater flow in standard flat channels as follows:

	Gradient	
	1-in-300 (min. grade)	Or maximum flow depending on grade
Residential, up to 200 persons/ha	55 ℓ/s	953 √ gradient
Residential, over 200 persons/ha	45 ℓ/s	780 √ gradient
Commercial	35 ℓ/s	606 √ gradient
Industrial	55 ℓ/s	953 √ gradient

This gradient calculation will reduce the amount of water carried in side channels as the pedestrian population increases, ie less disruption to pedestrians walking over water channels during heavy rain events. Tasman District Council may also wish to reduce side channel peak flows on through roads for traffic reasons. Early consultation on this point is recommended.

7.5 Outfall Structure Design

7.5.1 General Design

The design, construction and maintenance of outfall and inlet structures in waterways and to the coast must meet the following general objectives:

a) Erosion of the bed and banks of the waterway is avoided or minimised

b) The structure allows for ongoing fish passage, where there is existing or potential for upstream or downstream habitat (refer TRMP Part 4), which is suitable for those fish species anticipated to use the area. Council may require an independent assessment by a suitably qualified aquatic ecologist where fish passage has not been allowed for in outfall design.

c) Structures are safe and designed to be visually unobtrusive and blend into adjacent banks (refer drawing 724).

Further guidance on good outfall design and provision of fish passage can be found in Council's 'Best Practice Guidelines Waterway Crossings' 2009, Council's brochure on 'Providing for fish passage at culverts' (both available from Council's website) and from Christchurch City Council's *Waterways, Wetlands and Drainage Guide 2003.*

7.5.2 Sea Outfall Level Design Criteria

It is imperative that properties (assets) and, in some instances, land be protected from inundation especially from the sea and potential climate change characteristics.

In the mid 1950s Harbour Boards and LINZ worked together to establish a consistent datum for levels. This was defined as mean sea level and equated to a 0.00 datum. Tasman District Council subsequently accepted this datum 0.00 for all levels around the region. Due to gradual sea level rise, present day mean sea level has risen above the 0.00 datum particularly for benchmarks established some decades ago. Therefore any design should take into account any local change in the mean sea level in the relevant area.

To give some guidance to Designers the following requirements are made to set minimum levels in terms of inundation from the sea:

a) Any discharge to the Coastal Marine Area will require resource consent under the TRMP.

b) Designers will need to satisfy Council that all known and potential adverse environmental effects including those resulting from projected climate change and sea level rise are taken into account when designing for the life of the asset.

c) The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report "Climate Change 2007" notes that a model-based range of project sea level rise of 0.18-0.59m could occur by the mid 2090s relative to the average sea level over 1980-1999. The Ministry for the Environment (MfE) in their March 2009 publication "Preparing for Coastal Change – A Guide for Local Government in New Zealand" recommended a range of baseline allowances for sea level rise, along with consideration of the consequences of a greater sea level rise for each timeframe. Thus for the period 2090-2099 a baseline allowance of 0.5 m is recommended with consideration of the consequences of sea level rise of at least 0.8m. Add 10mm/year beyond 2100.

d) Significant areas of catchments in the district are low lying and may present a problem when attempting to dispose of stormwater adequately. In these locations Designers shall consider the backwater effects of tidal water levels as well as the free-draining capacity of hydraulic systems.

e) For the purpose of pipe and open channel design the hydraulic grade line at the sea outfall shall start at 100mm above the MHWS mark in each coastal marine area.

7.6 Ground and Building Levels to Manage Flooding Hazards

7.6.1 Minimum Ground Levels Adjacent to the Coast (Tidal Flooding)

f) Minimum ground levels to mitigate flooding and seawater inundation risk depend on the local of the land. Minimum GLs on an open coast may differ to those for land adjacent to an estuary. Specific design will be required in most cases. In the absence of specific assessment Table 7-5 sets out the required allowances for increases in finished ground level above Mean High Water Springs (MHWS) for subdivision and developments adjacent to the coast in a 100-year time horizon.

Table 7-5: Basis of Minimum Finished Ground Levels above MHWS (Mean High Water Springs) for open coast settings

Tidal Component	**Height Above MHWS(m)**
Extreme high tide/storm surge (Astronomical Spring Tide or Highest astronomical tide) Global Warming Sea Level Rise Allowance (–MfE “Preparing for coastal change – March 2009) / Wave run up/River flow effects	 1.0 1.0 0.50
Initial minimum land levels in the coastal environment above MHWS	**2.50**
Effects of variables such as wave set up require specific investigation. In extreme cases, combined wave run up and wave set up can exceed 1.0m elevation. Estuaries, tidal inlets, causeways and storm water drains can all affect final water levels for design and these influences and settings require specific assessment.	

b) MHWS, in terms of TDC datum, will need to be confirmed by survey at each locality and the ground level raised by a minimum of 2.50m above that level. Note that Tasman District Council figures will differ slightly from Nelson City Council due to tidal variations around the coastline.

g) c) There are tidal variations around the district.

Table 7-6 is provided as a guide for finished ground levels in the specific locations in Tasman District, and specific design will be required to be submitted with the consent application.

Table 7-6: General Guide for Finished Ground Levels for coastal subdivisions in the two bays in Tasman District in relation to MSL

Area	Height of MHWS above MSL	Minimum Ground Level in Relation to MSL
Tasman Bay		
Richmond	1.90	4.40
Mapua	1.90	4.40
Motueka	1.88	4.38
Golden Bay		
Tarakohe	1.88	4.38
Puponga	1.93	4.43
Collingwood	1.91	4.41
Note: Some data is approximate and will require specific design to ascertain the correct MSL and its relationship to TDC datum.		

h) For required floor levels refer to the Building Act. Minimum floor levels are dependent on foundation design and flood risk exposure.

i) The minimum ground level requirement will be reviewed at the time of every TRMP review or at relevant resource consent application.

j) Where ground levels are raised, this shall not exacerbate flood hazards on other properties.

7.6.2 Minimum Ground Levels (Residential Areas Below Road Level)

a) In areas of level topography (ie 1-in-20 or flatter), roads vested with Council shall be used as secondary flow paths.

b) The site shall be contoured as necessary to ensure that:

i. Where practicable, the minimum finished ground level is greater than the crown level of the road to which the piped stormwater from the allotment is drained.
ii. Stormwater shall not flow from the road reserve into the site (either as backflow via stormwater connections or as surface run-off).
iii. No fill shall be placed which interferes with the natural run-off from neighbouring land. Where filling of the site obstructs the natural run-off from an adjoining property then provision shall be made for the drainage of that property.
iv. There is continuous fall towards the road that the site is draining to. Provision shall be made for potential development and filling of any intermediate sites.

7.6.3 Minimum Ground Levels (Adjoining Rivers and Streams)

a) Where a site adjoins a river or stream the minimum building platform will be controlled by water levels for a minimum 1% AEP (a 1000-year return period on average) event and a 500mm minimum freeboard for the design life of the building.

b) Where building platforms are raised above adjoining ground levels, a safe access shall be provided to the building platform. This access shall not significantly impede overland flow or locally raise flood risk.

c) To obtain subsequent floor levels refer to the Building Act.

d) For permanent structures the Designer must allow for changes in rainfall patterns, either through a higher design standard or an increased freeboard.

e) Council's Environmental Information officers who can interpret 50-year flooding levels should be consulted with respect to flood hazard areas for major streams/rivers in the Tasman District. No development will be permitted in the above areas until adverse effects have been mitigated.

7.7 Accepted Methods

This section outlines accepted design solutions for stormwater management and drainage in the Tasman District.

7.7.1 General

There are a number of methods available for the management of stormwater and it is likely that new developments will utilise a combination of methods.

A low impact approach which retains and utilises natural features to manage stormwater is preferred. In all greenfield, and suitable brownfield developments, retention of open watercourses and development of associated greenways is required. The design standards and conditions for greenways are set out in Section 7.7.3.

Where a piped system is to be used Section 7.7.4 sets out the key piped system design standards and conditions that must be met in order for the system to meet Council's expectations.

The following guidelines set out the other available methods of stormwater management and disposal that are generally considered to be acceptable provided that all standards and conditions associated with their design and installation are met.

7.7.2 Soakbeds and Soakage Trench Design

In areas with approved soil classifications that have sufficient natural soil permeability, Council may permit use of soakage with specific design.

a) Approval of soakage for stormwater is at Council's discretion. Grounds for refusal of soakage may include:

   i. potential groundwater contamination;
   ii. high groundwater levels;
   iii. slope stability concerns;
   iv. compatibility with the built environment and Council's existing assets;
   v. lack of secondary flowpaths; and
   vi. specific geology, including Karst systems

b) Specific design of soakage solutions is required, due to the variation of soil types and shallow groundwater levels throughout the district. Refer NZBC/E1 for site testing regime (Verification Method E1/VM1).

c) Soakage systems shall have a capacity adequate for a 5% AEP (20-year) event. This capacity shall be proven through field testing that is consistent with Verification Method E1/VM1 and at a time of seasonally high groundwater (normally winter).

d) Continued maintenance is required for soakage systems, as silting up of the soakage media may occur over time. This maintenance must be specifically addressed by the Designer and outlined in a maintenance plan to be submitted with any application for resource consent. A maintenance period of between 2-6 years plus a Bank Bond shall apply for any soakage asset vested in Council.

e) For any development intended to include privately owned soakage systems a consent notice or other appropriate legal instrument shall be included on titles requiring checking and maintenance of the soakage system to retain the desired design soakage levels.

f) Rigorous flood risk analysis and overland (1% AEP, Q_{100})flow design will be required where soakage is chosen as a preferred disposal option. When assessing flood risk and overland flow, no allowance for soakage capacity shall be assumed.

g) The effectiveness of soakage may be maximised with the reuse, storage, or detention of stormwater on site through means such as tanks, and irrigation areas. In such instances a reduction of soakage capacity may be accepted in conjunction with other low-impact design solutions.

h) A typical soak pit / trench / rain garden concept is shown on TDC Drawing 725. This drawing is intended as a guide and specific proposals will require the Engineering Manager's approval.

i) Soakbeds and soakage trenches shall be kept clear of secondary over land flow paths with vehicle access provided for maintenance purposes.

j) Disposal of stormwater by soakage on a private right-of-way will require specific design. The right-of-way shall initially drain via a standard sump and then to a soak bed as shown on TDC Drawing 723. The ongoing maintenance of this soakage shall lie with the properties served by the right-of-way and Council will require this to be recorded on the title of each property.

7.7.3 Open Channel Design

Open channels should be designed, constructed and maintained to meet the following general criteria:

a) Open channels are the preferred method of stormwater conveyance for perennial and intermittent watercourses, and for flows requiring pipes of greater than 900mm diameter.

b) In all cases the size, shape and grade of open channels shall be to the approval of the Engineering Manager.

Council's preference is for open channels to have a natural, pleasing appearance with:

i. maintenance of design flood flow capacity
ii. existing flow regimes maintained
iii. stable bed and banks
iv. meanders and natural irregularity

v. channels to have appropriate diversity in bed and bank form and alignment in order to provide good habitat and ecological values
vi. allowance for a low flow channel
vii. stream water temperatures maintained through riparian shading and channel design
viii. native eco-sourced plants used in riparian planting (refer Section 12 for riparian planting guidance)
ix. fish passage provided
x. habitat for aquatic and riparian fauna encouraged, and
xi. allowance for suitable maintenance access within designs.

A comprehensive design may be requested to fulfil these design criteria. Refer to TDC Drawing 724.

c) Works within waterways may require resource consent under the TRMP. All works and maintenance on open channels are to comply with the requirements of the TRMP and all relevant resource consent conditions.

d) Where natural and modified watercourses or formed artificial channels are to be vested in Council, they shall be located within a drainage reserve of sufficient width to contain the full design flood flow with a minimum freeboard of 500mm and allow for super elevation on curves and allow for mature riparian growth within the channel and maintenance vehicle access.

e) Watercourses that are vested in Council should be located in appropriately sized greenways including a central drainage reserve and appropriate local reserves (refer section 12).

f) Sizing of greenways is dependent on allowance for the design flood flow extent and a minimum berm area adjoining each side of the design floodway of 5.0m to accommodate amenity plantings and shared pathways with good pedestrian and maintenance vehicle access (refer section 12). Maintenance accesses are not to be located on roads.

g) The floodway design shall allow for a minimum of a 1% AEP. Where the downstream system cannot accommodate the flow, suitable detention structures shall be installed as per section 7.7.10.

h) Councils preference is for watercourses to be vested in Council, however where watercourses are to remain in private ownership, a consent notice (or other suitable legal instrument) shall be placed on the property titles outlining the land owner's responsibilities for maintaining the watercourse to retain flood capacity and healthy riparian vegetation.

i) Drainage reserves shall ideally have a maximum batter slope of 1 vertical to 5 horizontal and allowance for safety considerations (eg ease of egress from channel). Maintenance access shall be provided for the full length of the channel by a 6.0m wide berm on one side or a 4.0m berm on both sides with allowance for riparian vegetation growth. Consideration in design must be given to the types of maintenance required over the long term - including management of riparian and aquatic vegetation, sediment and debris removal and repair/replacement of in-stream infrastructure assets -allowing these activities to take place without undue damage to riparian plantings, habitats, channel form or other infrastructure. Maintenance accesses are not to be located on roads.

j) Channel works shall include protection against scour and erosion of the stream banks and stream bed where necessary.

k) Low-flow channels shall be retained in existing channels and formed in the invert of any newly formed channels. Low flow channels should reflect best practice for protection of ecological and habitat values (eg minimum depth and maximum width to maintain water temperature and depths), while also allowing for efficient maintenance. See TDC Drawing 724 for outfall details and waterway design concepts. Further guidance on waterway design can be found in Christchurch City Council's *Waterways, Wetlands and Drainage Guide 2003*.

   Natural open stream areas shall be cleared of all unsuitable plant growth (including noxious or invasive weeds and plants creating significant impediments to flood flows or inlet/outlet capacity). Material removed from the bed or wetted margins shall be initially positioned to allow trapped fish etc to re-enter streams. Exposed bank areas shall be replanted to an appropriate landscape design approved by the Reserves Manager. The landscape design shall also include outlining of maintenance requirements for the establishment period post planting (refer section 12).

l) Channel design shall be consistent with the objectives of the Te Tau Ihu Mahi Tuna (Nelson/North Marlborough Eel Management Plan).

7.7.4 Piping of Watercourses

The piping of natural watercourses should be avoided. The piping of continually or intermittently flowing watercourses with an equivalent pipe size over 900mm is not recommended due to cost, long-term maintenance liabilities and freshwater habitat effects. Ephemeral water courses should be retained as natural drainage features where practicable and must be protected where they function as secondary flood flow paths.

In some infill and brownfield circumstances retention of open channels is not possible due to the ongoing maintenance requirements and access restrictions.

Where piping of watercourses is necessary, the following standards shall apply:

a) Resource consent will be required.

b) Should a watercourse be piped (such as in an intensively developed area), a subsoil drain 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 flow paths shall be provided. These shall be shown on the Engineering Drawings and protected by easements from development that may modify or obstruct flows or impede access for maintenance. Note design capacity of Q_{100} – 1% AEP is required.

d) Where a perennial or intermittent watercourse is replaced with a pipe of 600mm or greater, allowance shall be made for fish passage, including velocity considerations, and provision of an in-stream environment (eg natural bed retention). 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 (refer to *Best Practice Guidelines for Waterway Crossings*, TDC, 2009; TP 131 for further guidance on fish passage).

7.7.5 Temporary Intakes into Pipe Networks

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

7.7.6 Cut-Off Channels

a) Approved cut-off channels may be required parallel and adjacent to the uphill boundaries of high level sections. When required, these shall be located within the upper boundary of the property to be protected and covered by suitable easements.

b) In this case a consent notice (refer RMA Section 221) shall be placed on the property title outlining that the property owner is responsible for maintaining the cut-off channel and outlining the applicable standards for design and maintenance.

7.7.7 Culverts Under Fill

a) Culverts shall be of sufficient strength to support all designed super imposed loads in accordance with NZS/AS 3725 and culvert design manuals.
Note 1 – minimum 375mm diameter for rural access crossings.
Note 2 – a free software download is available from http://www.cpaa.asn.au/General/design-software-pipeclass.hotml to facilitate these checks

b) Culverts shall have adequate wingwalls, headwalls, aprons, approved grills, traps and/or pits to prevent blockage, scouring and erosion and shall allow for fish passage where appropriate.

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

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

7.7.8 Sub-Soil Drains

a) Sub-soil drains draining residential land areas shall terminate at a sump (TDC Drawing 707). Sub-soil drains shall not discharge to the kerb and channel.

b) Sub-soil drains draining service trenches shall terminate at the closest stormwater manhole or sump.

c) Sub-soil drains are not to be considered as part of the surface water drainage system.

7.7.9 On-Site Retention of Stormwater

a) Water is a valuable resource and land owners are encouraged to retain and reuse stormwater collected on their site.

b) Retention and reuse also reduces peak stormwater flows in Council's pipe systems, releasing stored water after high intensity storms have passed, thereby minimising off-site adverse effects.

c) Retention of stormwater can be achieved via holding tanks on site. The lower two-thirds of a tank can be used for stormwater reuse and the top one-third of the tank for detention and slow discharge to Council's reticulation system if available. TDC Drawing 725 gives a working example for stormwater retention design.

d) Where detention tanks are to be used as a means of avoiding off-site adverse effects via attenuation, a consent notice (refer RMA Section 221), or other suitable legal instrument, shall be placed on the property title(s) outlining that the property owner is responsible for maintaining the detention tank attenuation capacity and associated outlet and outlining the applicable ongoing standards for outlet design, performance and maintenance.

7.7.10 Detention Basins

Detention basins that are to be vested in Council must have the prior approval of the Engineering and Reserves Managers. Detention basins may be needed for the control of stormwater flows should downstream stormwater systems be substandard. Because of long-term maintenance costs, large basins are preferred by Council over a series of smaller ones.

Council may consider smaller basins if they are incorporated into local purpose reserves and have other benefits for the public.

