5 EARTHWORKS[1]

5.1 Introduction

This section provides guidance and standards for the management of land disturbance, including earthworks, excavation, recontouring, soil disturbance and vegetation removal.

The standards seek to ensure that any disruption associated with earthworks is minimised, that soil loss and sedimentation are controlled to avoid adverse off-site effects, that development sites are safe and stable, and that finished landscapes are rehabilitated.

This section should be read in conjunction with relevant parts of the TRMP, including land disturbances rules in Section 18.5, activities in the river bed in Part 4, water damming and diversion in Part 5, and the discharge rules in Part 6.

Poorly managed earthworks and development can result in soil loss, erosion and instability. Sediment plumes that make their way into waterways can cause damage to habitats and kill aquatic plants and animals. A lack of adequate rehabilitation of worked landscapes can create an eye-sore.

There are three geological areas within Tasman that require special consideration when undertaking earthworks. These are the:

- Moutere Gravels (also known as the Moutere Clays)
- Separation Point Granites
- Limestone Karst Landscapes

The Moutere Gravels contain fine particle clays that once mobilised are difficult to settle and the use of flocculation onsite may be required. The Separation Point Granites are highly erodible and minimising exposed areas is important to reducing sediment yields.

The Karst landscapes are important from a receiving environment point of view as they have unique ecologies and hydrology's that can be particularly susceptible to sedimentation and changes in water flows. Such changes can have significant and unpredictable impacts on other areas, such as increased flooding or land subsidence.

5.1.1 Objectives

All land disturbance and earthworks being undertaken during the construction and installation phases of service infrastructure development meet the following general objectives:

[1] **Note:** Tasman District Council is currently developing a Tasman specific guideline for erosion and sediment control. The draft document is expected to be available in 2014. Until this time, for further information readers are directed to utilise best practice methods and controls identified in Auckland City Council's '*Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region'* (TP90). Further advice can also be obtained from Council.

a) The extent, duration and scale of land disturbance has been minimised;

b) Significant re-contouring and large-scale earth movement has been minimised;

c) All practicable measures have been undertaken to minimise erosion and prevent sediment from travelling off site onto adjacent land, or into waterways, Council infrastructure or onto roads and footpaths;

d) Finished landscapes, sites for future building development, and surfaces that will become part of the road network, meet geotechnical approval;

e) Finished landscapes have been rehabilitated to a standard that is the same as or better than the standard of finish prior to the earthworks activity;

f) The earthworks activity is consistent with all permitted activity standards and conditions, or has obtained resource consent, in terms of the TRMP (refer Section 18.5, and rules in Parts 4, 5 and Part 6);

g) All permitted activity standards, subdivision consents standards and/or conditions of any applicable resource consent have been met.

5.1.2 Key References

The standards and external references set out in Table 5-1 must also be taken into account in the design and management of any earthworks activity. Where a standard or document is referenced, this will be the current version including any associated amendments.

Table 5-1: Standards and External References

Matter	Standard or reference	Comment
Erosion and sediment control	TP90	TP 90 (erosion and sediment control guidelines for land disturbing activities in the Auckland region. Unless a Tasman specific version is available for use.
Land disturbance consenting requirements and permitted activity conditions	Tasman Resource Management Plan	A resource consent will be required where permitted activity standards and conditions cannot be met.
Subdivision	RMA Sections 104 and 106	Conditions may be imposed through the subdivisions consent process. All applicable conditions must be met prior to the Engineering Manager's final approval and prior to Section 224 Certificate approval. Subdivision may not be granted if land is not suitable for development as a result of instability, subsidence, inundation and/or erosion.
Engineering Plan and Subdivision Consent Approvals	RMA Section 223 and 224	Prior to Section 223 approval, Council needs to be satisfied that potential house sites can exist and can be serviced.

Matter	Standard or reference	Comment
		Prior to Section 224 approval Council must be satisfied that house sites do exist.
Consent notice requirements	RMA Section 221	Any conditions may be registered against the property and outlined in consent notices to be recorded on the individual titles pursuant to section 221.
New Zealand Standards	NZS4404, 4402, 4431	General earthworks standards and guidance for the preparation of a future building site or road sub-grade. NZ Standards Authority NZS4404 Land Development and Subdivision Infrastructure NZS4402 Methods of Testing Soils for Civil Engineering Purposes NZS4431 Code of practice for Earth Fill for Residential Development
Other technical publications	TP10, TP227, TP124 TNZ F/1	Stormwater and sedimentation control technical guidance from the Auckland Regional Council. TP10 – design guideline manual stormwater treatment devices. TP124 – low impact design manual for the Auckland region. TP227 – the use of flocculent and coagulants to aid the settlement of suspended sediment in earthworks runoff trials methodology and design. NZ Transport Agency (NZTA previously TNZ) TNZ F/1 specifications for earthwork, construction.

5.2 Land Disturbance, Including Earthworks

5.2.1 General

The following general principles shall apply to all land disturbance including earthworks in the Tasman District:

a) All land disturbance activities comply with permitted activity standards and conditions of Section 18.5, and rules in Parts 4, 5 and 6 of the TRMP or have obtained all relevant resource consents.

b) Information to show compliance with permitted activity standards, or that compliance can be achieved, may be required at the request of Council.

c) Where permitted activity standards and conditions cannot be achieved, resource consent(s) must be obtained in accordance with the TRMP. The applicant may be required to provide information to show compliance with all conditions of consent;

d) An Erosion and Sediment Control Plan (ESCP) shall be developed for all earthworks and land disturbance, with sufficient detail reflecting the scale and risk of the works (refer section 5 below);

e) Management of sedimentation and control of erosion shall be undertaken in accordance with section 5.3 and section 5.4 below;

f) Stormwater and drainage management must be undertaken in accordance with section 7 of the Engineering Standards and Policies.

g) All stormwater infrastructure including low impact devices, must be protected from damage and sedimentation resulting from subdivision activities, land disturbance or subsequent building work. Any stormwater system or low impact device damaged or degraded as a result of sedimentation and construction activities will require repair and/or replacement to the full satisfaction of the Engineering Manager prior to their transfer to Council. Bonds may be utilised to ensure adequate performance in this respect.

5.2.2 Subsoil Drainage

a) Consideration should be given to avoiding disturbance of wet areas. Wet areas should be assessed during the concept and design phase to ensure they are not flood flow paths, intermittent waterways or wetlands.

b) Subsoil drainage will generally be required for significant areas of fill. Similar requirements in conjunction with more extensive sub-soil drains may be necessary on flatter ground in wet areas.

c) Sub-soil drains are discouraged under proposed building envelopes as they may be damaged in piling/excavations for the future dwelling.

d) Subsoil drainage will not be a general requirement for a permeable retaining wall except in the following circumstances:

   i. Where semi-watertight materials (such as tongue and groove boards) are used;
   ii. Where walls have a back-sloping, below-ground footing where water may be trapped;
   iii. Where seepage from a retaining wall may cause a nuisance to an adjoining property owner;
   iv. Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly; or
   v. Where a retaining wall is being built in an area of suspect stability and the removal of surface or groundwater would be an advantage.

e) Sub-soil drains shall be shown on all as-built drawings, with depths to finished ground levels.

