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9. EARTHWORKS

9.1 INTRODUCTION

This section provides standards for the management of earthworks, excavation, soil disturbance and sedimentation.

The purpose of the earthworks standards is to provide guidance to any operator involved in vegetation removal, excavation, recontouring of land and the preparation of sites for development involving any land disturbance works.

The standards are designed 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.

Poorly managed earthworks and development can result in soil loss, erosion and instability.

9.1.1 Objectives

Council is responsible for ensuring that all earthworks being undertaken during the construction and installation phases of land development meet the following general objectives:

- a) The extent and scale of disruption has been minimised;
- b) Significant re-contouring and large-scale earth movement has been minimised;
- c) All practicable measures have been undertaken to minimise soil loss, erosion and sedimentation from exposed surfaces;
- 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 NRMP.
- g) All permitted activity standards, subdivision consents standards and/or conditions of any applicable resource consent have been met.

9.1.2 Key References

The standards and external references set out in Table 9-1 must also be taken into account in the design and management of any earthworks activity. Where a Standard or document is referenced this shall be the current version including any associated amendments.

Table 9-1 Standards and External References

Matter	Standard or reference	Comment
Nelson Resource Management Plan	Earthworks Rule in relevant zone	A resource consent will be required where significant earthworks is proposed and/or where permitted activity standards and conditions cannot be met.
Subdivision	RMA Sections 104 and 106	Conditions may be imposed through the subdivisions consent process. Any applicable conditions must be met 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. 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.
Other technical publications	TP10, TP90, TP124 TNZ F/1	Stormwater and sedimentation control technical guidance from the Auckland Regional Council.

9.2 EARTHWORKS

9.2.1 General

The following general principles shall apply to all earthworks in the Nelson City Council area:

- a) All earthworks activities comply with permitted activity standards and conditions of the NRMP.
- 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, a land disturbance resource consent must be obtained in accordance with the NRMP. The applicant may be required to provide information to show compliance with all conditions of consent;

- d) All earthworks and land disturbance shall be consistent with the principles of earthworks in section 9.2.2 below
- e) Management of sedimentation and control of erosion shall be undertaken in accordance with section 9.3 below;
- f) Where a large earth fill is required, the following information shall be submitted:
 - 1) plans showing contours or levels of the existing site, existing water courses, drainage features and any water table information;
 - 2) a plan showing proposed final contour levels, sections boundaries, the extent of cut and fill;
 - 3) a plan showing batter slopes, surface and subsoil drainage and/or culverting; and
 - 4) the naming of a Designer experienced in soil compaction techniques, who will be responsible for supervising and controlling the operations on the site as set out in the specification.
 - 5) specifications on compaction methods and degrees of compaction required, also giving moisture/density test results of the soil to be encountered;
- g) On completion of the earthworks, certification shall be supplied from the Designer stating that the requirements of the specification have been carried out and giving details of the test results in accordance with the requirements of the specification (as per NZS 4431, section 10);
- h) Stormwater and drainage management must be undertaken in accordance with section 5 of the Land Development Manual.

9.2.2 Principles

All earthworks and land disturbance activities in the Nelson City Council area, regardless of the scale and size of the activity, compliance with permitted activity standards and conditions, or resource consent conditions, must 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) 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;
- d) 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;
- e) Compaction - all fill areas must be re-worked and compacted in accordance with the appropriate design relevant to soil conditions and geology.
- f) Protect steep slopes – Steep slopes shall be protected in accordance with section 9.3.2.3 to reduce erosion and sedimentation.
- g) Stabilise exposed areas rapidly – Exposed areas must be stabilised as soon as practicable. Vegetated ground cover is the most effective form of erosion control. Keep machinery off areas that have been stabilised;
- h) Protect watercourses - Vegetation clearance and soil disturbance is not permitted within 10m of the banks of any river or within 200m of the coastal marine area without resource consent as per the NRMP. The realignment of a natural watercourse is not permitted without resource consent;
- i) Install perimeter controls - Install diversion drains, silt fences and earth bunds to divert clean water runoff away from worked areas and keep separate from sediment prone water.