If detention basins are approved they are to be designed to the following standard:

a) The 10-year, 20-year and 100-year return period peak flood flow from the developed catchment shall be no greater than would have occurred from the undeveloped catchment at the critical downstream location(s) in the network. This requirement may result in design for a number of duration rainfall events.

b) The Designer shall provide for easily maintained amenity and recreation values around and within the detention basin in discussion with the Reserves Manager. The maximum internal side slope shall be 1-in-5 for safety and ease of maintenance.

c) A design and construction certificate shall be provided for each structure by a suitably qualified Chartered Professional Engineer stating that the basin has been designed and constructed in accordance with the appropriate standards.

d) A 500mm freeboard shall be provided above the maximum design storage level to the spillway crest. Council reserves the right to vary the freeboard requirement on discussion with the Designer.

e) The spillway shall be capable of passing the 1% AEP (Q_{100}) event without risk of over-topping the dam structure or eroding the spillway.

f) In locations where the majority of the flow into the structure would be via overland flow the discharge into the downstream stormwater system shall be through a standard stormwater intake (TDC Drawing 702).

g) In dry detention basin locations where the majority of the flow into the structure would be via piped systems, the piped systems shall be extended under the basin with surcharging capabilities to allow:

- Multi-use options for the basin area;

- Peak flood flows to bubble up via a sump out of the pipe system into the storage basin;
- Stored water to drain once the flood peak has passed;

h) For detentions dams within continually flowing catchments, a naturalised channel with appropriate riparian vegetation should be provided, including allowance for detention capacity taken up by mature vegetation and appropriate species selection and downstream stormwater intake design to avoid blockages.

i) In all cases a secondary intake shall be provided terminating 500mm below spillway crest level (or at an approved alternative level as per (d) above). An acceptable example is shown on TDC Drawings 701, 702 and 703

j) An all-weather access track shall be provided from a legal road reserve to the basin of the detention dam and intake structures. The track shall be no steeper than 1-in-7, have a physical width of not less than 3.0m and be provided with stormwater control.

k) Detention pond design shall mitigate any actual or potential adverse effects by addressing the following points:

- side slope stability and safety considerations;
- ease of maintenance, including mowing (consider alternatives for boggy low points – eg planting and silt cleanout);
- shape, contour and planting for amenity value;
- the effectiveness of the outlet structure;
- secondary overflow options;
- dam or bank failure;
- silt traps;
- fish passage, aquatic and terrestrial habitats and birdlife enhancements;
- pedestrian links to other reserves and recreation opportunities;
- safety fencing and appropriate contours; and
- vegetation islands, shading.

l) Detention ponds shall vest as “utility reserves” and not form part of a reserve fund calculation trade-off, unless previously agreed with the Reserves Manager.

7.8 Piped System Specifications

7.8.1 Pipe Design

All systems shall be designed to accept flows from above a proposed development, and shall be of sufficient capacity to provide for maximum flows from possible future development (as indicated by zoning in the TRMP).

Pipe capacity matching that of the pre-developed state, will only be accepted if appropriate mitigation measures (such as detention structures or on-site detention) approved by the Engineering Manager are constructed by the developer and legally protected from modification.

Any mitigation measures must be designed so that flows into the entire downstream network are attenuated for the appropriate design event(s) and appropriate secondary flood flow paths are identified and protected for events exceeding the design level. Refer to the detailed requirements for detention dams/basins (refer section 7.7.10).

For flows requiring pipes of greater than 900mm diameter stormwater should ideally be managed through an appropriately-designed open channel system (refer section 7.7.3).

In all cases the diameter and grades of pipelines shall be to the approval of the Engineering Manager.

Table 7-7 sets out the minimum specifications for public stormwater pipe design.

Table 7-7: Minimum Specification for Public Stormwater Pipes

	Concrete pipe	**uPVC pipe**
Permitted size	Minimum 225mm ID Thereafter in 75mm increments	Minimum 225mm ID Maximum 300mm ID
Minimum standard	NZS4058	AS/NZS1260
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
Cover depth	Refer Table 7-8	Refer Table 7-8
Joints	Rubber ring jointed	
Pipe capacity	5% AEP (1 in 20 year)	
Flow velocity	Minimum 0.75m/s** Maximum 6.0m/s#	
Pipe location (in preference)	Road reserve Other Council Reserve Other Council owned land Private land with legal protection Note TDC Drawing 700	
Clearance from other services	Minimum 200mm vertical Minimum 500mm horizontal (lesser clearance on approval of the Engineering Manager)	

* Pipes in vulnerable situations, eg lateral connection of sumps to mains should be checked against NZS/AS 3725. A free software download is available from http://www.cpaa.asn.au/General/design-software-pipeclass.html to facilitate these checks.
** Gravel or silt traps may be required to be installed in low velocity flow situations.
# Maximum flows may need to be lower where fish passage is required.

7.8.2 Calculation of Pipe Capacity

Pipe sizes and grades shall be calculated using standard hydraulic formulae (Manning, Colebrook-White), or an approved hydraulic calculator or model.

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

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.

A pipe roughness calculated using either the Mannings ($n = 0.013$) or Colebrook-White formulae (k_s = 1.5mm – up to 450mm dia/ k_s = 0.6mm – over 450mm dia) shall be adopted to account for gravel and grit deposits and other *in-situ* 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.

7.8.3 Calculation of Flow in Steep Pipelines

Where a pipe gradient exceeds 1-in-10 an allowance for the bulking of the flow due to air entrainment should be made. This allowance is made by increasing the area of the pipe for the additional volume of air in the flow. The air-to-water ratio may be calculated from the formula:

$$\frac{Air}{Water} = \frac{kV^2}{gR}$$

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)

7.8.4 Pressurised Pipelines

A pressurised stormwater system shall be subject to Engineering Manager approval. Stormwater pumping is not generally permitted. Any stormwater pump station design must be specifically approved by the Engineering Manager and generally be in accordance with Council's wastewater pump station design standards.

Where a non-pumped pressurised stormwater system is deemed to be necessary (for a 5% AEP design storm) 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.

7.8.5 Pipe Cover

Pipe systems shall be designed to ensure the minimum cover over the barrel in accordance with Table 7-8.

Generally deep pipelines exceeding 2.5m deep shall be avoided. Over-depth pipelines are difficult to access in the future for maintenance and renewal works.

Table 7-8: Pipe Cover Standards

Location of Pipe	**Minimum Cover Required**	
	Concrete Pipe	**PVC Pipe**
Areas subject to highway traffic loading eg, within road carriageway.	600mm	750mm
Areas subject to light traffic loading outside road eg ROWs, driveways, car parks, maintenance accesses and berms.	450mm	600mm
Areas never subject to traffic loading.	300mm	450mm
Under continuous concrete encasement for full circumference (specific design required to mitigate expansion of pipe material).	300mm	300mm

Reduced cover on pipes may be approved by the Engineering Manager providing the appropriate class of pipe is specified and cover is according to the manufacturer's specification.

Minimum cover may also be reduced providing the pipe is concrete encased and subject to the Engineering Manager's approval. The minimum thickness of concrete encasement shall be 100mm and the minimum concrete strength shall be 20MPa. Capping of the pipe may be permitted subject to specific design and approval by the Engineering Manager. Where pipes with inadequate cover require concrete encasement the extent and thickness of concrete and concrete strength shall be specified on the drawings.

These standards are specific to the installation of particular components of the stormwater system:

a) Backfilling, compaction and maintenance of the circular shape of the pipe is of paramount importance when laying thin walled pipes. The relevant specifications shall be adhered to. Pipelines constructed with thin walled pipe require close supervision during construction.

b) For minimum pipe cover requirements refer to Table 7-8. Minimum cover may be reduced providing the pipe is concrete encased and subject to Council's approval.

c) To avoid reflective cracking of pavements and differential settlement concrete encasement shall not be permitted to penetrate the basecourse or pavement construction.

d) No concrete protection shall be placed around the pipe until the line has been inspected and approved by the Engineering Manager.

e) PVC piping adjacent to concrete shall be protected with appropriate 6mm thick denso tape or equivalent 250 micron polythene.

7.8.6 Manholes

Table 7-9 sets out the minimum specifications for manholes, mini-manholes and lamp hole cleaning eyes.

Table 7-9: Required Pipe Access Openings and Limiting Requirements

	Manholes	**Mini-manholes**	**Lamp Hole Cleaning Eyes**
Locations where pipe access openings must be provided:	Manholes to be provided at: • Change in grade • Change in direction • Change in size • Pipe junctions • End of public pipe 100m centres	Mini Manholes to be provided at: • Private connections, out of areas subject to traffic loading.	LHCE not to be used. Except at changes in grade at top of steep sections where they are not in carriageways, footpaths or berms.
Maximum pipe size	450mm (1050 mm dia) 750mm (1350 mm dia) 1075mm (1500 mm dia) 1200mm (1800 mm dia)*	225mm ID	225mm ID

	Manholes	Mini-manholes	Lamp Hole Cleaning Eyes
Maximum depth	2.5m	0.9m for public pipe	1.5m
Maximum deflection angle	90° for pipes up to 375mm dia 60° for pipes >375mm dia	45°	-
Maximum distance between centres	100m	100m	100m
Approved materials	Concrete	uPVC Concrete	uPVC
TDC Drawing	717	803	807 and 808
* Factory-made “T” manholes will be permitted for pipes of 1350mm diameter and over, subject to the approval of the Engineering Manager.			

Stormwater manholes shall be constructed of pre-cast and cast *in-situ* concrete in accordance with TDC Drawings 716 and 802.

The diameter of any manhole installed shall meet the dimensional requirements set out in TDC Drawing 716.

A fall of no less than 50mm shall be provided through all manholes.

All pipe soffits shall be matched to the soffit of the outgoing pipes incorporating the 50mm fall noted above when working with different pipe diameters.

7.8.7 Manhole Construction

a) Manholes shall be constructed in accordance with TDC Drawings 717, 719 and 803.

b) All manholes shall be made water-tight by effective sealing of manhole section joints (with mastic sealant) and pipe entries with epoxy mortar.

c) Manholes must be designed to resist uplift especially in areas where high groundwater is experienced.

d) All concrete pipes entering or leaving a manhole shall have one flexible joint within 500mm of the manhole and a second flexible joint within 3.0m of the manhole.

e) 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. “Starters” and “finishers” shall be used as appropriate.

f) A semicircular channel shall be formed with *in-situ* concrete through the manhole connecting the upstream and downstream pipes. The channel shall be finished with a smooth, regular half-circle invert with no abrupt changes in direction. Benching shall be steel float finished to give a regular smooth surface. The height of the concrete channel shall not be less than the diameter of the pipe on the downstream side of the manhole.

g) If manhole lids other than Humes or Hynds pre-cast concrete lids are to be used, then the appropriate certification must be submitted to Council showing that the lids will withstand loadings of 0.85 HN. Manholes shall have a minimum opening of 600mm in the concrete lid and picton ring.

h) Minor pipelines are generally connected to major pipelines through manholes. Direct connection of minor pipelines to major pipelines is acceptable provided it is either through a suitable junction (eg, a prefabricated and welded junction for large PVC diameter); or through a saddle, provided the diameter of the minor pipeline is not greater than half the diameter of the major pipeline.

i) A saddle junction shall be formed by cutting the collar end off a pipe of sufficient length below the collar to enter the pipe wall fully without intruding into the main pipe. The hole in the main pipe shall be as neat as possible and the “saddle” entry shall be neatly and securely epoxy mortared. Refer TDC Drawing 717.

7.8.8 Mini-manholes

Shallow concrete mini-manholes shall be in accordance with the requirements set out in TDC Drawing 803.

Prefabricated uPVC mini-manholes shall only be used on approval by the Engineering Manager.

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.

7.8.9 Lamp Hole Cleaning Eyes (LHCE)

The use of lamp hole cleaning eyes shall be limited to changes in grade at the top of steep banks where installation of a manhole or mini-manhole would not be practicably feasible. They are not to be placed in carriageways, footpaths or berms (refer Table 7-9).

7.8.10 Sumps

Sumps shall be 900mm x 450mm and constructed in accordance with TDC Drawings 705 to 711 and in accordance with the requirements of

Table 7-10.

Table 7-10: Required Sump Locations and Limiting Requirements

	Standard Back Entry Sumps	**Standard Back Entry Sumps with toothed connectors**	**Duplicate Sumps**
Approved locations	At each tangent point of the channel on the upstream side of road intersections where the grade is less than 1:100. At any low spot in a channel. Serving any right-of-way. Bubble sump in channel (TDC approved only).	At each tangent point of the channel on the upstream side of road intersections where the grade is greater than 1:100. Where the 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.
Prohibited Locations	Sumps shall not be positioned at vehicle crossings or pram crossings.		
Minimum lateral pipe size	225mm ID	225mm ID	300mm ID
TDC Drawing	705 – 711	705 – 711, 715, 716	705 – 711
Maximum depth	1300mm		
Maximum distance between sumps*	Standard kerb: 100m Mountable kerb: 60m (Subject to specific design on a case-by-case basis. Closer spacing of sumps may be required depending on the rate of runoff expected.)		
Approved materials	Concrete		

Sumps draining private right-of-ways can be a minimum 150mm square subject to suitable catchment design and a secondary flow path being directed to the road carriageway.

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

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) – refer also to the roading section of these standards.

Sumps which are located in tidal areas or in areas subject to flooding may require non-return systems as shown on TDC Drawing 721 to prevent backflow up the line. Other designs will be assessed on a case-by-case basis.

Sump connections may be made to stormwater pipes by use of saddle connections where this is physically possible.

7.8.11 Individual Site Connections

Connections to each site shall meet the following standards:

a) In all subdivisions a stormwater connection of a minimum 100mm diameter shall be provided to each property and terminate at least 1.0m inside the boundary of each lot. The pipe end shall be painted green to denote that it is a stormwater pipe.

b) A LHCE (inspection point) is required on all lateral connections, at a maximum depth to invert of 1.2m and located at the roadside of the property boundary. See TDC Drawing 807.

c) 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.

d) 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.

e) Individual house/site/lot stormwater shall be disposed of by piping to one of the following approved outfalls in order of preference; a lesser option will only be considered if a more preferable option is not practical or economically feasible:

   i. Detain/reuse on site
   ii. stormwater pipe;
   iii. kerb entry;
   iv. bubble-up sump (pressurised);
   v. on-site soakage, subject to testing.
   vi. watercourse/swale;

   In some areas and special cases (ie, free-running gravels and sands), on application and subject to Building Code requirements, soakage disposal may be an approved preferred option. Note secondary flow paths must be maintained.

f) On-site requirements for stormwater management systems, such as special sumps and filters, are also governed by the Building Act and its regulations.

7.8.12 Potentially Contaminated Stormwater

a) The discharge of stormwater to water or land that does not meet the TRMP permitted activity conditions for water quality will require resource consent (refer TRMP Chapter 36).

b) Stormwater from high risk land use, in particular proposed industrial land, requires careful management, including good onsite management practices, treatment devices and regular ongoing maintenance of onsite stormwater systems. Advice on on-site management can be obtained from Council's compliance department.

c) Bunded areas around fuel or hazardous materials storage areas shall only discharge to the stormwater network via a suitably designed and maintained stormwater interceptor treatment device (SITD) with an appropriate shut-off valve system to contain spills.

d) Where it is considered that there is a high risk of yard run-off being contaminated with oil and silt or other contaminants then a stormwater interceptor treatment device, with an appropriate shut-off valve system shall be required prior to connection to the stormwater system. This shall require site-specific design and approval by the Engineering Manager and shall include details of lifecycle maintenance for any treatment devices.

e) In some cases an appropriate mechanically or electronically operated wastewater diversion system may be required. Maximum permissible discharge rates to the wastewater network may be restricted by the Engineering Manager subject to network constraints. The generation of contaminated stormwater should be minimised using roof areas, perimeter bunds (see TDC Drawing 801 and good onsite management practices.

f) Stormwater shall not be allowed to directly discharge to the wastewater system without appropriate treatment and unless an appropriate trade waste consent has been obtained from Council (refer wastewater chapter of these standards).

g) Contaminated runoff that may contain a combination of detergent and/or degreasing agents with oil and/or silt shall be treated as trade waste (refer section 8.2.3) and directed to the wastewater sewer after first passing through a silt and oil trap built to TDC Drawing 801 standard. This also requires “Trade Waste Discharge” consent.

7.9 Pipe System Construction

The following specifications must be met in the construction of any reticulated stormwater management system.

7.9.1 General Specification

The following specification shall apply to the preparation of pipe installation, including trenching works (refer also chapter 4):

a) All drainage pipelines shall be constructed in accordance with the requirements of New Zealand and Australian standards as set out in Table 7-1, except as modified by the Tasman District Council Engineering Standards & Policies.

b) The maximum width of trench for side support to the pipe, measured at the level of the top of the pipe shall not exceed:

   i. For pipes up to 1200mm diameter – external diameter of the pipe plus 300mm;
   ii. For pipes over 1200mm diameter – external diameter of the pipe plus 500mm.

c) Excavation for manholes shall be only of sufficient size to leave adequate space for construction and for compaction of backfill and sealing of the manhole.

d) Excavations shall be kept free of water during construction. Water from any excavation will be disposed of so as not to cause any damage, nuisance or contamination or sediment discharge (eg passed through an appropriate sediment control device prior to discharge). Discharge consent may be required.

e) In no circumstances shall stormwater or groundwater be allowed to drain into any existing sewer, and pipe ends shall be plugged to prevent such ingress.

f) During construction discharge of stormwater or groundwater to existing stormwater drains or the pipes already laid will be permitted providing adequate erosion and sediment controls are in place and silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains, the pipes already laid, or on roads occur as a result of the operations of the landowner or the contractor, then such deposits shall be cleared forthwith at the landowner's or the contractor's expense to the satisfaction of Council.

g) Groundwater lowering may be permitted except where this practice may present a risk of subsidence
Note – Resource consent may be required.

h) The contractor or landowner or consent holder shall cause as little damage or interference to property, persons or the environment 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.

i) All materials and workmanship in mass or reinforced concrete shall be in conformity with NZS3109, and structural concrete shall have a minimum crushing strength of 20 MPa at 28 days

j) Bedding metal shall consist of graded metal to the following sizes and as shown on TDC Drawings 810 and 908:

    i. PVC – uniformly graded chip, all passing 9.5mm sieve and all retained on 4.75mm sieve.
    ii. Concrete Pipe – 18mm aggregate, with a minimum of 66% crushed, all passing an 18mm mesh and all retained on a 9mm mesh.
    iii. Or to manufacturers' specifications.

k) Alternative bedding material will only be permitted on the approval of the Engineering Manager.

l) The bottom of the trench shall be carefully hand trimmed to the correct line, grade and level and a bedding of pea gravel or 18mm drainage metal shall be provided, to a minimum thickness of 100mm under the pipe.

m) At the position of any collar, a hole shall be formed in the bedding so that the pipe barrel rests evenly on the bedding along its length.

n) The pipes shall be brought to true alignment and level before covering the pipes with side support material to the approval of the Engineering Manager.

o) Should substandard foundations be present that cannot be excavated, or in-filled ground service support structures will be required as shown on TDC Drawing 720.

p) In general a laser shall be used by the contractor for fixing line and grade, setting pipes to line and level, and for jointing.

q) Sight boards and boning rods will only be approved on minor works, eg, infill subdivisions or on steep gradients.