5.3 Erosion and Sediment Control

All earthworks and land disturbance activities in the Tasman District - regardless of the scale and size of the activity must utilise best practice and be consistent with the following principles:

a) **Minimise disturbance** – significant works should be staged, to minimise the total area of exposed soils at any point in time. Every effort should be made to minimise disturbance of existing vegetation;

b) **Maintain natural drainage** – where practicable, retain existing natural contours and features, such as gullies, streams and wetland areas. Avoiding disturbance of these areas can help to reduce the potential for excessive soil loss, erosion, sedimentation and inundation;

c) **Install perimeter controls** – install clean water diversion drains to divert clean water runoff away from worked areas and keep separate from sediment laden water;

d) **Protect steep slopes** – steep slopes shall be protected to reduce erosion and sedimentation. This includes diverting upslope water around work areas, reducing slope lengths (using diversion channels/bunds, contour drains or benched slopes), utilising surface roughening where appropriate and undertaking rapid stabilisation, using hydroseeding, as soon as possible. Vegetation should be monitored to ensure good long-term coverage (>80%) is achieved and maintained. If this is not practicable, alternative methods of permanent stabilisation should be used;

e) **Protect watercourses** – projects need to comply with the TRMP regarding discharges, vegetation clearance, earthworks and soil disturbance in or adjacent to the bed any river, lake, stopbank, floodplain or the coastal marine area. The realignment or modification of a watercourse is not permitted without resource consent (this includes watercourses that may already be highly modified);

f) **Topsoil stripping** - All topsoil shall be stripped from the earthwork areas with the stripped area being kept to the practical minimum at any one time. Topsoil should be stockpiled and used in the rehabilitation of the site. Any compaction of topsoil should be suitable to allow for healthy plant growth;

g) **Unsuitable material** - All unsuitable material uncovered during stripping or earthworks shall be excavated. Unsuitable material is generally described as any material having a California Bearing Ratio (Scala or equivalent) (CBR) inferred value of three or less;

h) **Compaction** - all fill areas must be re-worked and compacted in accordance with the appropriate design relevant to soil conditions and geology. Specifications should be provided on compaction methods and degrees of compaction required, also giving moisture/density test results of the soil to be encountered and certified by an appropriate charter professional engineer for the intended use.

i) **Stabilise exposed areas rapidly** – exposed areas must be stabilised as soon as practicable. Vegetated ground cover is the most effective form of permanent erosion control. Keep machinery off areas that have been stabilised.

5.3.1 Erosion and Sedimentation Control Plans

Consideration of erosion and sediment controls should be done with ANY land disturbance activity as failure to adequately retain sediment on site may result in breach of the Tasman discharge rules and subsequent enforcement action or a breach of building consent resulting in work stoppages.

Most resource consents for land disturbance and building consents will require the provision of an erosion and sediment control plan for approval by Council.

Site characteristics, the type of development, the extent of land cover change, and the scale of earthworks, will among other things, influence the need for certain types of erosion and sedimentation management.

Erosion and Sediment Control Plans (ESCP) should be appropriate to the scale of the activities. They can be very simple for small, low risk sites, but should be more comprehensive for larger scale, risky sites. A comprehensive ESCP should include both site plans and a written methodology covering the following:

Table 5-2: Erosion and Sediment Control Plan Content

Site Plan Information	Written Methodology Information
• A title, date and drawing reference number, a north arrow, scale • A unique identification number for each erosion and sediment control structure • The extent of soil disturbance (earthworks footprint) • Topsoil stockpiles • The location of E&SC devices • Identification of contributing catchments for each E&SC device • Identification of any 'no go' or buffer areas to be maintained on the site • Clearly marked areas of cut and fill • Arrows depicting the general flow path/direction of water within each catchment • All watercourses and overland flow paths • Historical/cultural sites • Vegetation and natural features • Site entranceways • Site boundaries • Contour lines • Any other relevant site information	• Project description • Estimate of sediment loss • Principles to minimize erosion and sediment discharge from the site • Design of erosion and sediment control devices • Methodology for flocculation if proposed • Timetable and nature of site stabilisation • Maintenance, monitoring and reporting procedures • Heavy rainfall response and contingency measures • Procedures for review and/or amendment to the ESCP • Identification of specific site responsibilities • Construction timetable

More than one site map may be required to effectively illustrate the evolution of the ESCP, particularly for staged sites or where recontouring alters site drainage. Additional maps can also be used to provide a greater level of detail in high erosion risk or environmentally sensitive areas.

ESCPs should focus on prevention of erosion in the first instance, as this avoids the problems and additional cost of addressing soil loss and sediment retention.

5.4 Methods for Erosion and Sediment Control

5.4.1 General

The methods set out in this section provide some technical guidance as to how erosion can be avoided, and sediment transport minimised during construction.

Site characteristics, the type of development, the extent of land cover change and the scale and duration of earthworks, will among other things, influence the need for specific types of erosion and sedimentation management.

The following methods may be used to manage erosion and sedimentation as part of best practice site management. All erosion and sediment controls should be identified in the Erosion and Sediment Control Plan.

Additional information and advice can be obtained from Council's compliance department and TP90 (in lieu of a Tasman specific guideline).

5.4.2 Erosion Control

Table 5-3 sets out key methods that can be implemented to help control erosion. Several methods may be required on site to control erosion, particularly in high risk areas.

Table 5-3: Erosion Control Methods

Management Method	Standard and/or reference	Comment
Diversion channel or bund	Channel will contain a Q_{20} return period peak flood flow from the catchment, plus 300mm freeboard. Where channel velocity is greater than 1.0m/s stabilisation measures such as geotextile, rock check dams or pipe drop structure will be required to prevent channel erosion. See TDC Drawings 500 to 502.	Diversion channels and bunds are to be used to divert clean or sediment laden runoff. Channels are to be of a trapezoidal cross- sectional shape. Avoid abrupt changes in grade / direction, or design structure to allow for sediment deposition or super-elevation. Incorporate erosion proof outfall, such as a level weir to prevent scour and reduce outfall velocities. Where there are critical downstream structures, secondary flow path measures may need to be considered.
Contour drain or benched slopes	Contour drains should be used where the slope of disturbed land or exposed soil is between 1-in-25 (4%) and 1-in-5 (20%). The drains gradient should not exceed 1-in-50 (2%). The land slope:contour spacing requirements are as follows: 4 to 10% 50m 10 to 15% 40m 15 to 20% 30m Benched slopes should be used	Contour drains and benched slopes are to be used to reduce slope lengths and prevent overland flow velocity build up on long continuous and steep slopes. Install additional drainage where natural seepage is present which may affect slope stability or create excessive runoff. Consider risk of erosion, sedimentation, slippage, settlement, subsidence and rotation of the slope on downstream land.