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

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

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

u) Joints shall be flexible and water tight.

v) Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out at the landowner's or the contractor's expense and to the satisfaction of Council.

w) Acceptance of completed assets will be conditional on CCTV inspection of assets where required by Council.

7.9.2 Sump Construction

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

- 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.

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

- The sump shall be placed within 20mm of being vertical.

- The maximum depth of a sump shall be 1300mm as per TDC Drawing 709.

- The finished level of the sump shall ensure compliance with the tolerance requirements for kerb and channel finished level as per the roading network section.

7.9.3 Private Connections

a) As stormwater construction proceeds, each connection shall be marked by a 75mm x 25mm ground-treated marker stake suitably identified and partly painted **green** (**red** for wastewater, **green** for stormwater).

b) The end caps and inside of all new stormwater lateral connections must be painted with green acrylic paint to help with future identification. The actual work of pipe laying shall be done by a person approved by Council.

c) Kerb entry connections may only be installed using approved kerb entry adaptors (not PVC) and with the Engineering Manager's approval. Approved kerb entry adaptors shall be 100mm diameter galvanised steel for a continuous length to the lot boundary.

d) Where a manhole is not required at a pipe junction the connection shall be made by using a "y" junction or a proper "saddle" junction. See TDC Drawings 718 and 810.

7.10 Alternative Assessment Framework

7.10.1 Introduction

The alternative assessment framework has been developed to provide further guidance to applicants considering a design, management method or solution that does not meet one or more of the Council approved methods outlined in this document.

In particular, the assessment framework has been developed to help applicants and Council when considering Low Impact Design (LID) approaches to stormwater management involving the need to assess specific low impact stormwater management devices and new technologies.

Low Impact Design (LID) is as an approach to land development and stormwater management that recognises the value of natural systems in order to mitigate environmental impacts and enhance local amenity and ecological values. The approach promotes the use of stormwater management methods and solutions which protect, incorporate and mimic natural drainage processes of a given site or catchment

A Low Impact Design approach should include:

a) Integrating stormwater design into the early stages of design and planning of development proposals;

b) Understanding existing drainage patterns within the catchment;

c) Retaining or enhancing natural drainage systems where possible;

d) Minimising impervious surface cover within developments;

e) Avoiding, rather than mitigating, adverse effects by managing stormwater at source (on-site);

f) Using natural systems and processes, such as soil infiltration and vegetation, in the management of flow and quality treatment of stormwater.

g) Integrating stormwater management and disposal with other urban values, such as open-space retention and ecological, recreation and amenity benefits;

Council encourages the use of LID principles in the management of stormwater within every development. However, Council also recognises that LID approaches may not be suitable under all circumstances such as (but not limited to) the following:

a) Where the proposed development is located within an urban area that has a high percentage of impervious surface cover and, where the existing stormwater systems rely on piped infrastructure;

b) Where the development is located on land that has poor natural drainage and/or a high water table, especially during high rainfall periods;

c) Where the soil or naturally occurring ground surface has poor permeability, preventing infiltration;

d) Where site conditions (such as total land area available, surface slopes or access issues) limit the effective operation and ongoing maintenance of a proposed system.

7.10.2 Information Requirements

The following information must be submitted with engineering designs:

a) A general outline of the proposed stormwater management system, design philosophy and design standards, referencing best practise methods that are used.

b) A description of the activities occurring on the site that will have an effect on stormwater drainage. Include a description of the nature of the effects on water flows and potential for water contamination;

c) A projection of the reasonably expected future development density, including the estimated impervious surface cover, and the type of activities likely to occur within the catchment;

d) A copy of all relevant resource consents. This must include a copy of any discharge consents, it may include subdivision and land-use consents where they relate to the site and stormwater activity;

e) A catchment plan that clearly defines the site, the catchment boundaries and all existing drainage features such as drainage infrastructure and watercourses, within it; and,

f) A hydrological analysis of rainfall run-off and design flows and a hydraulic analysis of system capacity, performance and flood levels including any assumptions made in capacity calculation.

g) Any proposed non-compliance with these standards.

7.10.3 Design Parameters

The applicant must provide Council with information to show that the proposed stormwater system is capable of managing stormwater effectively and efficiently.

For the purpose of this document, a capable system is defined as one that avoids adverse effects such as nuisance inundation, flooding, road safety risk, water quality degradation, habitat degradation and/or risk of property damage, within the following design parameters:

a) The system must be able to manage stormwater generated by a rainfall event in accordance with Section 7.1.1 and Section 7.2 and Table 7-2 of this document.

b) The system must be able to manage stormwater runoff from all surfaces within the contributing catchment area, and must allow for all stormwater that flows from upstream land assuming maximum probable development to TRMP zonings

c) Must be designed to cope with failure through blockages, bank failure or reduction in performance without placing property at undue risk.

d) The calculation of run-off must be provided in accordance with Section 7.2.3 of this document.

e) The system shall be designed such that if the pipe system fails, for example, blockage or is overwhelmed, then an adequate secondary system will cope with storm flows. The secondary flow path must be spatially identified and afforded suitable legal protection.

In addition stormwater management systems should ideally maximise the amenity, ecology and aesthetic values of the catchment and community they service.

7.10.4 Site Suitability

The site must be suitable for the proposed design method or solution. The following matters may be relevant to the assessment of suitability. The applicant must provide information that addresses each of the following matters where they are relevant.

a) The proposed method of transfer or disposal is suitable for the slope or topography of the site.

b) Where on-site disposal is used for all or part of the proposed system, the ground permeability must be demonstrated to be suitable.

c) Where ground infiltration is to be used, show that there will be no adverse effects on any groundwater resource, nor adverse effects on the proposed system by groundwater.

d) Where ground infiltration is to be used, show that there will be no adverse effects on ground stability, and any infrastructure asset such as roads, pipe systems or the amenity of reserves. A ground infiltration test shall be carried out during seasonally high groundwater (usually winter) using Verification Method E1/VM1).

e) The proposed stormwater management method must be able to be integrated with existing stormwater infrastructure, above and below the given stormwater management system within the catchment.

f) The receiving environment or reticulation network at the point of discharge must be able to accommodate any additional flow and/or water quality changes, without adverse effects on the downstream stormwater system, receiving environment or properties.

7.10.5 Design Specifications

The applicant must provide information to Council outlining detailed specifications of the proposed design. The following information must be submitted to Council where applicable:

a) Plans must be submitted to Council in accordance with section 7.10.2 and sections 2 and 3 of this document;

b) The specifications of all materials used in the design and construction of the stormwater system shall be submitted to Council;

c) The method of construction for any proposed device or system shall be provided, including construction techniques; and,

d) References to Best Practice Design in the construction of Low Impact Design solutions, such as the Auckland Regional Council TP124, shall be provided.

7.10.6 Maintenance and Management

Information about what, when and how a proposed system will be maintained to ensure its ongoing effectiveness in achieving stormwater management functions, must be submitted to Council at the time of application.

This must include estimated lifecycle costs of ongoing maintenance and address the following matters where they are applicable:

a) A comprehensive description of ongoing maintenance procedures and frequency required to ensure that the system operates effectively and efficiently, including consideration of potential effects of maintenance procedures on other Council assets, water quality and receiving environments (eg impacts on stream habitats and downstream reticulation);

b) Specification of accessibility to all points of the stormwater system;

c) An assessment of the durability of each device/system and/or materials used;

d) Specification of any resource consent conditions, and description of how they will be achieved;

e) Clearly defined ownership and management responsibilities for every part of the given system, including the resource consent holder(s);

f) Sufficient information to describe how the proposed device integrates into the existing infrastructure;

g) The replacement value of any system devices, including the method of replacement; and

h) Lifecycle costing of the given system.

i) For those assets to be vested with Council, a list of assets and asset attributes suitable for inclusion within Councils electronic Asset Management System

7.11 Stormwater Network Ownership and Responsibilities

7.11.1 Stormwater Pipe Assets to be Vested in Council

The stormwater pipe assets that would normally be vested in Tasman District Council are as follows:

- All stormwater pipes in the road reserve
- Any stormwater pipe 300mm and larger if connected to a public stormwater reticulation system.
- Pipes smaller than 300mm that carry water from the road reserve (refer drawing 700)

All other pipes are the responsibility of the property owner(s) or body corporate that are serviced by the pipe reticulation. All private reticulation should be shown on property titles via a consent notice or other suitable legal instrument.

Any Council asset located on private property shall have an easement in place, in favour of Council, that protects the asset and access to it for maintenance and renewal works (refer section 3.4.2).

7.11.2 Open Channels and Flow paths to be Vested in Council

The open channels that would normally be vested in Tasman District Council are as follows:

- Open channels within new subdivisions – including associated reserve land and maintenance access areas (refer also chapter 12)

Any secondary flow path, located on private property shall have an easement in gross or other instrument in place that protects it from development that may impact on its capacity or function during flood events.

7.11.3 Stormwater Discharges to Receiving Environments

The coastal marine area and natural and modified waterbodies, including drainage channels, streams, lakes, ponds, estuaries and wetlands are receiving environments for the purposes of regulation of stormwater discharges to water.

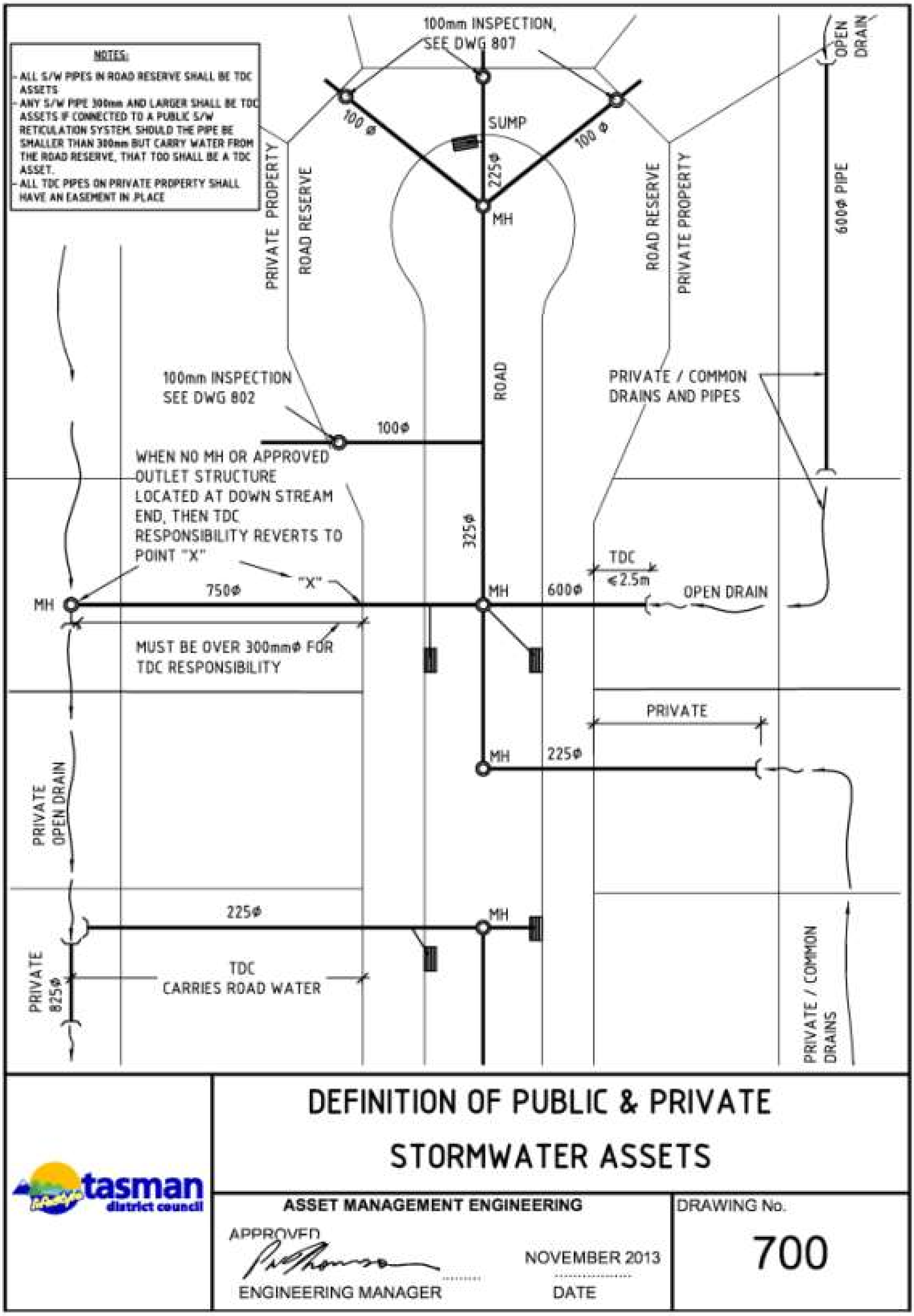
Council owns and manages some aquatic receiving environments within the network, however others are in private ownership.

The Council has responsibility as a Unitary Authority to regulate discharges to receiving environments.

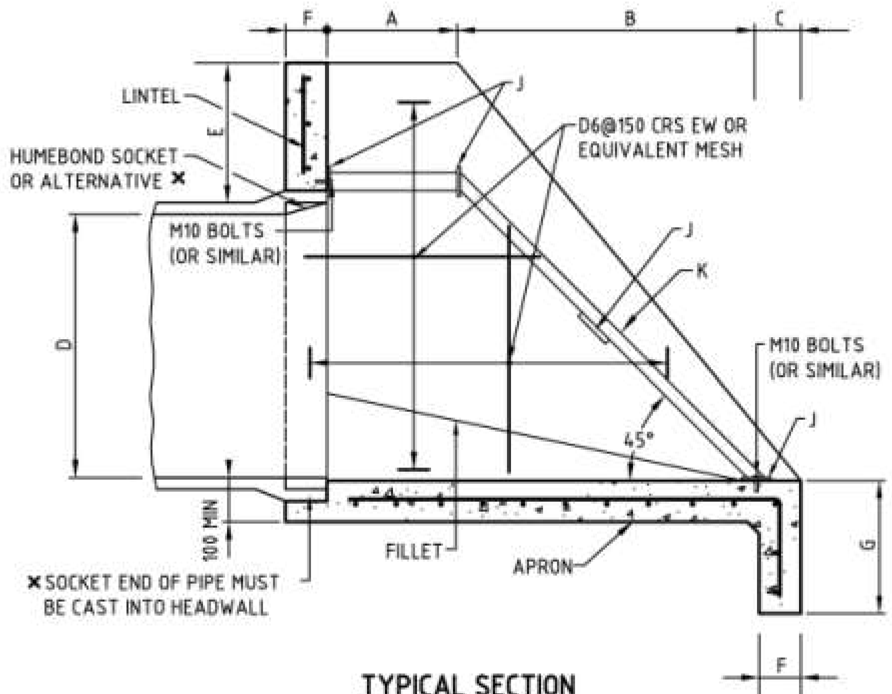
All new discharges (and those since 19 September 1998) to the coastal marine area require discretionary resource consent.

Discharges to other receiving environments must either comply with the TRMP permitted activity rule 36.4.2 and the permitted activity conditions or they will require resource consent.

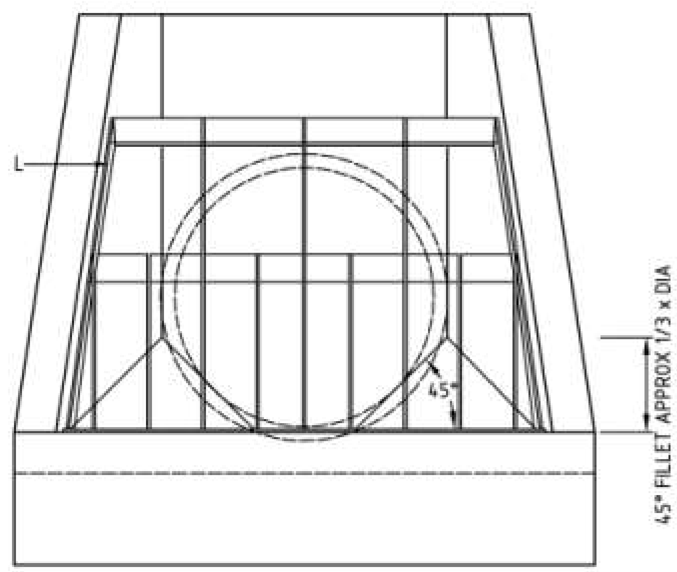
Drawing 700 – Definition of public & private stormwater asset



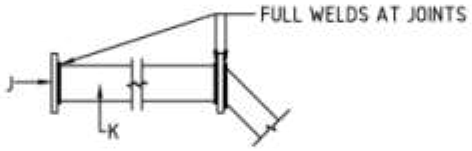
Drawing 701 – Typical stormwater intake structure details



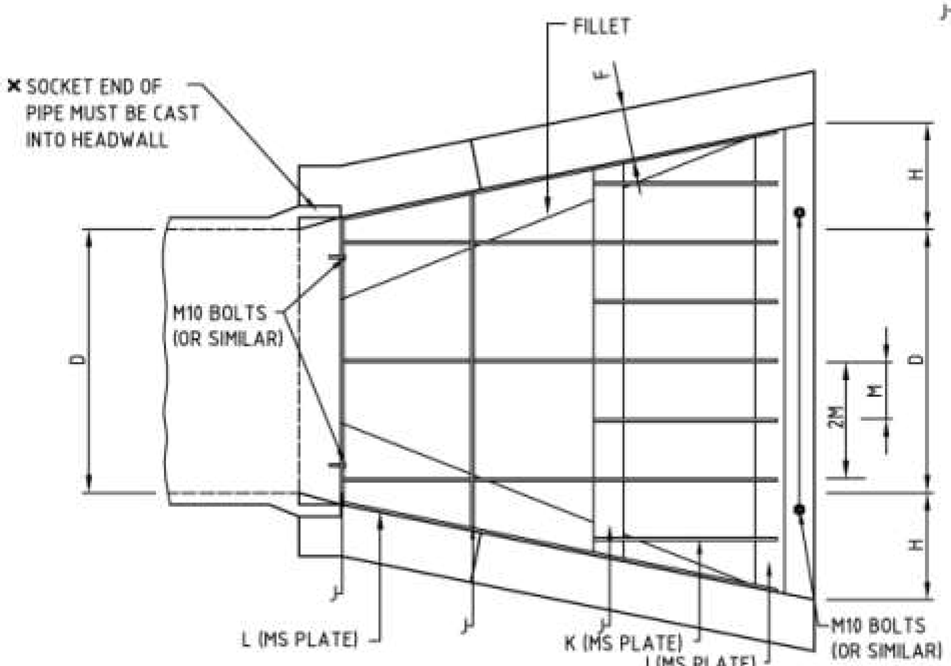
TYPICAL SECTION
SHOWING REINFORCING DETAIL



TYPICAL ELEVATION
SHOWING GRATE DETAIL



TYPICAL GRATE DETAIL
SHOWING PLATE JOINS

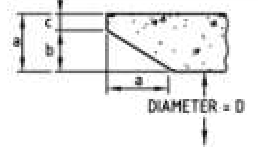


TYPICAL PLAN
SHOWING GRATE DETAIL

NOTES

1. SKEW AND/OR VERY STEEP APPROACH INLETS WILL REQUIRE DETAIL DESIGN BASED ON THIS STANDARD.
2. REINFORCING IS MINIMUM AND RETAINING WALL MUST BE DESIGNED FOR INDIVIDUAL CIRCUMSTANCES.
3. ALL REINFORCEMENT TO BE PLACED CENTRALLY IN WALLS AND FLOOR AND TO BE CONTINUOUS BETWEEN WALLS AND BETWEEN FLOOR AND WALLS.
4. AT LEAST 2 HORIZONTAL BARS TO BE PLACED OVER THE PIPE IN THE END WALL.
5. GRADE OF APRON TO BE NOT LESS THAN GRADE OF PIPE. DIMENSIONS OF GRILL TO BE FULLY DETAILED FOR EACH CASE. FULL HEADWALLS AND SIDEWALLS TO BE PROVIDED AS CASE REQUIRES IN ADDITION TO MINIMUM REQUIREMENT SHOWN.
6. 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.
7. GRILL & EXPOSED STEEL TO BE HOT DIP GALVANISED.

× ALTERNATIVE TO SOCKET END OF PIPE



b/D	a/D	c/D	d/D	ENTRANCE TYPE
0.042	0.063	0.042	0.083	A

BEVELLED RING
MINIMUM 300°

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. →					
D12 BARS 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
D12 BARS 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

tasman district council

TYPICAL STORMWATER INTAKE STRUCTURE DETAILS

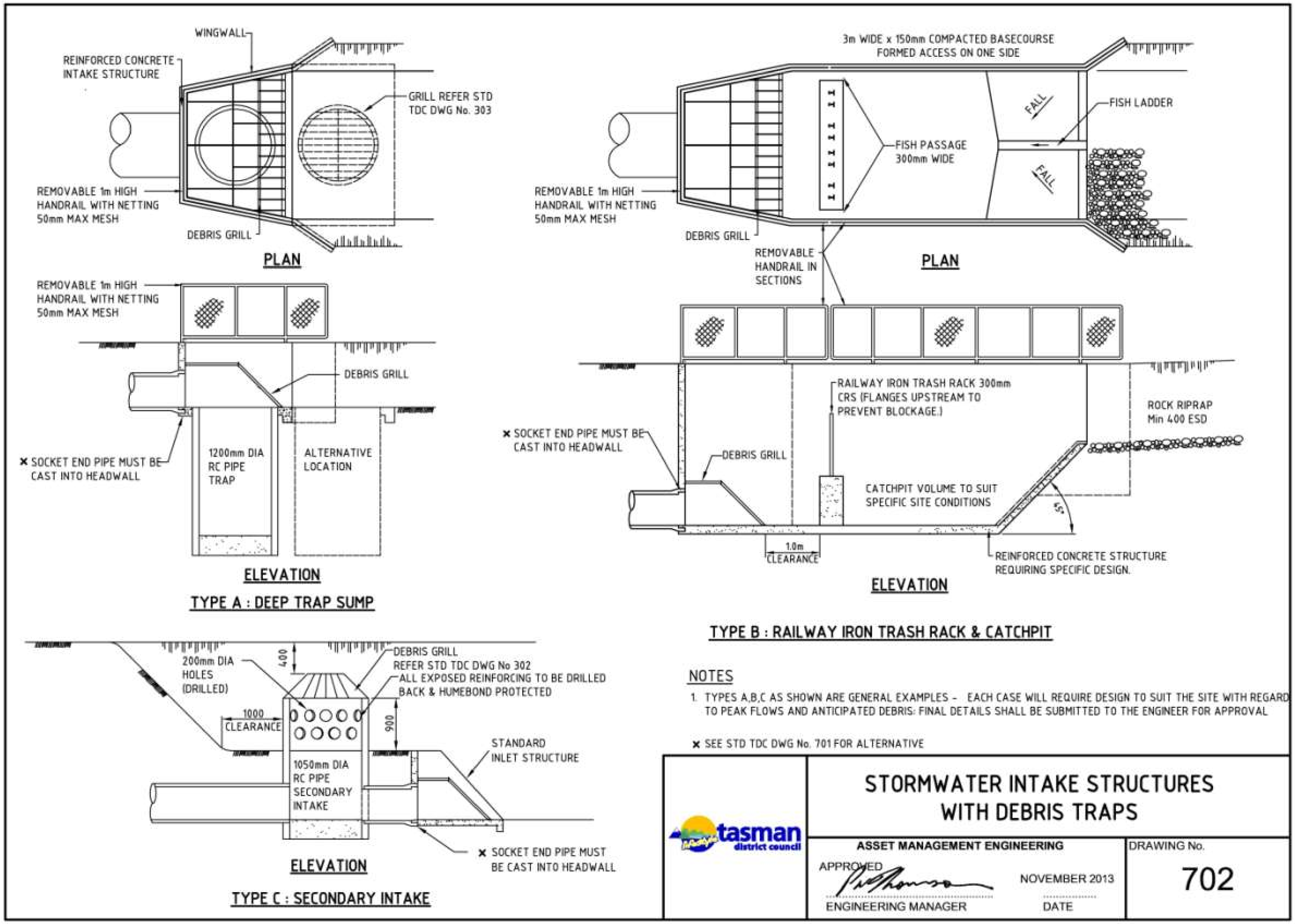
ASSET MANAGEMENT ENGINEERING

DRAWING No. 701

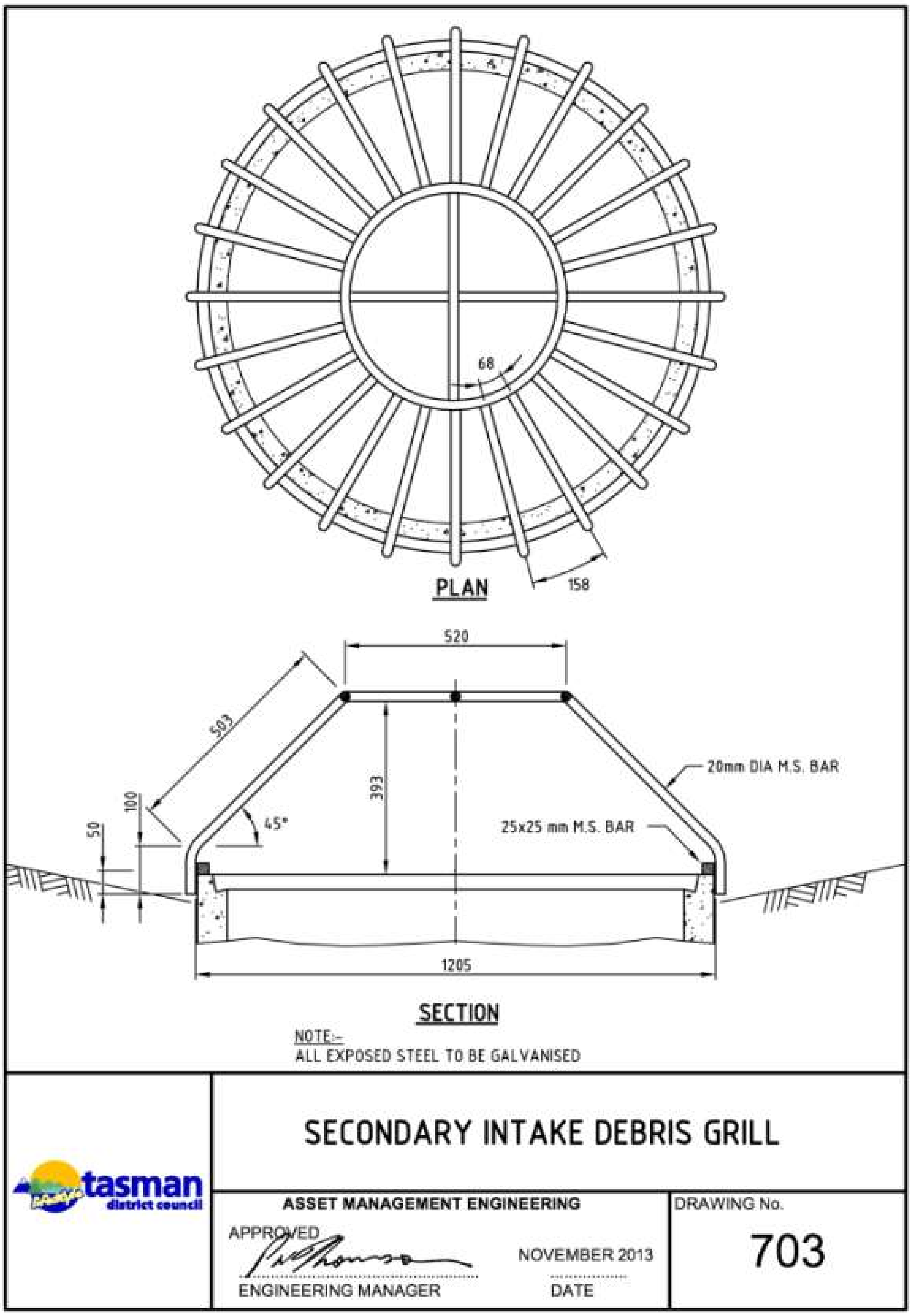
APPROVED .... ENGINEERING MANAGER

NOVEMBER 2013 .... DATE

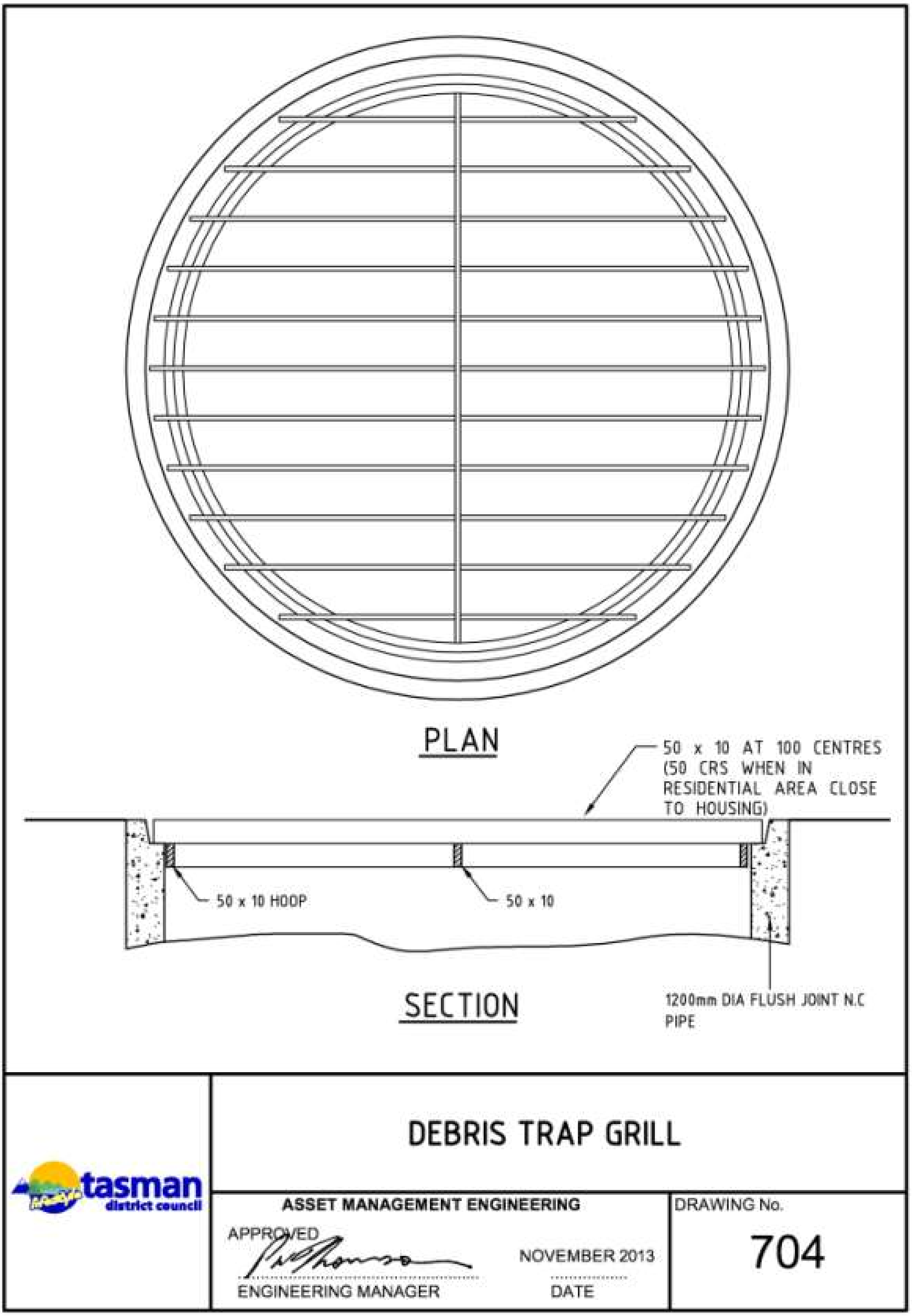
Drawing 702 Stormwater intake structures with debris traps



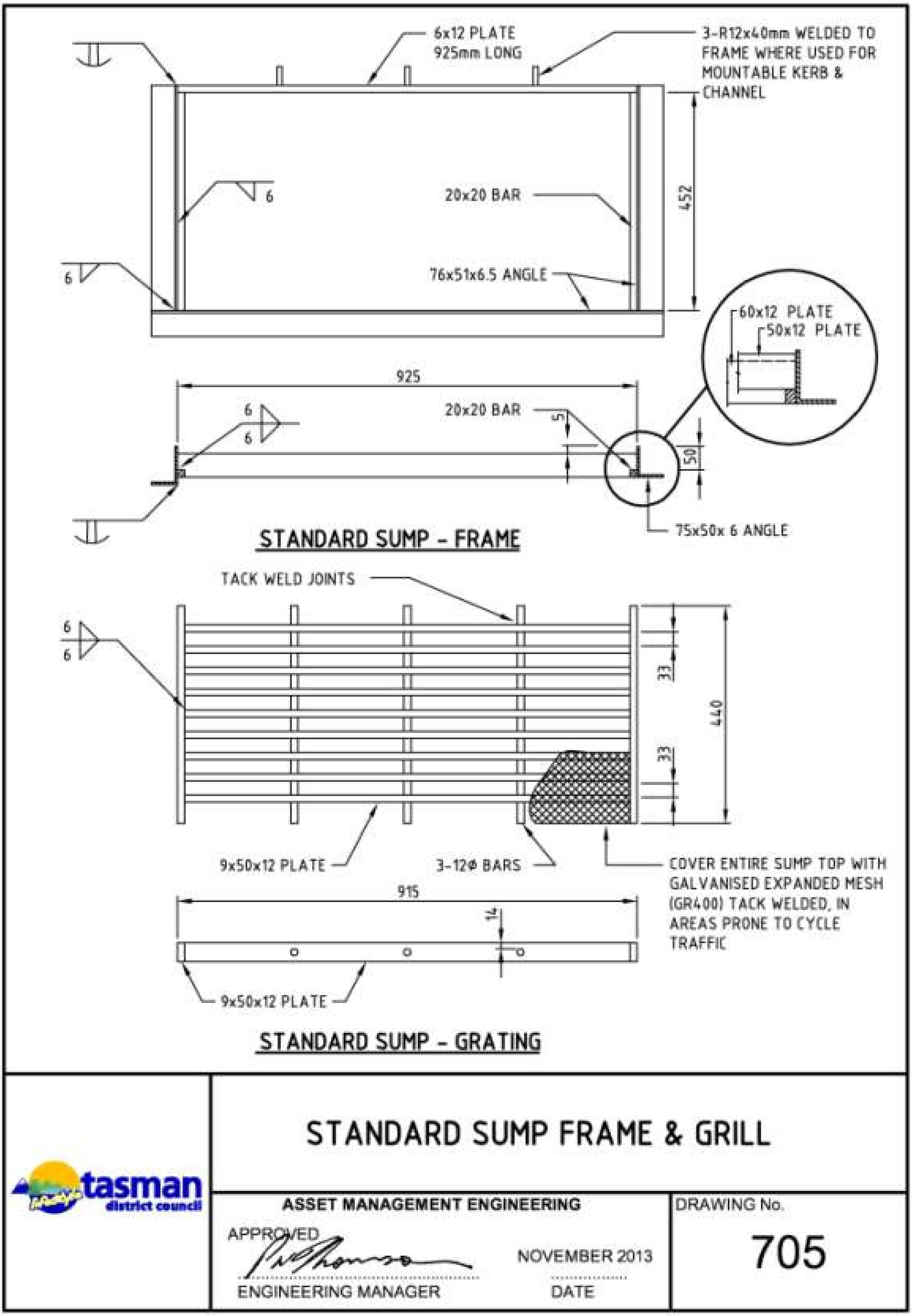
Drawing 703 Secondary intake debris grill