Management Method	Standard and/or reference	Comment
	where the slope of disturbed land or exposed soil is greater than 1-in-5 (20%). The spacing of the benched slopes should be: 20 to 32% 20m 33 to 50% 15m Greater than 50% 10m The benched slope with a maximum reverse angle of 1-in-6.6 (15%), a minimum depth of 300mm and a width suitable to allow access for maintenance (minimum 3.0m). The benched slope gradient should not exceed 1-in-50 (2%). Benched slopes are to be a maximum 250m long. Refer to TDC Drawing 500.	Consider design of diversion channel draining the benched slopes.
Stabilised construction entrance	A stabilised construction entrance is required on all site entrances onto a public road or right-of-way. A stabilised entrance leading on to the carriageway from the construction area will be 10.0m x 4.0m wide where the vehicle will travel the length over a 75-100mm sized washed aggregate which will help dislodge soil particles from the wheels etc.	A stabilised construction entrance is required to prevent site access points becoming sediment sources. Where it is found or anticipated that a stabilised construction entrance will not prevent sediment being transported onto the road additional measures will be required such as the installation of a wheel wash facility and regular road cleaning.
Pipe and flume drop structures	The structure shall meeting the following standards: Calculations showing that the structure will contain a Q_{20} return period peak flood flow from the catchment. Materials, inlets and joints should be watertight. Secure the pipe drop structure to the slope at least every 4m. Careful consideration of the inlet and outlet is required to ensure no erosion occurs.	A pipe drop structure is required to convey runoff down an un-stabilised slope to prevent erosion of that slope. Pipe flume drop structures can be used as diversion channels where run off velocities are high.

Management Method	Standard and/or reference	Comment
	The structure is placed on suitably compacted or undisturbed material. The structure is constructed in accordance with TDC Drawing 502.	

5.4.3 Stabilisation

In addition to the above stormwater flow management, earth stabilisation techniques should also be used. The following guidelines should be used in the stabilisation of soils and exposed surfaces:

a) Stabilisation measures include seeding, mulching, hydroseeding, turfing and the installation of geosynthetic erosion control systems. Mulching "with sheep-foot roller compaction" is the most effective instant protection.

b) Seeding may be used to stabilise disturbed ground or exposed soils where the gradient is less than 1-in-4 (25%) and where the seed is applied between 1st March and 30th April and between 1st September and 31st November.

c) For slopes greater than 1-in-4 (25%) mulching must be used in conjunction with seeding.

d) Install the seed bed free of large clods, rocks and other unsuitable material and apply a minimum of 100mm topsoil. Fertiliser may be applied where necessary.

e) Seeded disturbed land is considered stabilised once a healthy grass sward with at least 80% coverage is achieved.

f) Mulching can be used at any time of the year, where the instant stabilisation of exposed soils is required. Mulching may be used in conjunction with seeding and sheep foot roller compaction on steeper slopes.

g) Mulch should contain un-rotted small grain straw and an adhesive and be applied at a minimum rate of 4,000kg per hectare spread uniformly to a minimum depth of 60mm.

h) In some circumstances, ground conditions and the season should be taken into consideration when assessing the method that the mulch will be anchored to the ground.

i) Alternative mulch materials such as wood fibre, wood chip, hay, hydromulch may be acceptable, where appropriate, subject to approval.

j) Hydroseeding should be used to establish vegetation quickly for critical areas such as steep slopes and sediment retention pond batters. The proposed limits of application and specification should be specified by the supplier for approval.

k) Hydroseeded disturbed land is considered partially stabilised upon application, however it is only considered permanently stabilised once a healthy grass sward with at least 80% coverage is achieved.

l) Grass turf may be used where immediate cover is required (ie, runoff diversion channels and beside watercourses). Turf reinforced with geosynthetic matting should be considered for areas of high erosion potential.

m) Turf is to be installed in accordance with the supplier's recommendations.

n) Geosynthetic erosion control systems provide artificial protection of channels and slopes and include matting, geotextiles and erosion matting. There are several types of systems suitable for different circumstances. They should be installed in accordance with the supplier's recommendations.

5.4.4 Sedimentation Control

The methods set out in Table Table 5-4 may be used to help prevent sediment transport off site. Note several methods may be required in a 'treatment train' to achieve adequate sediment retention.

Table 5-4: Sedimentation Control Methods

Method	Standard and/or Reference	Comment
Sediment retention pond	The pond should be designed so that larger runoff events will receive partial treatment, while smaller events will receive a high level of treatment. Refer to TDC Drawings 500 to 505. Refer to Appendix 5-1: Sediment Retention PondAppendix 5-1.	A sediment retention pond is a temporary structure designed to treat sediment laden runoff by dewatering the pond at a rate that allows suspended sediments to settle out. The pond shall be cleaned out once 20% of the design volume has been filled with sediment.
Silt fence	They should be used on low gradient sites, or for confined areas where the contributing catchment is small (less than 0.5ha.). Refer to TDC Drawing 506. Excavate a trench a minimum 100mm wide and 200mm deep along the line of the proposed fence. Install the support post and fence fabric and backfill the trench with compacted soil. Maximum slope length, spacing of upslope returns and gradients for silt fences are given in the table below:	Silt fences should be used to detain sheet flow runoff so that sedimentation can occur through settlement. Silt fences should not be used as velocity checks in channels or watercourses or to intercept concentrated flows. Silt fences should remain in place until the catchment has been stabilised. Repair fences where bulges occur or when sediment accumulation reaches 50% of the fabric height.

<table>
<tr><th>Method</th><th>Standard and/or Reference</th><th>Comment</th></tr>
<tr><td></td><td>
<table>
<tr><th>Slope</th><th>Upslope Return Length (m) Maximum</th><th>Spacing of Returns (m)</th></tr>
<tr><td>Flatter than 2%</td><td>Unlimited</td><td>N/A</td></tr>
<tr><td>2-10%</td><td>40</td><td>60</td></tr>
<tr><td>10-20%</td><td>30</td><td>50</td></tr>
<tr><td>20-33%</td><td>20</td><td>40</td></tr>
<tr><td>33-50%</td><td>15</td><td>30</td></tr>
<tr><td>>50%</td><td>6</td><td>20</td></tr>
</table>
Where water may pond behind the fence provide extra post support.
The fence fabric should have minimum tension strength of 0.345pa, minimum tensile modulus of 0.140pa and apparent opening size of 100µm.
Fence supporting posts should be a minimum 50mm square of tanalised timber or steel waratahs, a minimum 2m apart.
The top of the fence fabric should be reinforced with 2.5mm galvanised wire, tensioned and tied.
</td><td></td></tr>
<tr><td>Stormwater sump protection</td><td>Stormwater sump protection shall be used only as a secondary control device to filter sediment laden runoff before it enters the existing stormwater reticulation system from small catchments less than 0.5ha.</td><td>Additional measures are required such as filter cloth, sump lining bags, diversion bunds, contour drains, benched slopes and silt fences to minimise the volume of sediment laden water reaching the stormwater inlet. On-site vehicle washes may also be required.