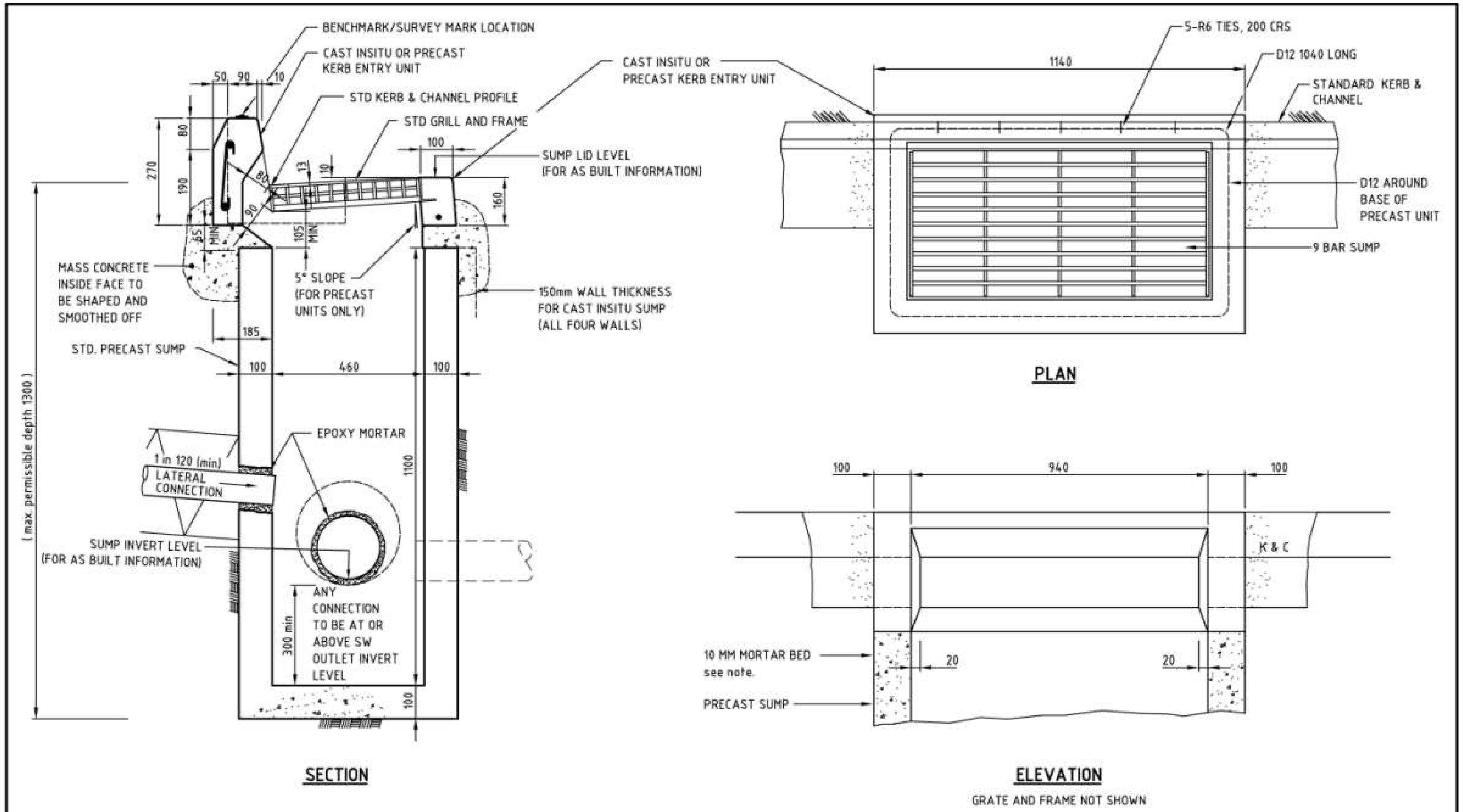
Drawing 704 Debris trap grill



Drawing 705 Standard sump frame & grill



Drawing 706 Standard back entry sump in standard kerb and channel



NOTES

1. SEE SHEETS STD TDC DWG No, 704 FOR DETAILS OF STD GRATING AND FRAME
2. INSITU CONCRETE TO BE 20 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

tasman district council

STANDARD BACK ENTRY SUMP IN STANDARD KERB AND CHANNEL

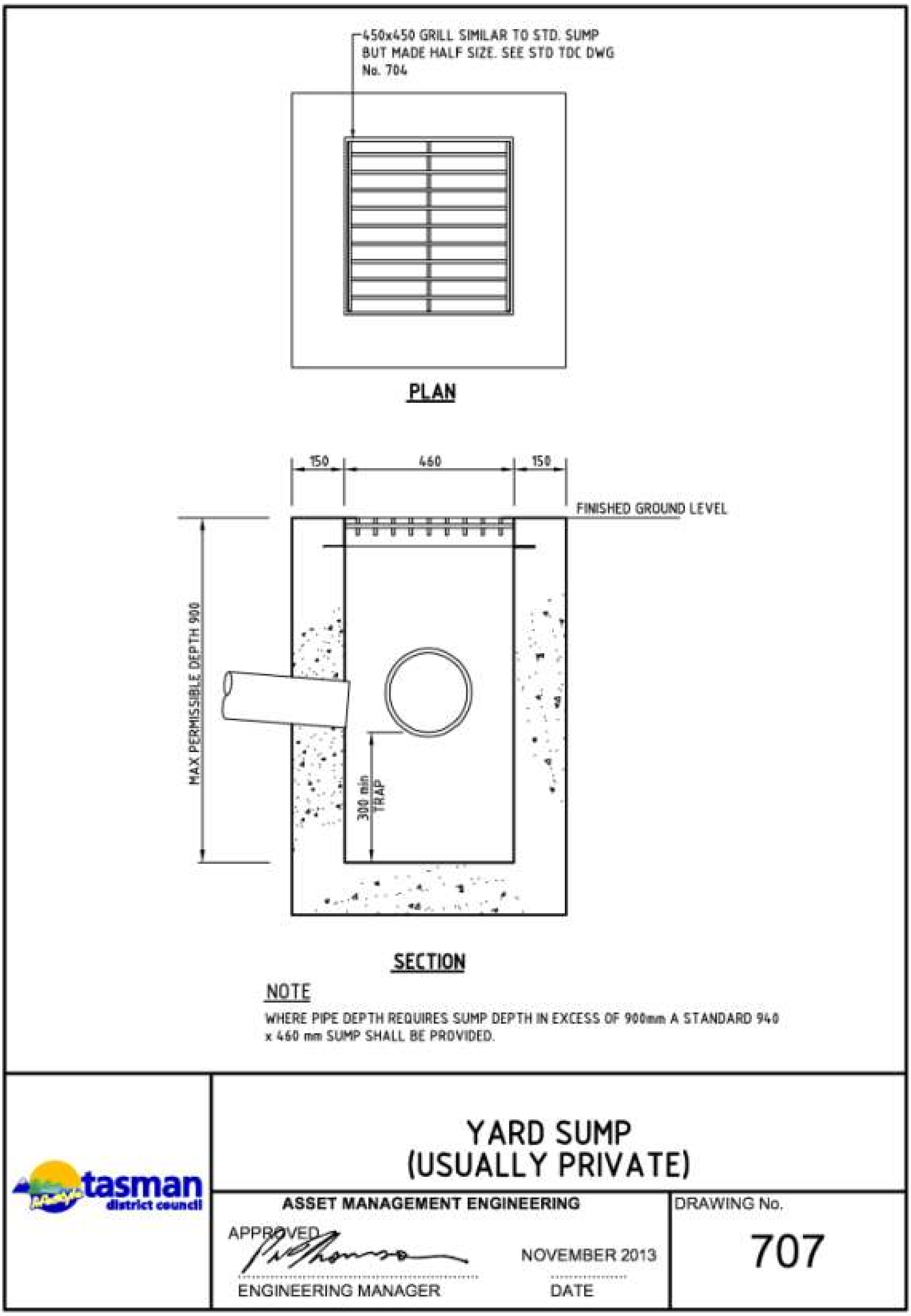
ASSET MANAGEMENT ENGINEERING

APPROVED ENGINEERING MANAGER

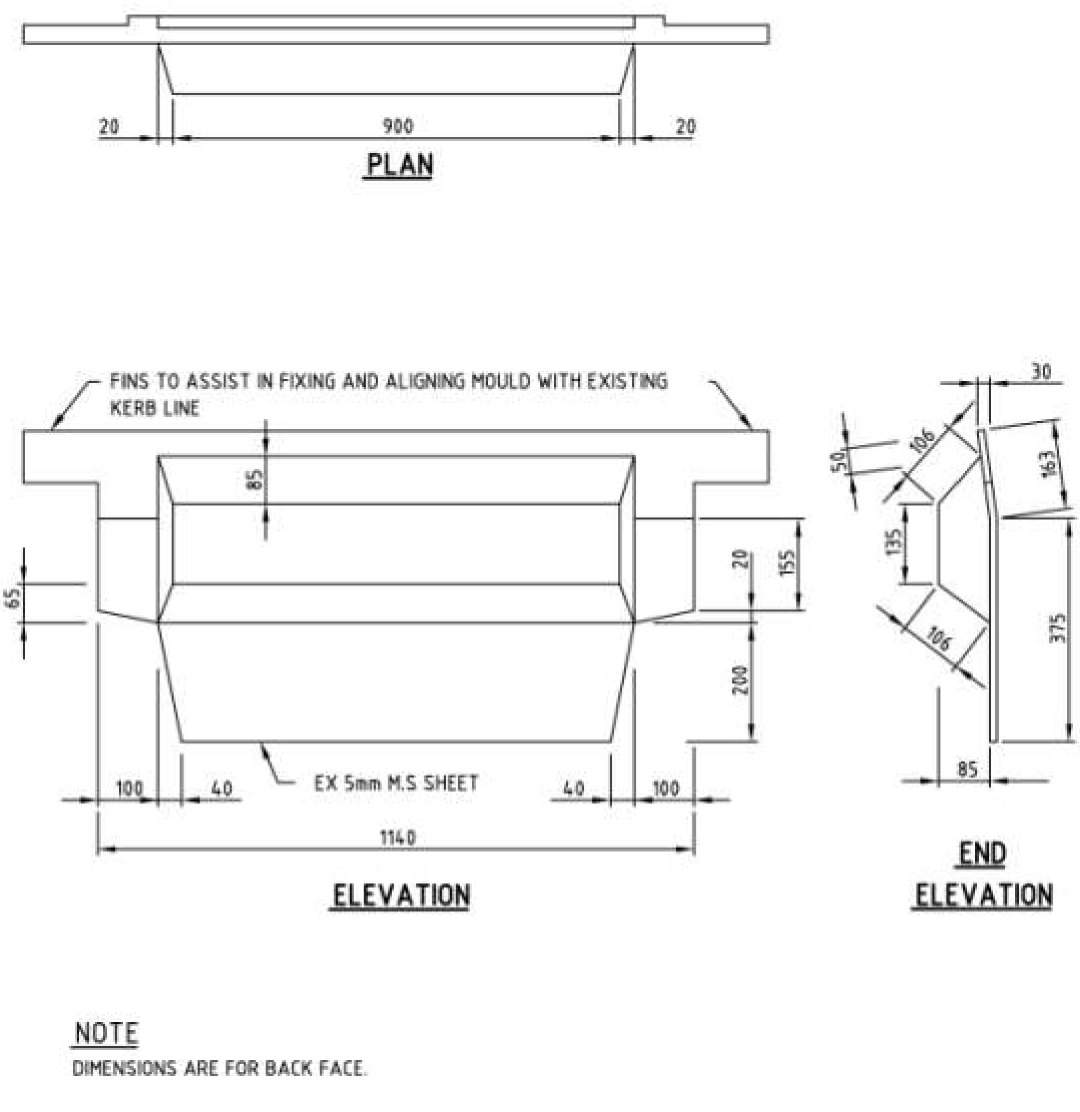
NOVEMBER 2013 DATE

DRAWING No. 706

Drawing 707 Yard sump (usually private)



Drawing 708 Standard stump top mould for standard kerb and channel



STANDARD SUMP TOP MOULD FOR STANDARD KERB & CHANNEL

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

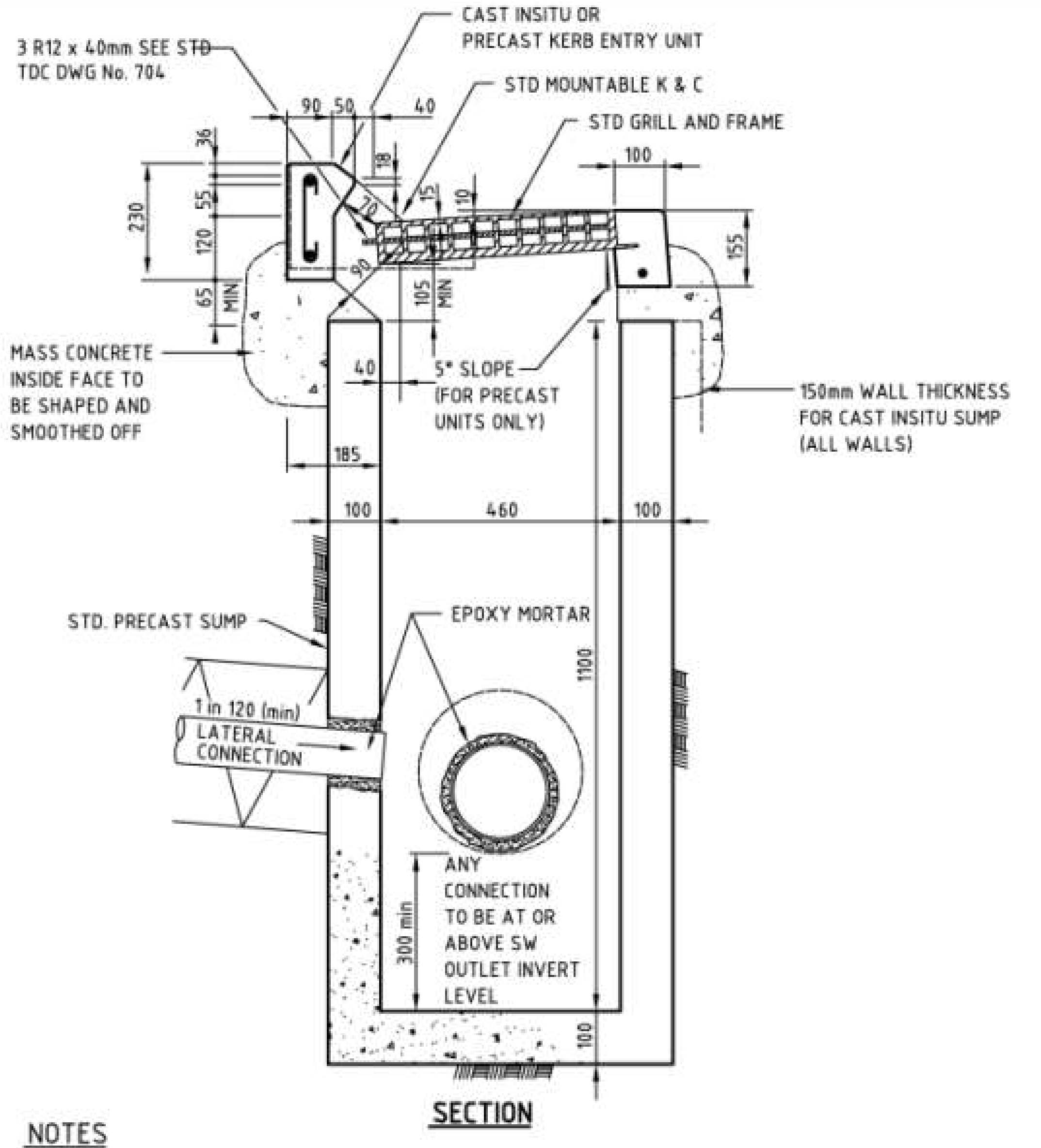
NOVEMBER 2013

DATE

DRAWING No.