A silt fence can be erected around the inlet or coarse geotextile fabric wrapped around the sump grate (and within the sump) with a layer of appropriately weighted material over to act as a primary filter and hold the fabric in place. Back entry sumps require additional fabric protection secured in place.

Sandbag check dams should be placed up the gutter to act as sediment traps, ensuring these are lower than the kerb to prevent berm runoff. These should be regularly cleaned out and material disposed of appropriately.</td></tr>
<tr><td>Earth bund</td><td>Earth bund outlets need to be designed as for a sediment retention pond decant system.</td><td>Earth bunds are used to intercept and detain sediment laden runoff for disturbed land or exposed soils that are to be</td></tr>
</table>

Method	Standard and/or Reference	Comment
	The pipe outlet should be 150mm lower than the stabilised spillway which in turn should be 250mm below the top of the earth bund. The outlet should be watertight along the bed of, and through, the bund. The impoundment area of the bund is to be level, and have a minimum volume (measured to the top of the discharge pipe) of $2m^3$ per $100m^2$ of contributing catchment.	stabilised within 14 days. They are to be kept in place until stabilisation is complete.

For all techniques the following design factors should be considered:

i. Site preparation – Install all necessary erosion and sediment control structures prior to any vegetation removal or soil disturbance;
ii. Irrigation – Address water supply measures for seed germination and plant growth. Control irrigation to prevent erosion;
iii. Protect stabilised areas – Protect re-vegetated areas from traffic and other ground disturbing activities; and
iv. Maintenance – Reseed where erosion occurs or germination is unsuccessful, otherwise consider other options for stabilisation;
v. Maintain sediment and erosion control structures in place until all disturbed land is permanently stabilised.

Appendix 5-1: Sediment Retention Pond

A sediment retention pond should be designed in accordance with the following requirements and figures:

a) for any activity where the disturbed land slopes less than 1-in-10 (10%) and less than 200m in length the pond shall be designed with a minimum volume of 1% of the contributing catchment, ie, 100m^3 for each hectare of contributing catchment;

b) for any activity where the disturbed land slopes greater than 1-in-10 (10%) and 200m in length the pond shall be designed with a minimum volume of 2% of the contributing catchment, ie, 200m^3 for each hectare of contributing catchment;

c) for any activity where the disturbed land slopes greater than 1-in-2.50 (40%) and 200m in length the pond shall be designed with a minimum volume of 3% of the contributing catchment, ie, 300m^3 for each hectare of contributing catchment;

d) the slope angle is determined by that slope immediately above the pond or by the average slope angle over the contributing catchment, whichever is greater;

e) ensure base of pond is level, between 1.0m and 2.0m deep and between three to five times longer than wide. The distance between the pond inlet and decant structure should be as great as possible;

f) the decant system should be carefully designed to ensure approximately 30% dead storage at the bottom of the pond to dissipate energy flows;

g) decants work only through the remaining 70% live storage volume. For catchments up to 1.5ha, 1 decant should work through the whole live storage height. For catchments 1.5ha to 3ha, 2 decants required, one through the whole live storage, the second through the top half only. For catchments 3ha to 5ha, 3 decants required one through the whole live storage, the second through upper two-thirds and the third through upper third of live storage;

h) a decant should be provided for each 1.5ha catchment with 6 rows of 10mm diameter holes at 60mm spacing (200 holes) along the 2.0m long decant arm. For catchments less than a multiple of 1.5ha, the appropriate number of holes should be sealed off (ie, for 1ha catchment drill 133 holes in decant), one 10mm diameter hole per 75m^2 of contributing catchment;

i) each decant should be weighted to keep it submerged just below the pond surface through all stages of the decant cycle to prevent blockage from debris;

j) the discharge pipe should be installed with anti-seep collars;

k) the pond inlet should utilise a level weir to maximise the pond capacity. The level weir should be the same width as the pond floor. The inlet slope, below the level weir should be protected from erosion with geotextile and at a slope no greater than 1-in-3 (33%);

l) the inlet level weir/spreader should be set 100-200mm above the invert of the emergency outlet spillway;

m) incorporate a 1.0m deep by 2.0m wide forebay in front of the level weir;

n) silt fences should be installed below the pond prior to construction to prevent downstream sedimentation until the pond batters are stabilised;

o) stabilise the pond batters and any other disturbed areas immediately after construction;

p) for catchments between 1.5ha and 3ha, a 150mm diameter primary spillway pipe is required. For catchments greater than 3ha, a concrete manhole riser and pipe outlet is required, sized for a Q_{20} return period peak flood flow from the catchment;

q) an emergency spillway must be installed on all sediment retention ponds, designed for a Q_{50} return period peak flood flow from the catchment. The spillway requires adequate stabilisation to accommodate a Q_{50} flow and should be a minimum 6.0m wide or the width of the pond floor, whichever is the greater. The spillway should have 300mm freeboard above the height of the primary spillway and 300mm below the pond banks;

r) fence sediment ponds as necessary in accordance with site safety management plan;

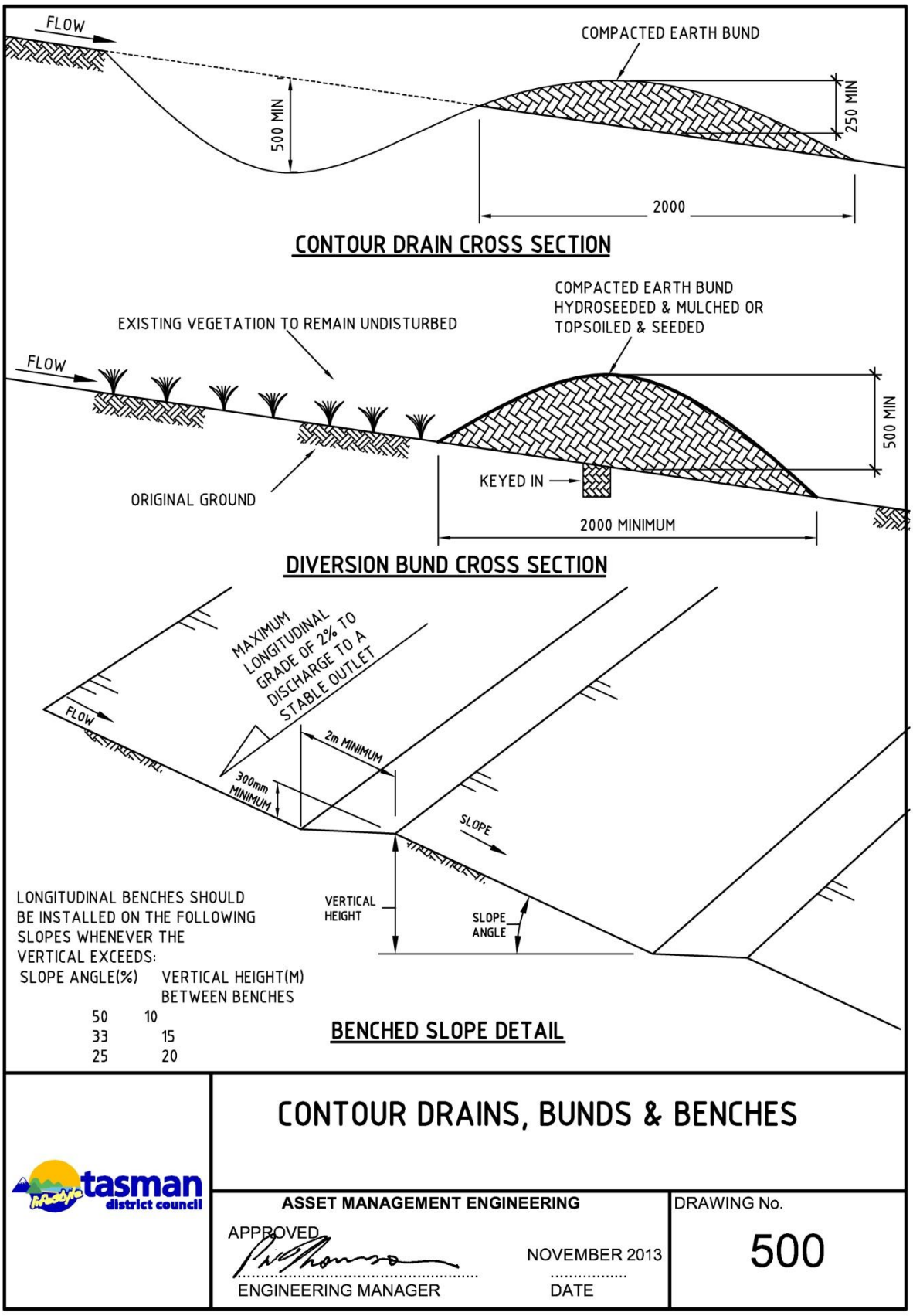
s) sediment ponds are to be cleaned out when the volume of sediment accumulated reaches 20%. The 20% level should be clearly marked on the decant riser;

t) identify sediment disposal locations where there is no risk of erosion;

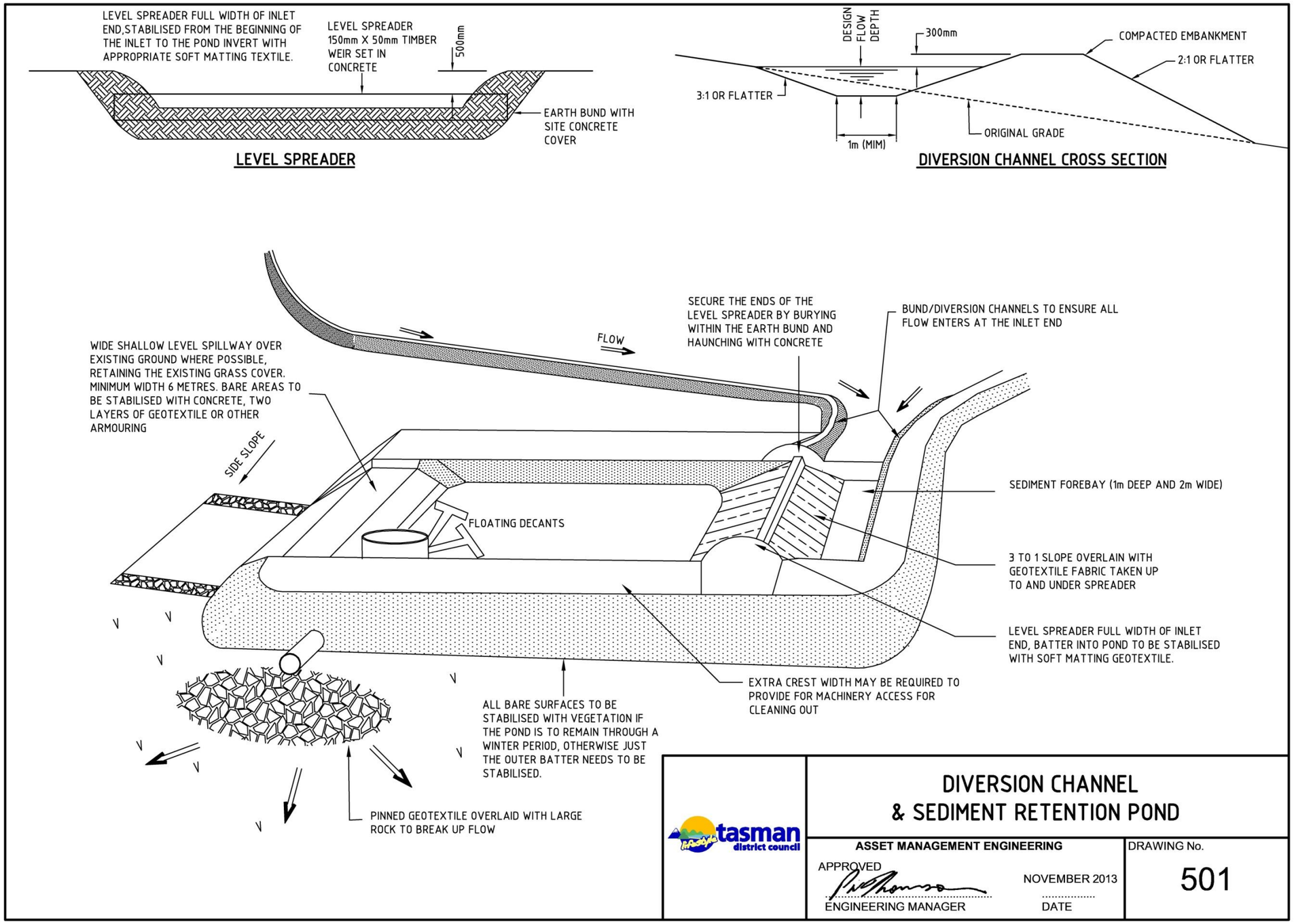
u) chemical treatment of the pond, promoting flocculation to increase the rate of sediment settlement may be considered, subject to Council approval, (1) in circumstances where the pond volume cannot be achieved, (2) where there are high levels of downstream sensitivity, (3) high proportion of clays in the disturbed land.

Refer to TDC Drawings 500 to 506.