708

Drawing 709 Standard back entry sump for standard mountable kerb & channel



NOTES

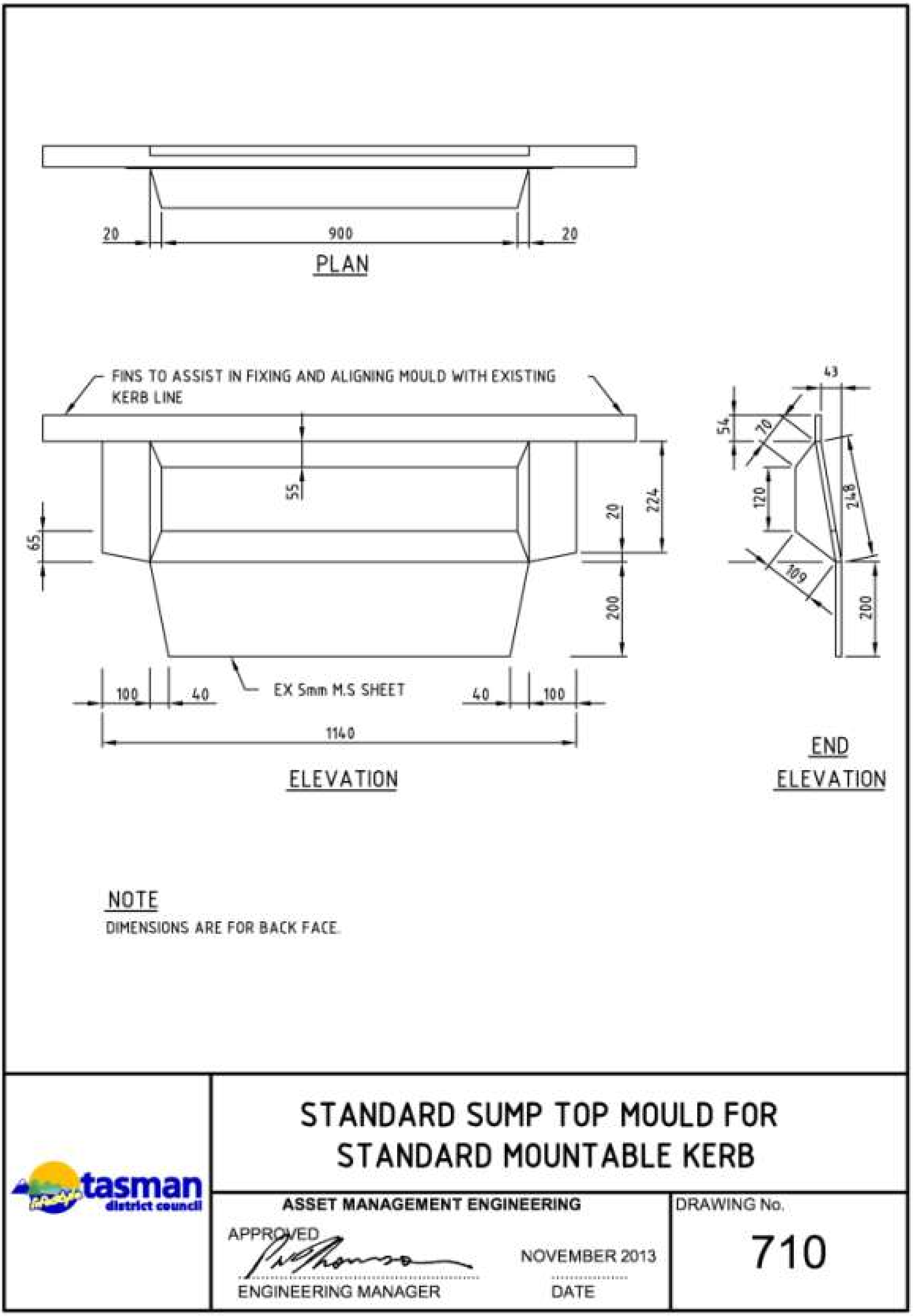
1 SEE STD TDC DWG No. 704 FOR DETAILS OF STD GRATING AND FRAME
2 INSITU CONCRETE TO BE 20 MPa AFTER 28 DAYS
3 NO REINFORCING REQUIRED FOR CAST INSITU BACK ENTRY UNIT
4 WHERE SUMP IS CONSTRUCTED TO INTERCEPT K & C AT DISTINCT GRADE THE ENTRY UNIT SHALL BE INCLINED ON THE INSITU PAD EXTENDED OVER THE SUMP WALL WIDTH

tasman district council

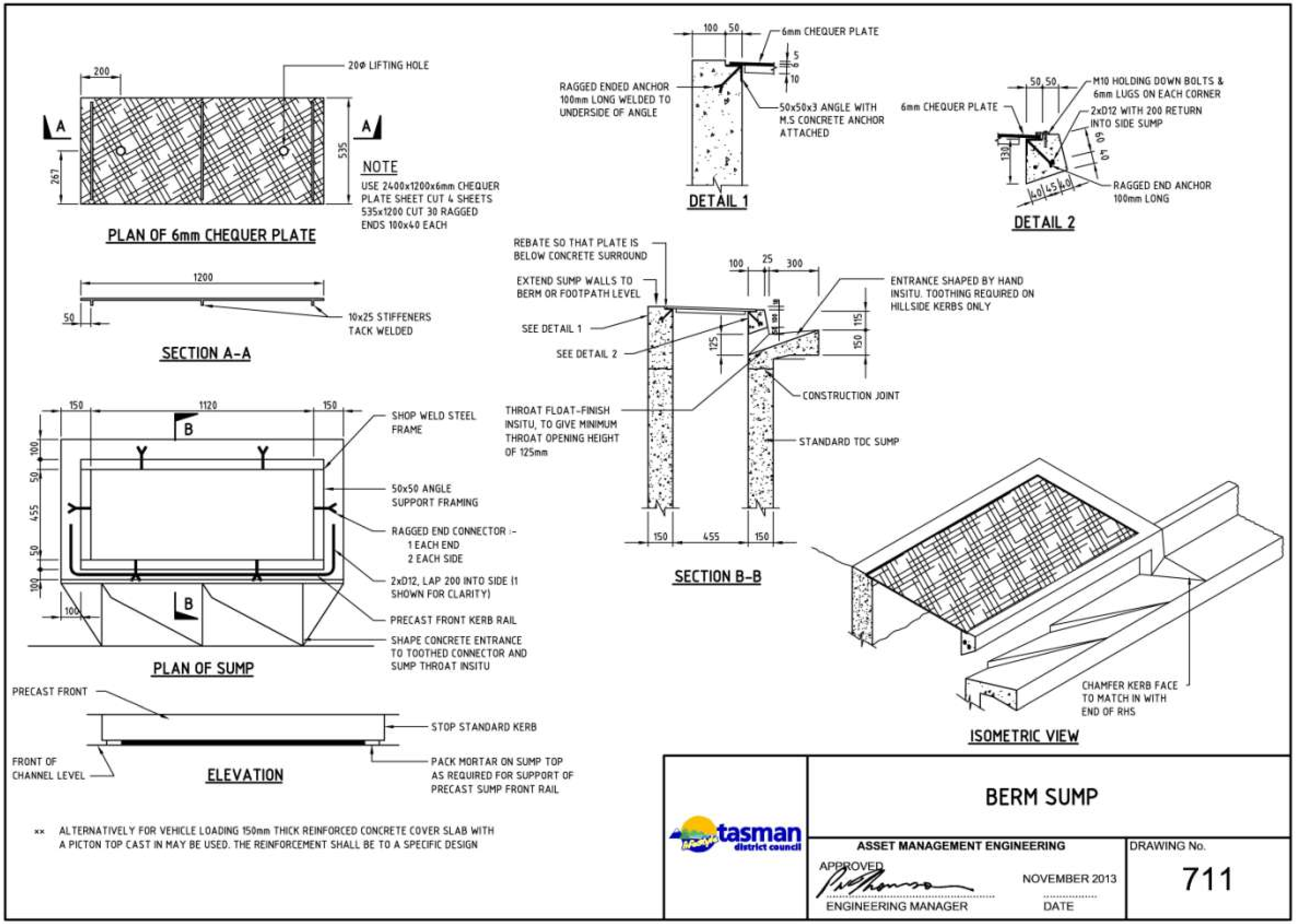
STANDARD BACK ENTRY SUMP FOR
STANDARD MOUNTABLE KERB & CHANNEL

ASSET MANAGEMENT ENGINEERING		DRAWING No.
APPROVED .... ENGINEERING MANAGER	NOVEMBER 2013 .... DATE	709

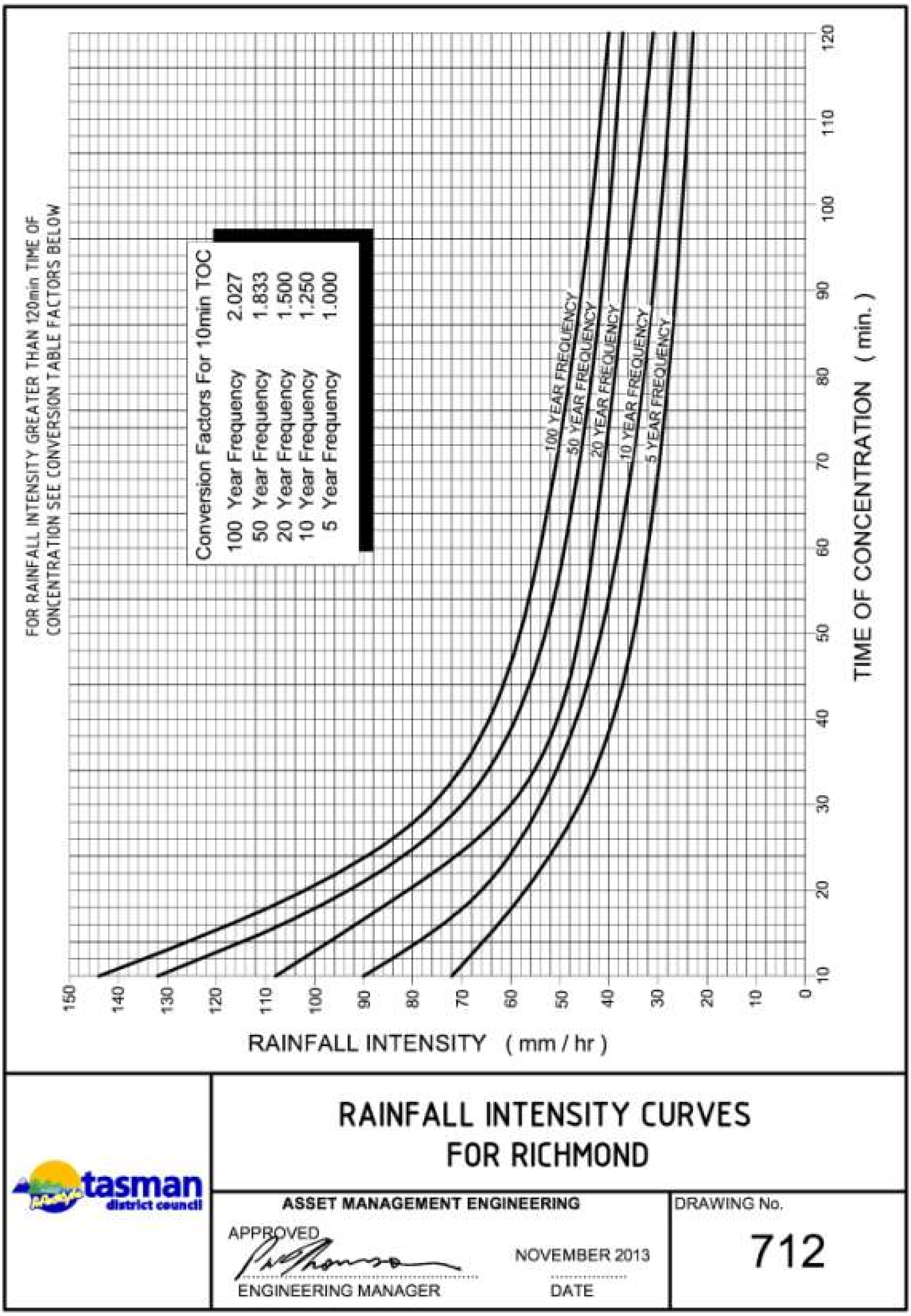
Drawing 710 Standard sump top mould for standard mountable kerb