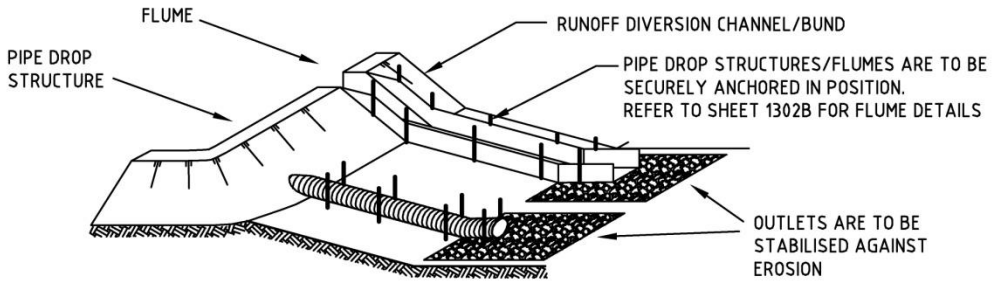
Drawing No. 500 – Contour drains, bunds and benches



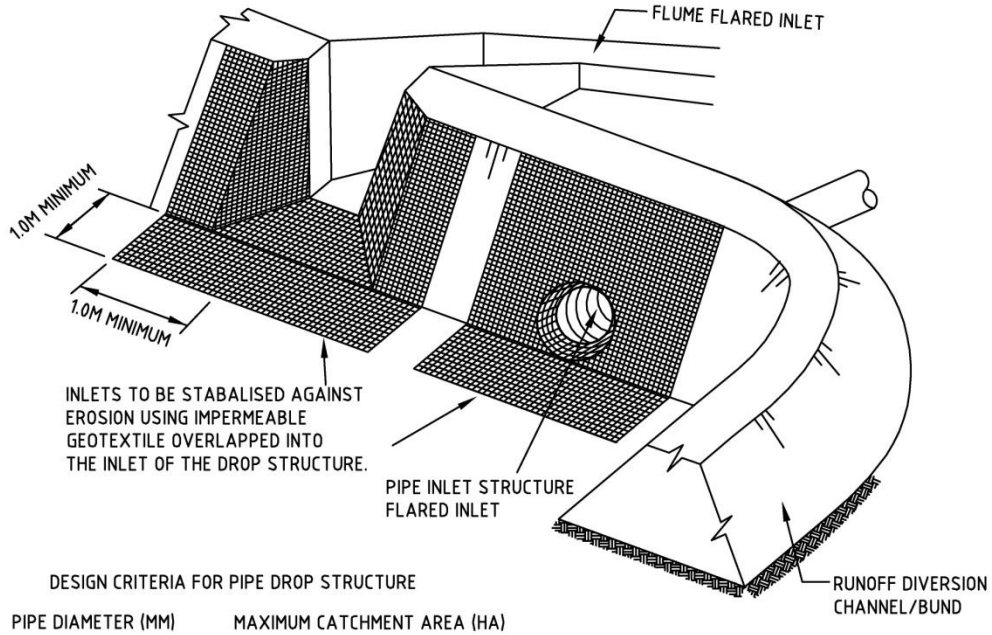
Drawing No. 501 – Diversion channel and sediment retention pond



Drawing No. 502 – Pipe/Flume drop structures



RUNOFF DIVERSION CHAMBER/BUND HEIGHT IS TO BE AT LEAST TWICE THE PIPE DIAMETER OR TWICE THE HEIGHT OF THE FLUME.



DESIGN CRITERIA FOR PIPE DROP STRUCTURE

PIPE DIAMETER (MM)	MAXIMUM CATCHMENT AREA (HA)
150	0.05
350	0.20
450	0.60
500	1.00
600	1.00

SPECIFIC DESIGN IS REQUIRED FOR FLUME SIZING

tasman district council

PIPE/FLUME DROP STRUCTURES

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

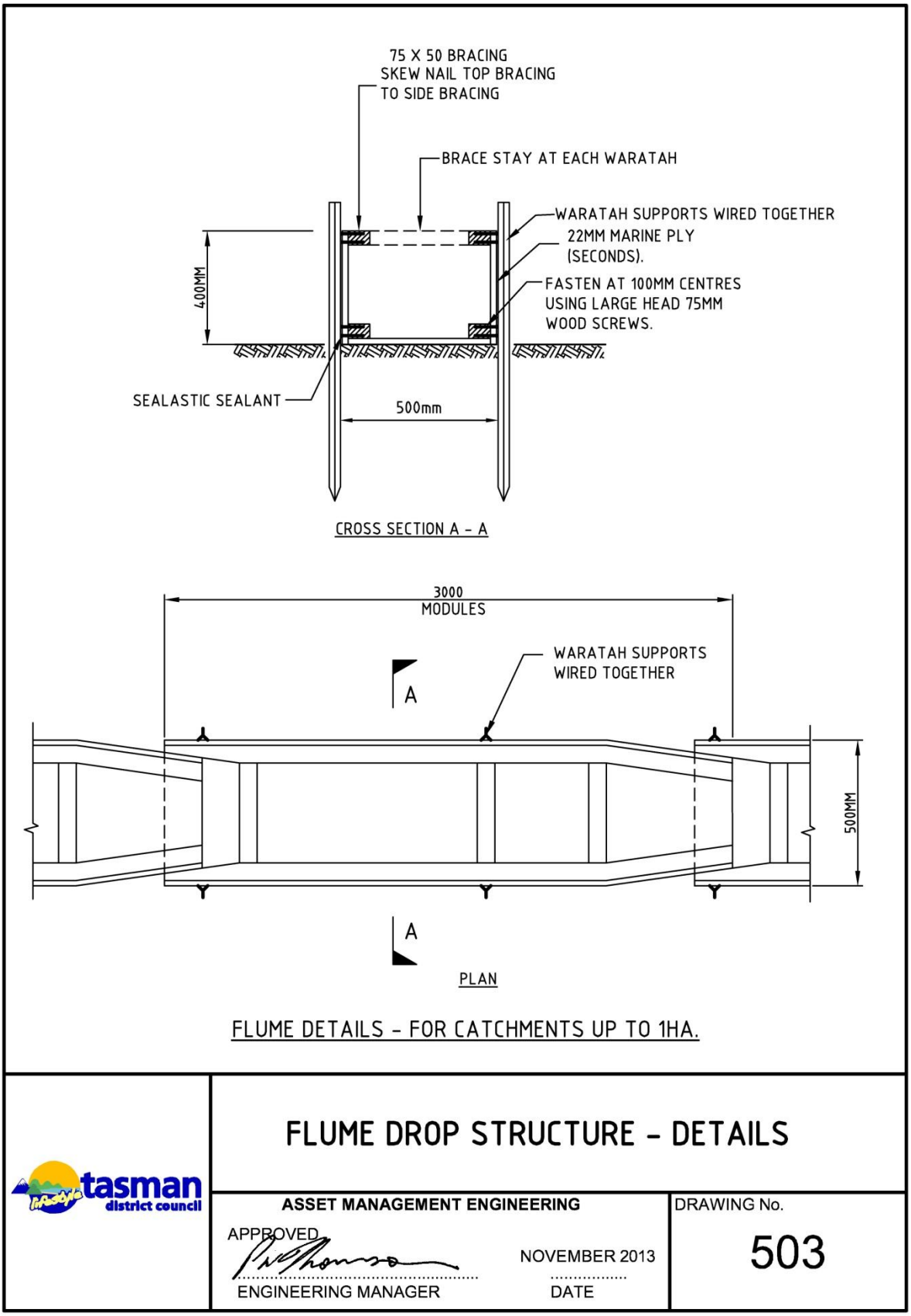
NOVEMBER 2013

DATE

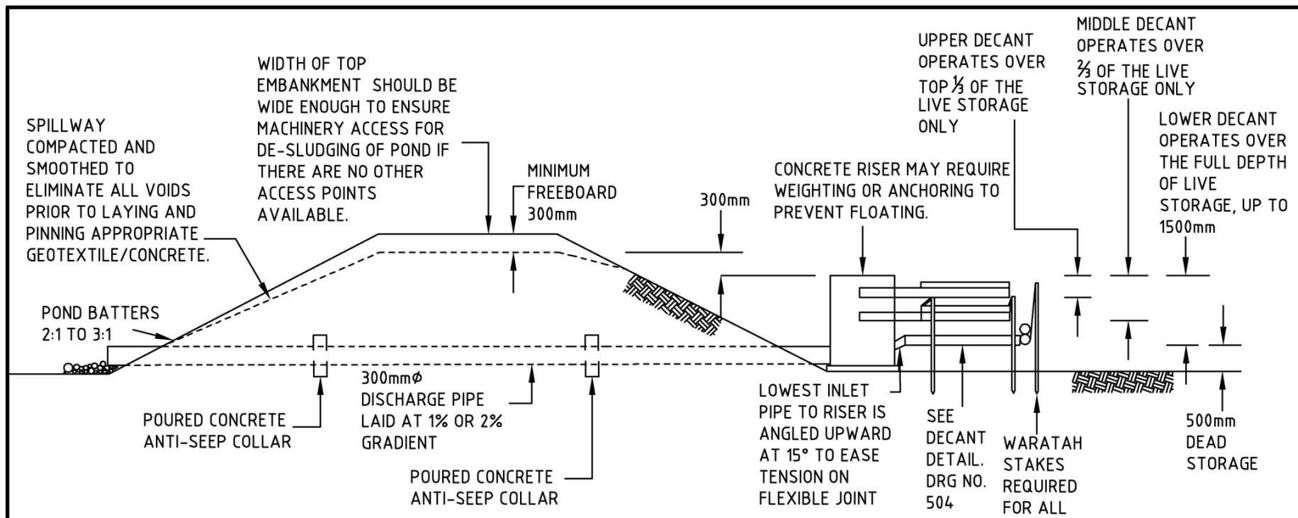
DRAWING No.

502

TDC Drawing No. 503 – Flume drop structure – details

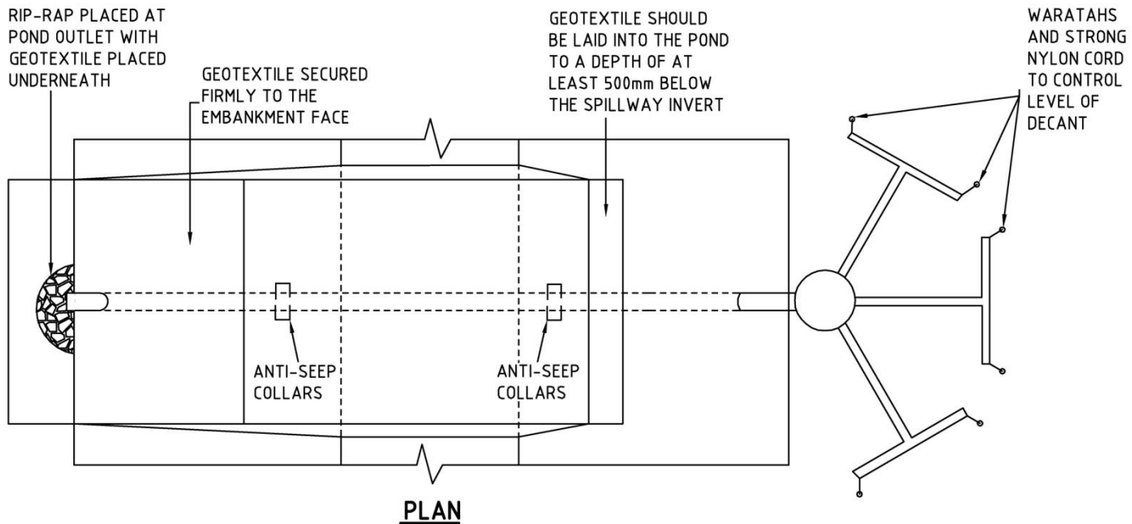


Drawing No. 504 – Decant detail for various catchments



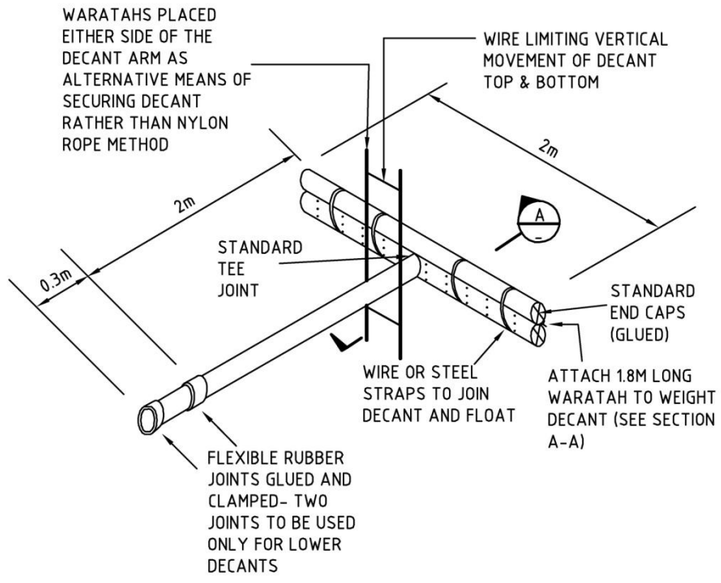
CROSS SECTION

CATCHMENTS >3ha TO < 5ha

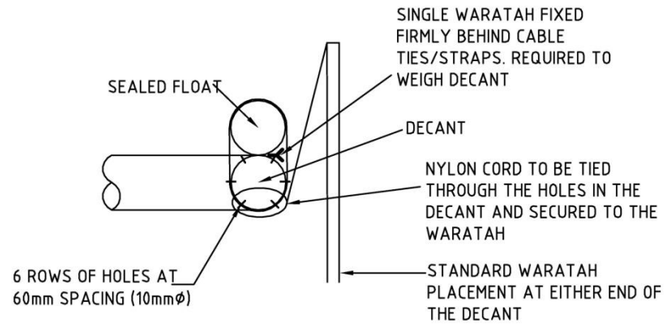


PLAN

CATCHMENTS >3ha TO <5ha



DECANT DETAIL.