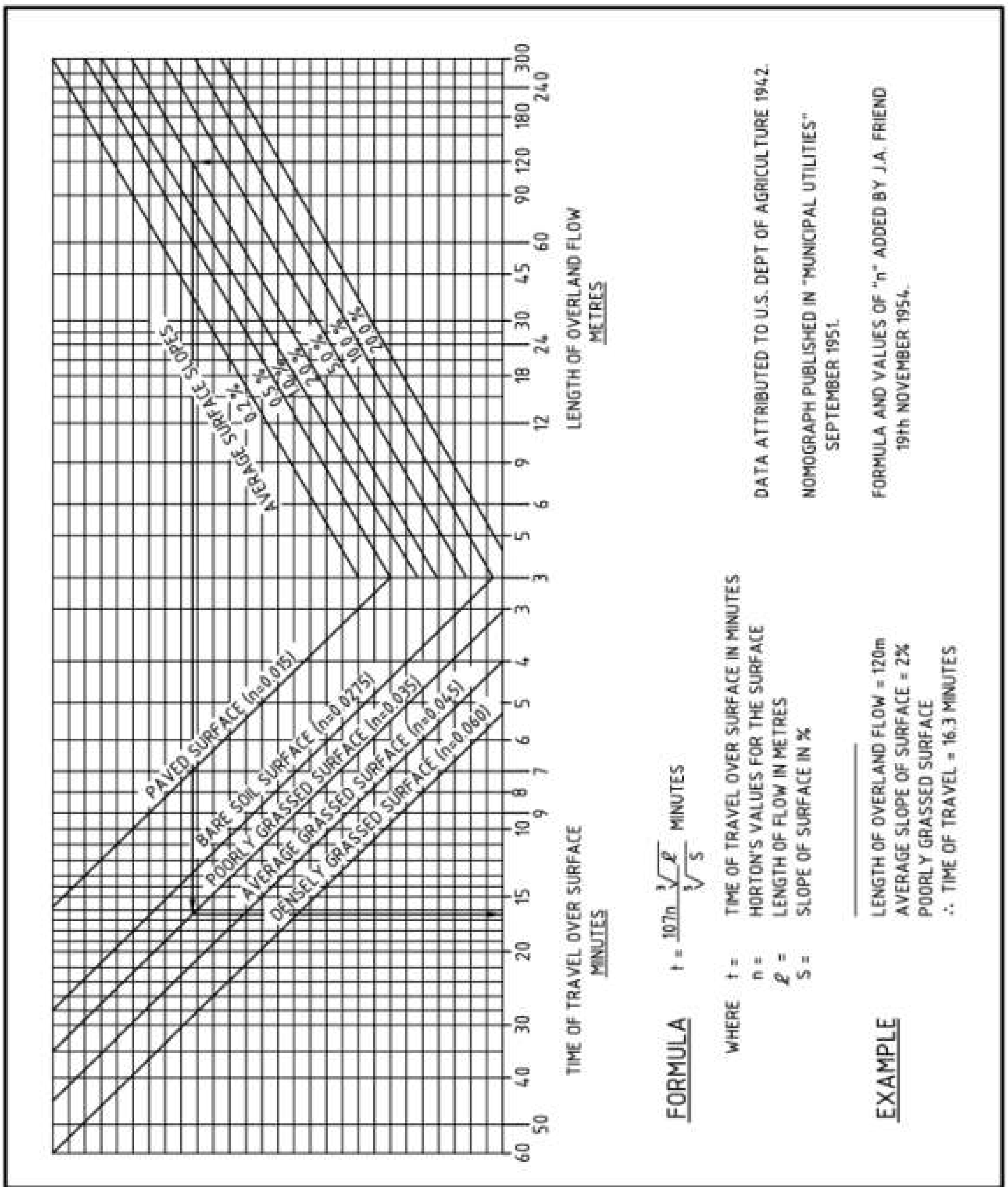
Drawing 711 Berm sump



Drawing 712 Rainfall intensity curves for Richmond



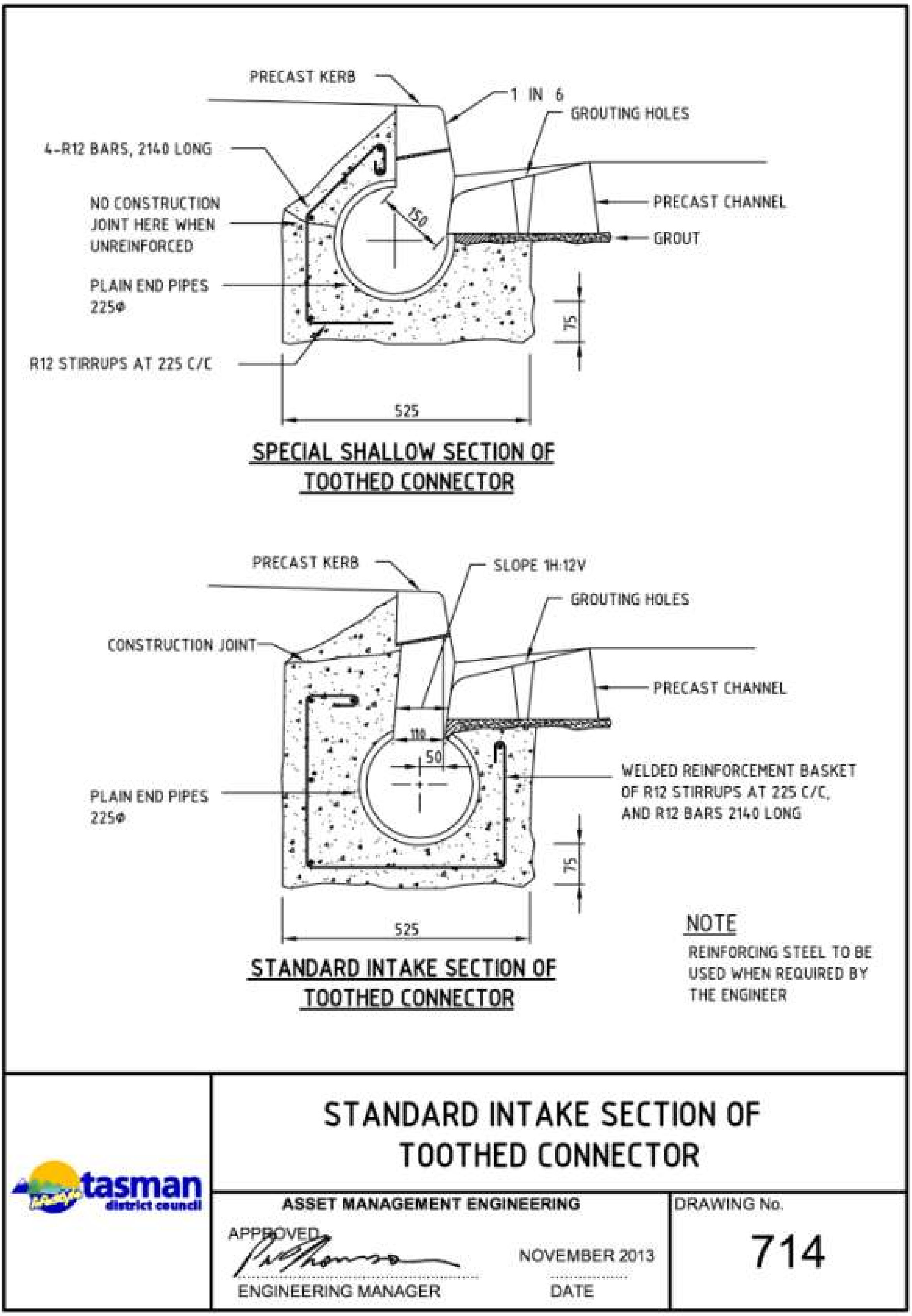
Drawing 713 Times for surface flow



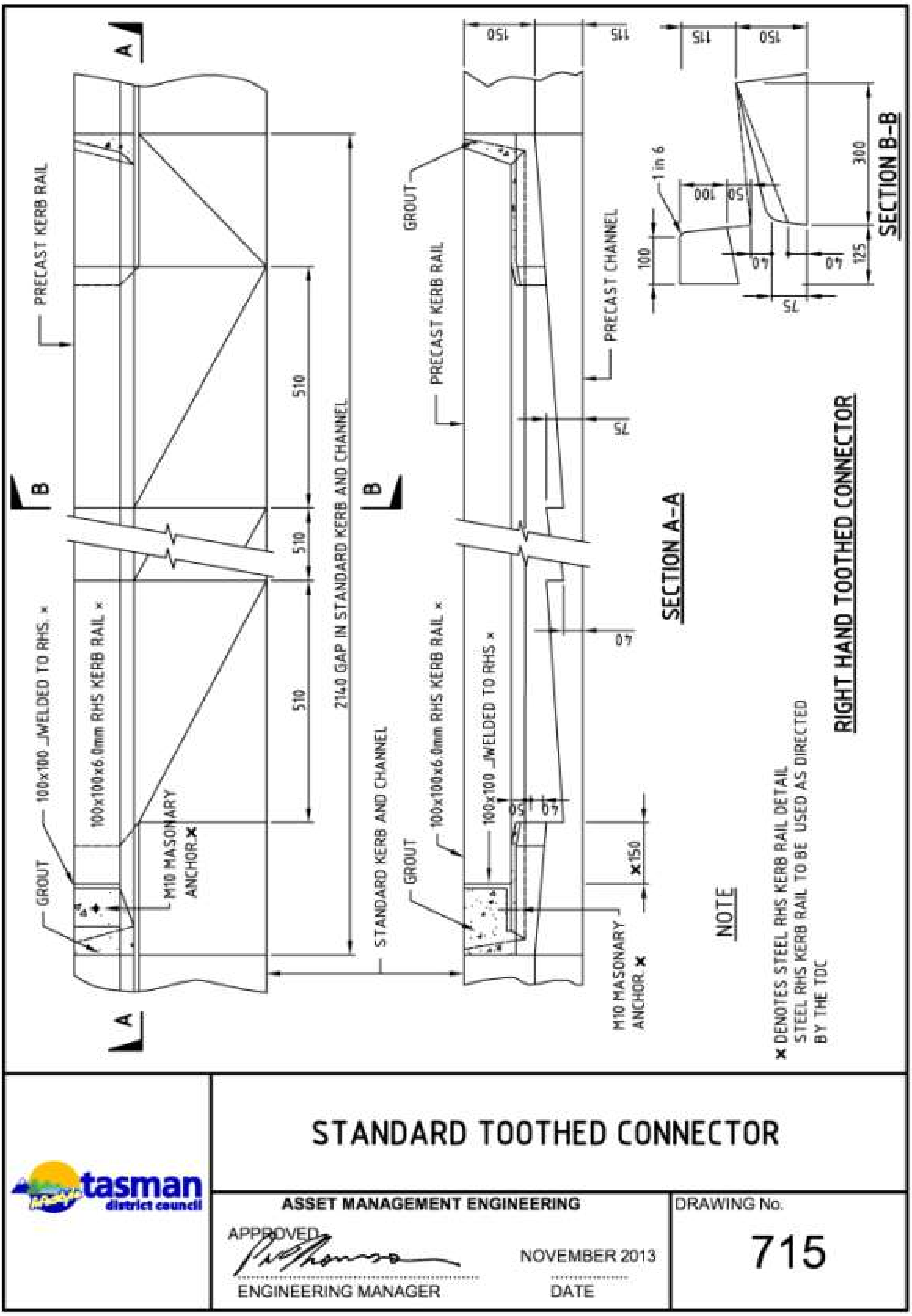
TIMES FOR SURFACE FLOW

tasman district council	ASSET MANAGEMENT ENGINEERING	DRAWING No.
	APPROVED ENGINEERING MANAGER — NOVEMBER 2013 DATE	713

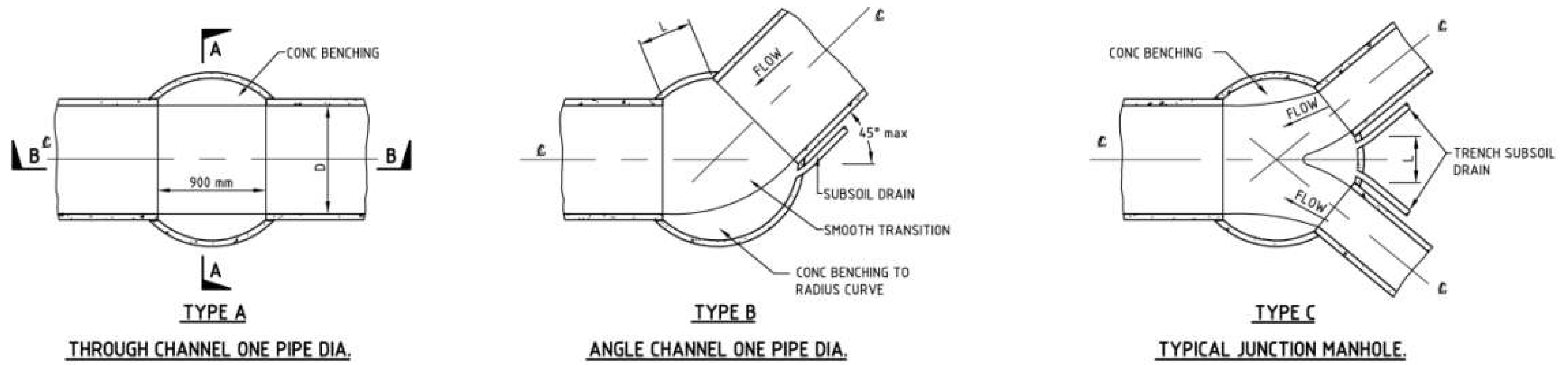
Drawing 714 Standard intake section of toothed connector

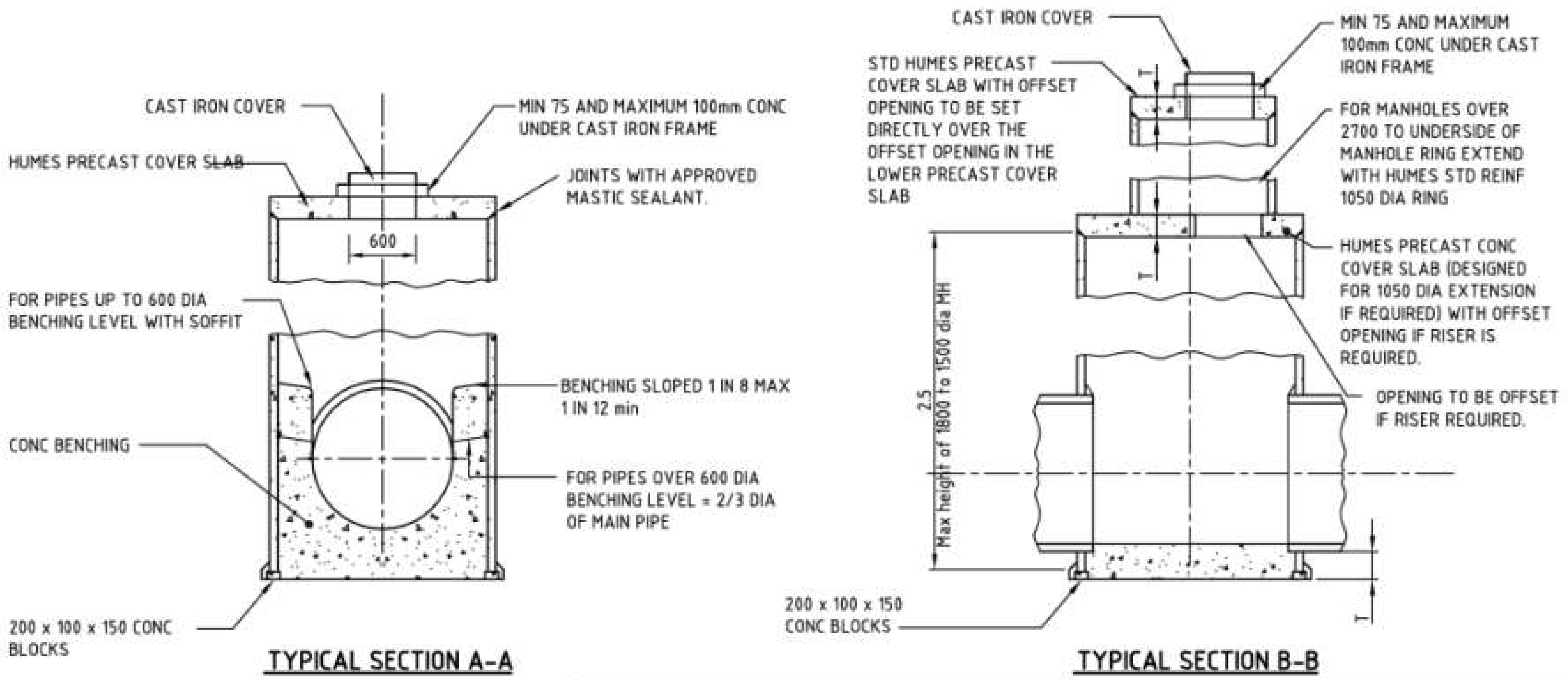


Drawing 715 Standard toothed connector



Drawing 716 Standard stormwater manhole details





NOTES

1. FOR PIPES OVER 1200 DIA AND FOR SITUATIONS WHERE THIS STANDARD CANNOT BE MET CAST IN-SITU MANHOLES ARE TO BE DESIGNED.
2. TABLE OF DIMENSIONS - APPROX

M.H (DIA)	L (MIN)	T (MIN)	D (MAX)
1800	650	200	1200
1500	500	200	1075
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 NZS 3107.
4. FOR MANHOLE FINISHING OFF DETAILS E.G. HAUNCHING, SEALING etc SEE STD TDC DWG No. 802
5. 600 OPENING TO MEET OSH REQUIREMENTS
5. ALL PIPES ARE TO ENTER/EXIT RELATING TO THE CENTRE LINE OF THE MANHOLE

tasman district council

STANDARD STORMWATER MANHOLE DETAILS

ASSET MANAGEMENT ENGINEERING

APPROVED

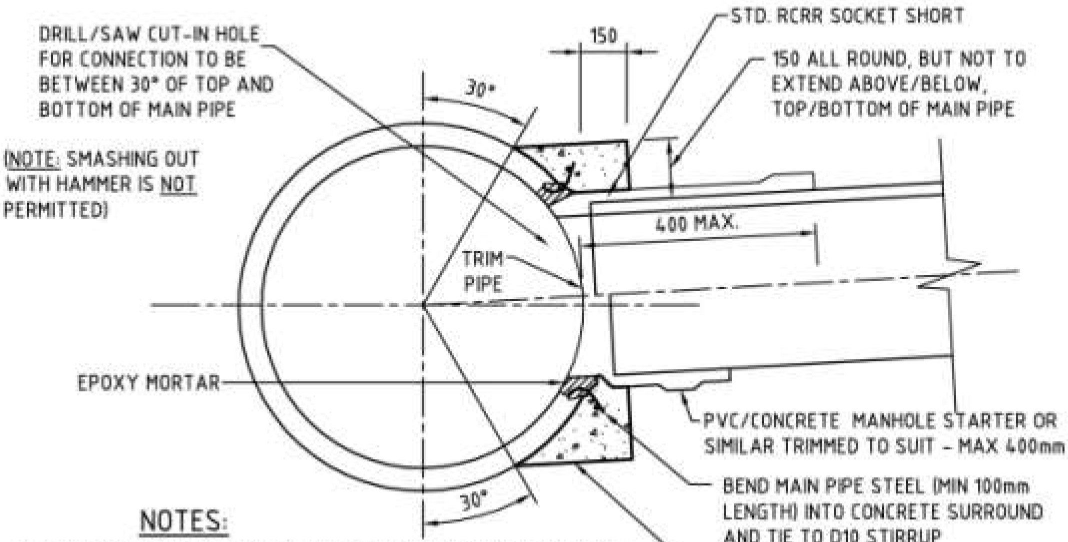
ENGINEERING MANAGER

NOVEMBER 2013

DATE

DRAWING No. 716

Drawing 717 Direct connections to stormwater pipes



NOTES:

1) ALTERNATIVE SADDLE CONNECTION (PROPRIETORY PRODUCT) WITH CONNECTING BAND IS THE PREFERRED CONNECTION.

2) SPECIAL DESIGN REQUIRED FOR:
MAIN PIPES OTHER THAN REINFORCED CONCRETE, MORE THAN ONE CONNECTION PER MAIN.

3) DIRECT CONNECTIONS OF THIS TYPE ARE NOT PERMITTED ON PLASTIC MAINS. (i.e USE STANDARD FITTINGS)

4) OUTSIDE EDGE OF MAIN PIPE CUT-IN HOLE SHALL BE NOT LESS THAN 300mm FROM COLLAR OR END OF PIPE.

5) MAXIMUM DIAMETER OF CUT-IN HOLE SHALL BE LESS THAN TWO THIRDS OF THE INTERNAL DIAMETER OF MAIN PIPE.

6) 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.

7) MAIN PIPE SURFACE SHALL BE ROUGHENED AND GROUT COATED BEFORE CONCRETE SURROUND IS POURED.

8) DIRECT CONNECTIONS MUST BE APPROVED BY THE ENGINEER, AND NORMALLY SHALL ONLY BE USED WHERE THE SIDE LINE 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.

9) 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

tasman district council

DIRECT CONNECTIONS TO STORMWATER PIPES

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

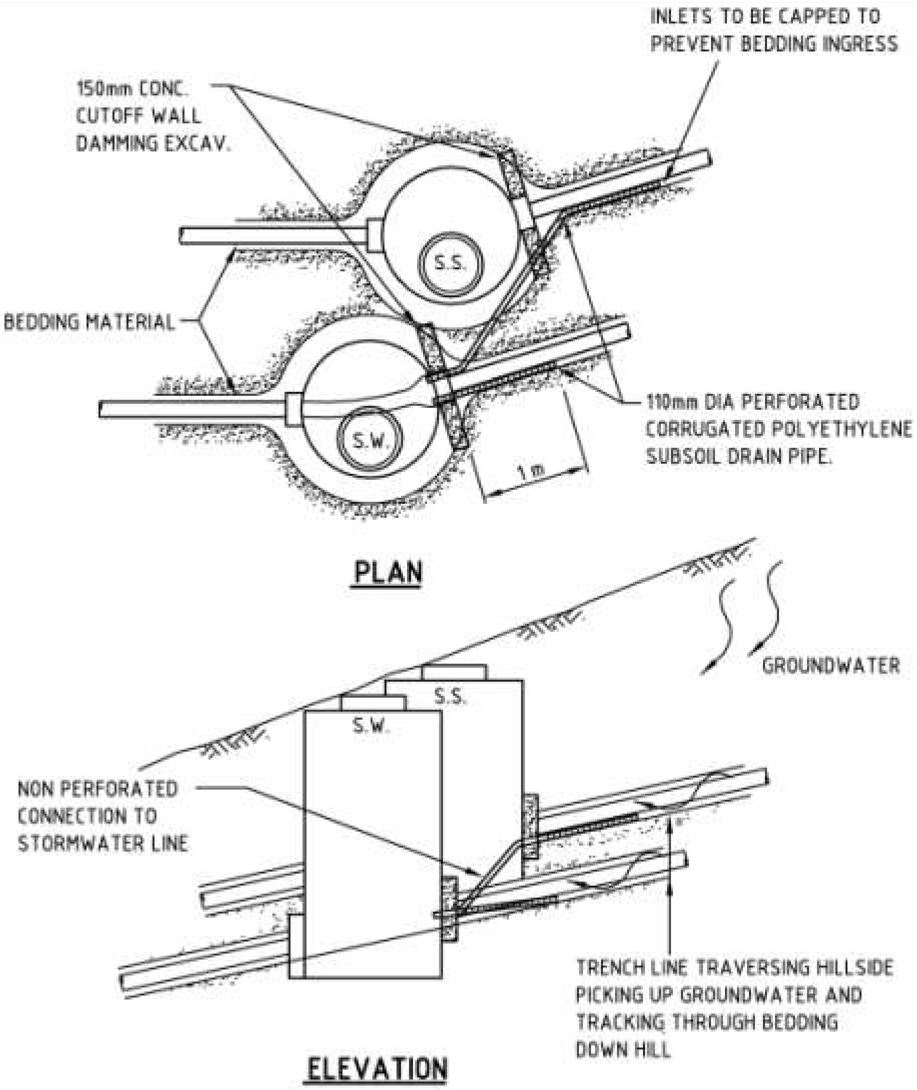
NOVEMBER 2013

DATE

DRAWING No.

717

Drawing 718 Hillside trench drainage details

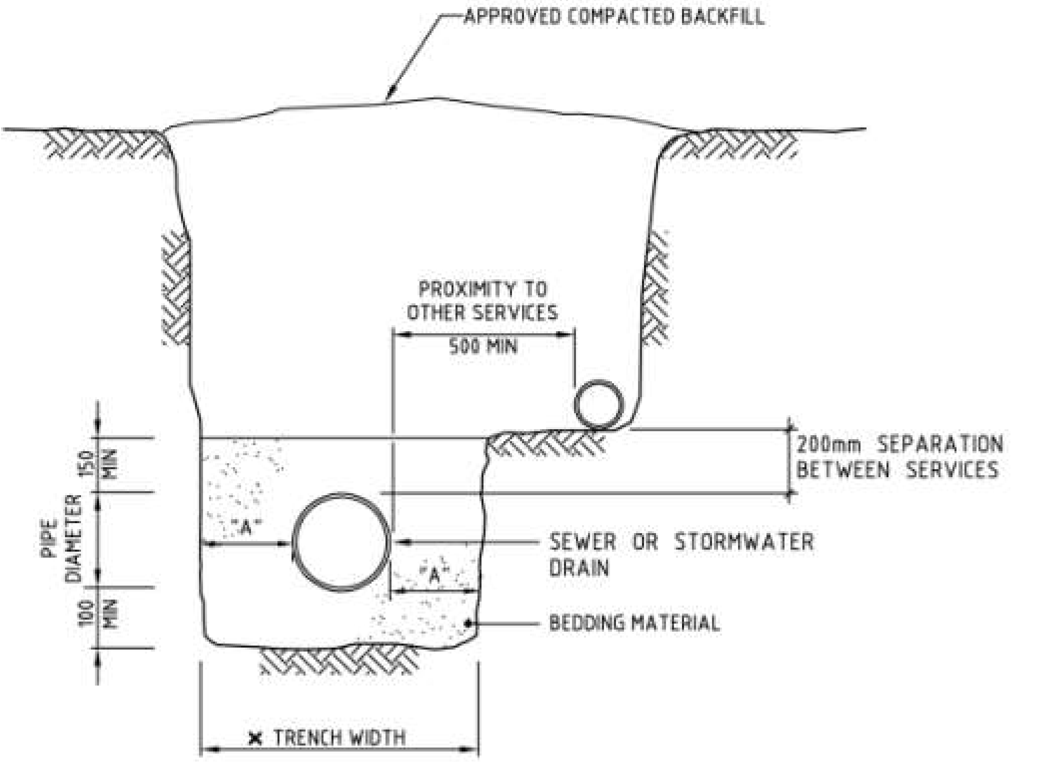


NOTE

1. SIMILAR PROVISION FOR DRAINAGE OF CABLE AND WATER TRENCHES MAY BE REQUIRED.
2. STORMWATER TRENCHES TO BE LAID SLIGHTLY DEEPER THAN SEWER TRENCHES WHERE POSSIBLE.
3. WHERE SEWER IS BELOW STORMWATER (WITH TDC APPROVAL ONLY) GRADE SEWER TRENCH OUT TO NEAREST STORMWATER DISCHARGE SOURCE, OR HAVE TRENCH BARRIERS (COMPACTED CLAY OR IMPERMEABLE MATERIAL) AT 10.0m CENTRES ALONG TRENCH.

tasman district council	HILLSIDE TRENCH DRAINAGE DETAILS	
	ASSET MANAGEMENT ENGINEERING APPROVED .... ENGINEERING MANAGER NOVEMBER 2013 .... DATE	DRAWING No. 718

Drawing 719 Drainage shared trench clearances



× TRENCH WIDTH

NOMINAL DIAMETER DN (mm)	MINIMUM TRENCH SIDE CLEARANCE "A"
UP TO 150	100
200 - 250	150
300 - 375	200

THE TRENCH WIDTH SHALL BE THE MINIMUM NECESSARY TO ADEQUATELY AND SAFELY LAY THE PIPE AND TO COMPACT THE SIDE SUPPORT ZONE

NOTE

STORMWATER TRENCH SHOULD BE DESIGNED BELOW SEWER TRENCHES SUCH THAT TRENCH DRAINAGE CAN DRAIN INTO STORMWATER LINE

tasman district council

DRAINAGE SHARED TRENCH CLEARANCES

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

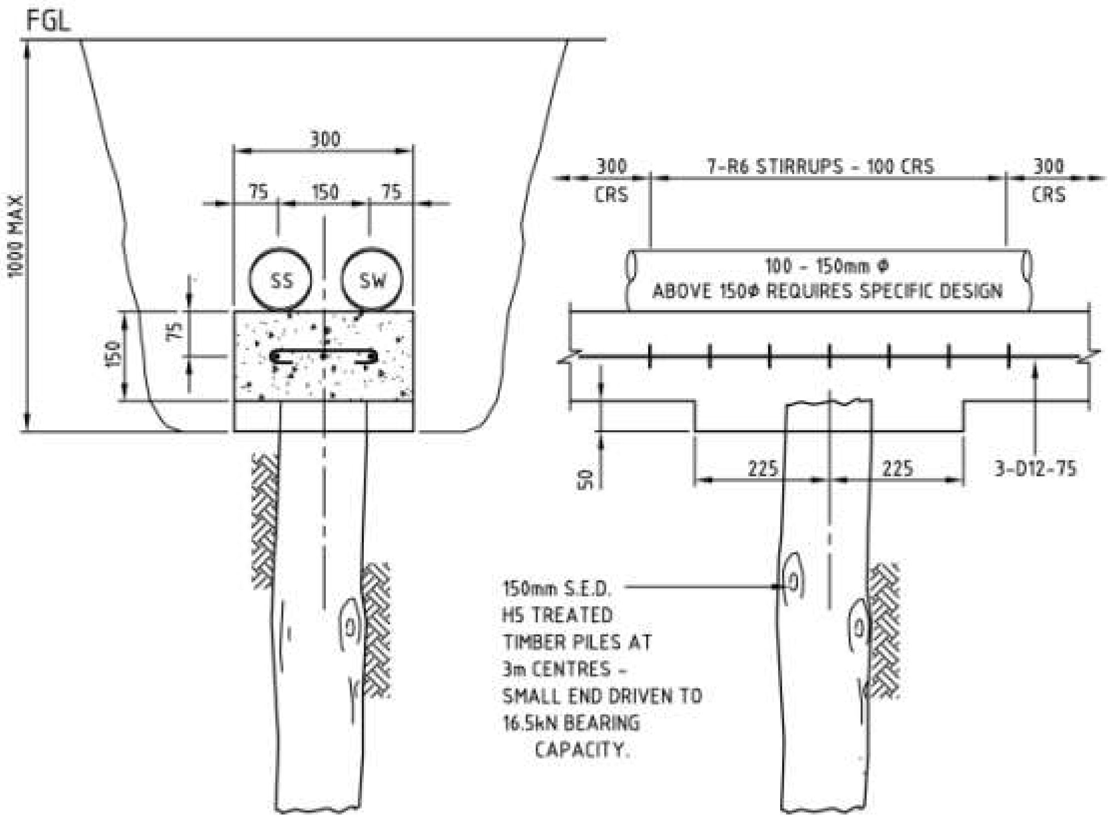
NOVEMBER 2013

DATE

DRAWING No.

719

Drawing 720 Services support beam for fill sites



tasman district council

SERVICES SUPPORT BEAM FOR FILL SITES

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

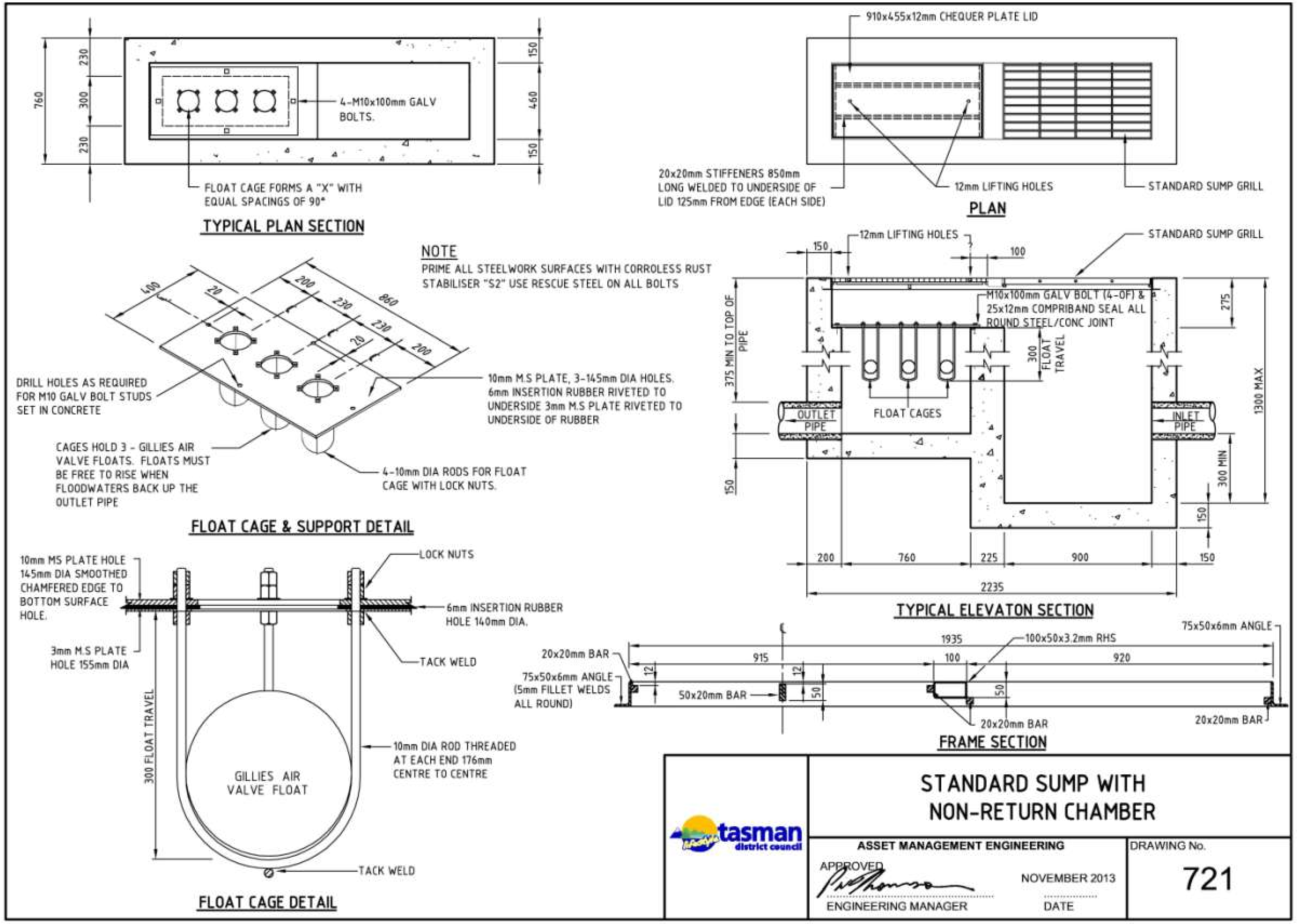
NOVEMBER 2013

DATE

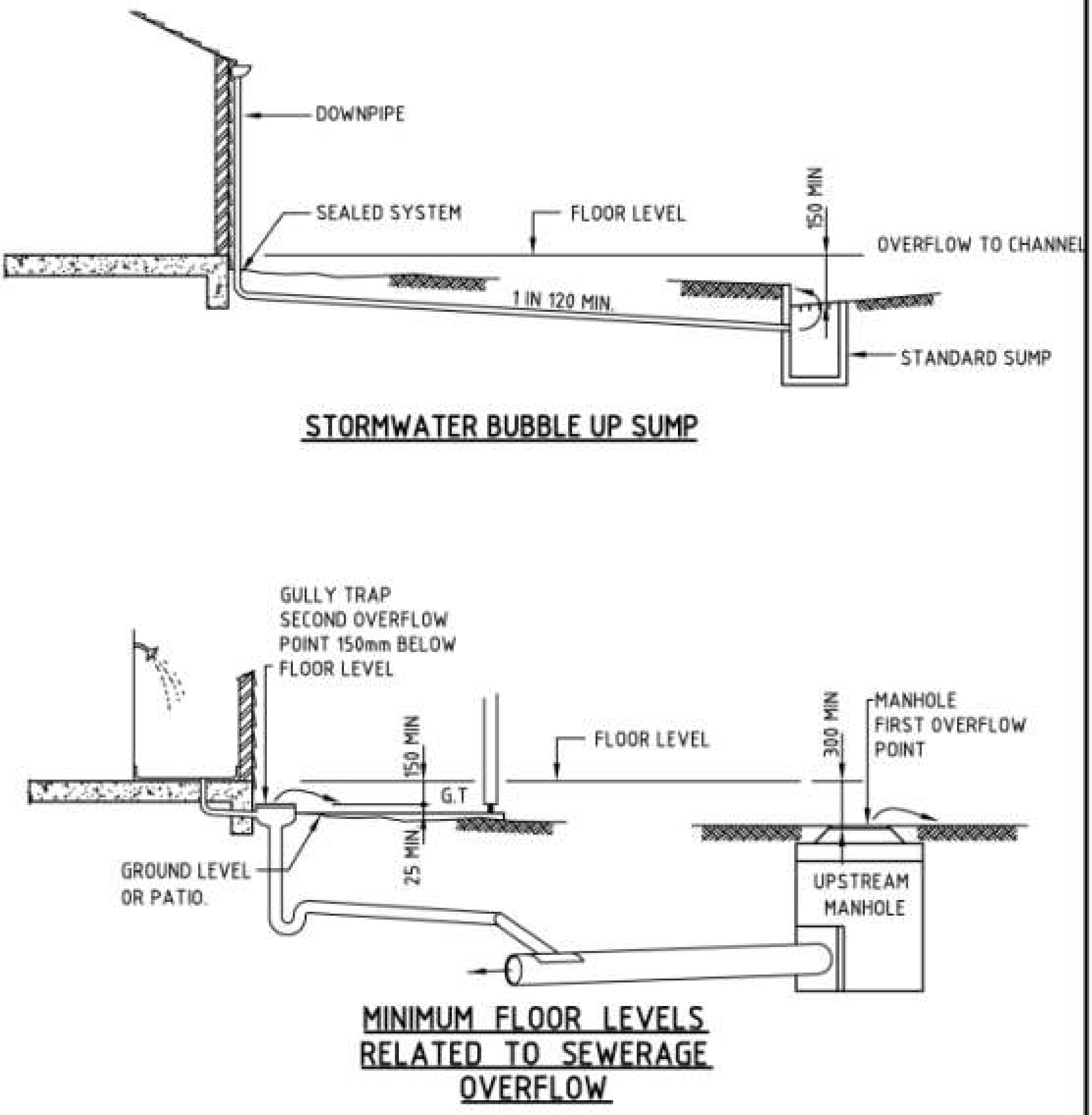
DRAWING No.

720

Drawing 721 Standard sump with non-return chamber

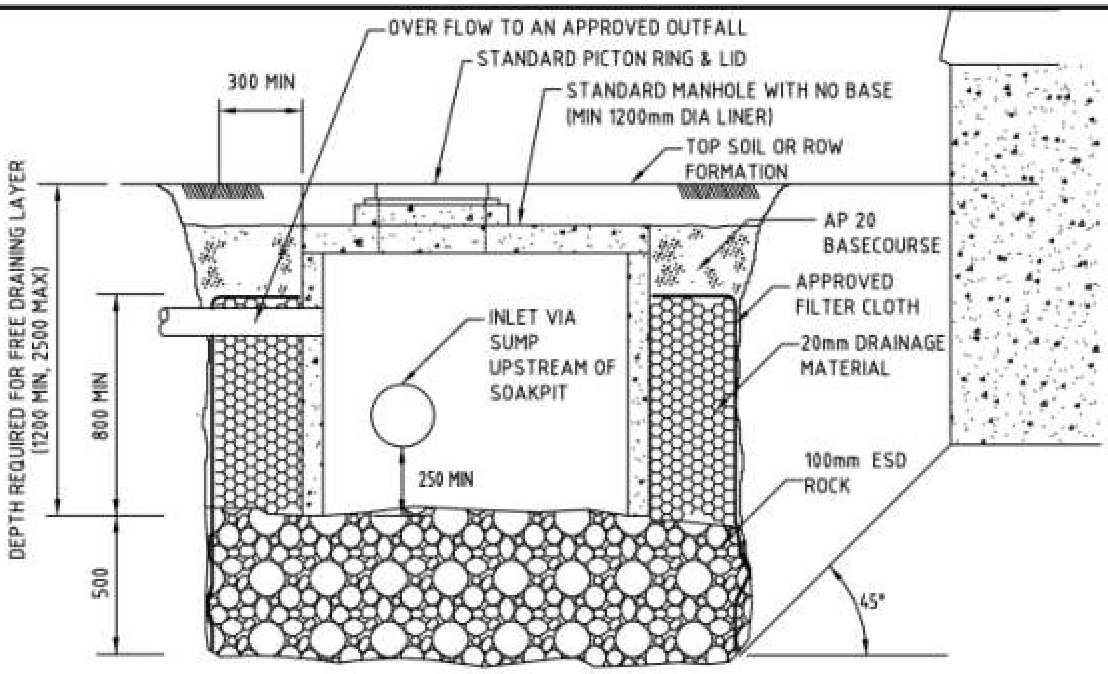


Drawing 722 Miscellaneous drainage details



tasman district council	MISCELLANEOUS DRAINAGE DETAILS	
	ASSET MANAGEMENT ENGINEERING APPROVED ENGINEERING MANAGER — NOVEMBER 2013 DATE	DRAWING No. 722

Drawing 723 Standard soak pit detail via sump



THIS DETAIL SHALL BE USED WHERE ONE SOAKPIT IS PROPOSED PER LOT

NOTE

1. SOAK PITS SHALL BE SITED AWAY FROM SERVICES BY 2m AND AWAY FROM BUILDING FOUNDATIONS BY 45° TO PIT BASE AS MINIMUM.

2. SILT TRAPS SHALL BE CONSTRUCTED WITH EVERY SOAK PIT WHERE DRAINING SURFACE WATER.

3. SOAKPITS MAY ONLY BE ALLOWED:
   A) ON FLAT LAND IN THE AREAS APPROVED BY COUNCIL, AND
   B) WHERE REASONABLE GROUND SOAKAGE CAN BE PROVEN BY TESTING IN ACCORDANCE WITH BIA E1 SECTION 9. DISPOSAL TO SOAK PIT AND TO THE ENGINEERS SATISFACTION, AND
   C) WHERE IT IS NOT POSSIBLE OR PRACTICAL TO CONNECT TO AN EXISTING COUNCIL STORM WATER SYSTEM SOAK PITS/RAIN GARDENS/SWALES ECT, DESIGNS SHALL CONSIDER:-

   SOIL CHARACTERISTICS / SOAKAGE RATE
   GROUNDWATER DEPTH & VARIATION
   NEARBY SURFACE WATER INFLUENCE
   TIDAL INFLUENCE
   DENSITY OF EXISTING STORM WATER SOAKPITS & SEWAGE EFFLUENT DISPOSAL FIELDS
   STORAGE OR DETENTION REQUIREMENTS

4. WHERE POSSIBLE AND PRACTICAL AN OVERFLOW CONNECTION IS REQUIRED FROM A SOAK PIT TO AN APPROVED OUTFALL.

5. SOAK PIT EVENTUALLY SILT UP AND WILL REQUIRE ONGOING MAINTENANCE, OWNERS SHOULD BE MADE AWARE OF THIS

tasman district council

STANDARD SOAK PIT DETAIL VIA SUMP

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

NOVEMBER 2013

DATE

DRAWING No.

723

Drawing 724 Outfall details & drainage waterway concepts