SECTION A-A

tasman district council

DECANT DETAIL FOR VARIOUS CATCHMENTS

ASSET MANAGEMENT ENGINEERING

APPROVED

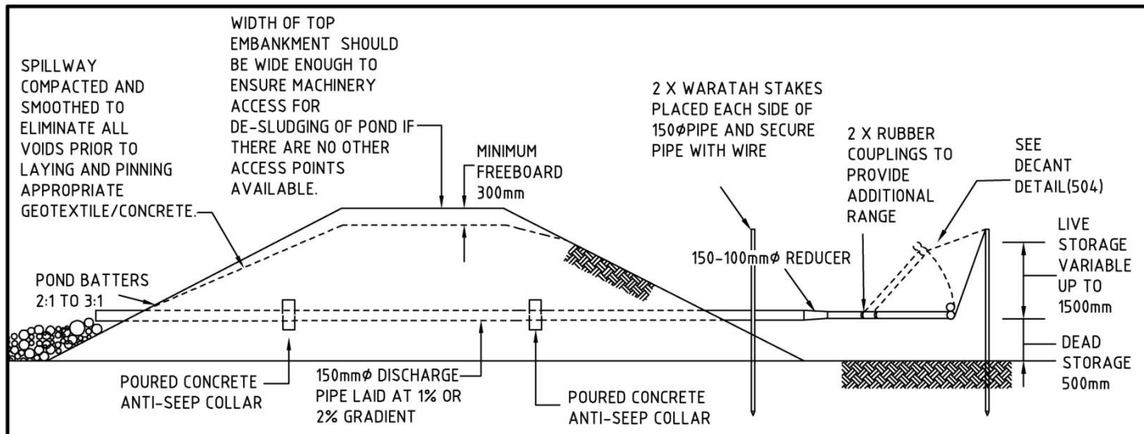
ENGINEERING MANAGER

NOVEMBER 2013

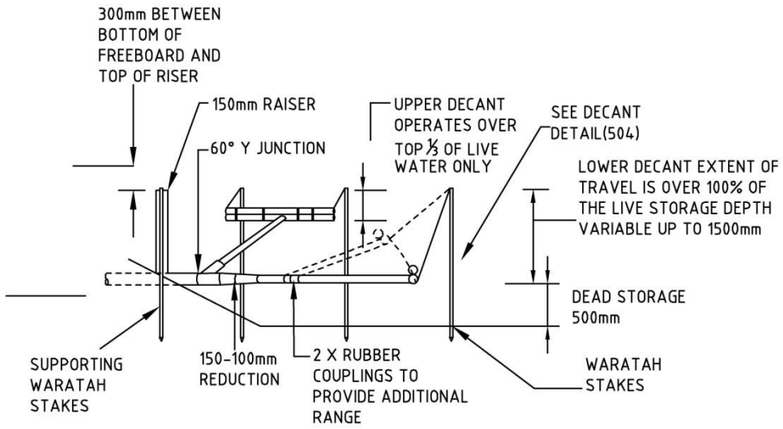
DATE

DRAWING No. 504

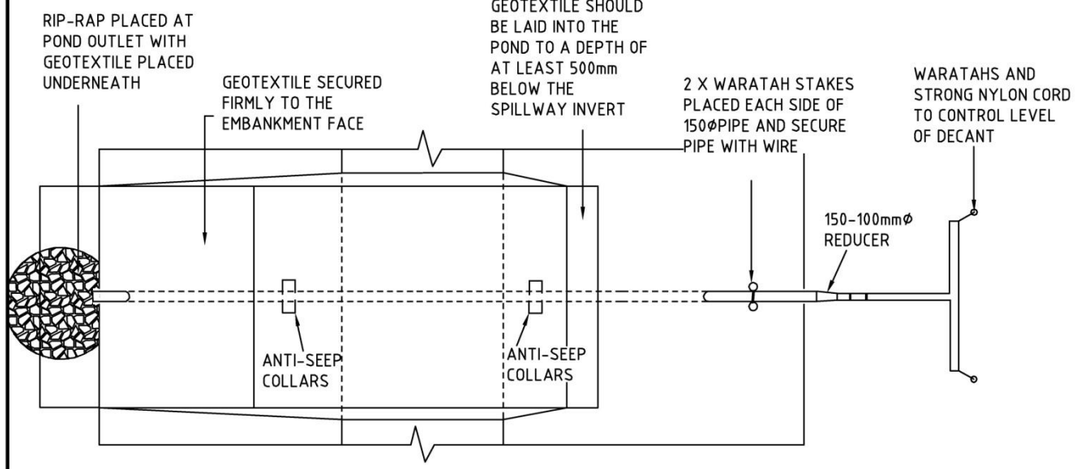
Drawing No. 505 – Decant detail for various catchments



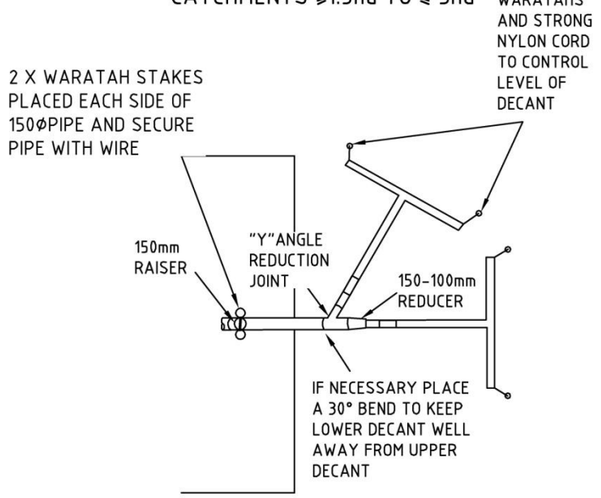
CROSS SECTION
CATCHMENTS UP TO 1.5ha



CROSS SECTION:
CATCHMENTS ≥1.5ha TO ≤ 3ha



PLAN
CATCHMENTS UP TO 1.5ha



PLAN:
CATCHMENTS ≥1.5ha TO ≤ 3ha

tasman district council

DECANT DETAIL FOR VARIOUS CATCHMENTS

ASSET MANAGEMENT ENGINEERING

APPROVED

ENGINEERING MANAGER

NOVEMBER 2013
DATE

DRAWING No.
505

Drawing No. 506 – Silt retention fences