9.2.3 Subsoil Drainage

- a) Subsoil drainage will generally be required for significant areas of fill. More extensive sub-soil drains may be necessary on flatter ground in wet areas.
- b) Sub-soil drains are discouraged under proposed building envelopes as they may be damaged in piling/excavations for the future dwelling.
- c) Subsoil drainage will not be a general requirement for a permeable retaining wall except in the following circumstances:
 - 1) Where semi-watertight materials (such as tongue and groove boards) are used;
 - 2) Where walls have a back-sloping, below-ground footing where water may be trapped;
 - 3) Where seepage from a retaining wall may cause a nuisance to an adjoining property owner;

- 4) Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly; or
- 5) Where a retaining wall is being built in an area of suspect stability and the removal of surface or groundwater would be an advantage.

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

9.3 EROSION AND SEDIMENTATION CONTROL

9.3.1 General

a) An Erosion and Sedimentation Control Plan (E&SCP) is required for any activity where the cumulative disturbed land is greater than 0.3ha, or where the disturbed land is in a sensitive area, to ensure that the adverse environmental effects of the activity are minimised.

b) Sensitive areas are classed as those within 5m of the banks of any river, within proposed esplanade strip (identified in Appendix 6 of the Nelson Resource Management Plan(RMP)) or within 20m of the coastal marine area, or where the slope of the land is greater than 1 in 2.0 (50%).

c) A land disturbing activity less than 0.3ha that requires a resource or building consent, and is outside a sensitive area does not require an E&SCP but is required to provide the minimum level of erosion and sedimentation control identified in Section 9.3.5. This minimum level shall be indicated on the resource or building consent application for approval by Council.

d) An E&SCP will not be applicable for general farming and forestry activities. Resource Consent requirements for these activities are covered under rules RUr.25 Vegetation Clearance, RUr.26 Soil Disturbance, RUr.27 Earthworks, RUr.53 Coastal; Environment Overlay (Earthworks), RUr.78 Subdivision.

e) E&SCP's are required to be submitted to Council, and approval given, prior to commencement of the activity on site. Notification of the start of the land disturbing activity is required a minimum of 1 week prior to commencement.

f) The E&SCP should be appropriate to the scale of the operation, and shall include: -

- 1) Consideration of the principles identified in section 9.3.2.
- 2) Details required in Appendix A
- 3) Site drawing(s), to the standards required in section 2, clearly identifying:

- Site boundaries and relevant features, i.e. streams, access points etc.

- Site description, i.e. topography, vegetation, soil types, including highlighting steep areas where slope of disturbed land or exposed soil is greater than 1 in 20 (5%), 1 in 5 (20%), 1 in 2.0 (50%) and 1 in 1.43 (70%).
- Proposed stages of construction with boundaries and limits of land disturbance identified on the plan.
- Plans showing proposed erosion and sedimentation controls, i.e. diversion channels, perimeter cut offs, benched drains, stabilisation/revegetation types and locations, stabilised construction entrances, sedimentation ponds, silt fences etc.
- Details of any stream crossings.

4) Specifications and supporting calculations for erosion and sedimentation controls proposed.

5) Measures to be taken to ensure the E&SCP is implemented and adequately maintained on site. An example of the proposed erosion and sedimentation control inspection checklist will be required. It is recognised that the Plan will be a working document and may be subject to change as the activity progresses. Provision should be made for identifying and recording necessary changes on the inspection checklist.

6) Details of any other measures designed to reduce the impact of the activity on the environment.

7) Copies of the inspection checklists should be submitted to Council at regular specified intervals for the duration of the activity.

8) Where a major variation to the planned site works is proposed a revision to the E&SCP shall be submitted to Council, and works shall not commence until approval is given.

9) Erosion and sedimentation controls should only be removed from each stage of the development when the land from that stage has been fully stabilised.

10) Disturbance is defined in section 2 of the Nelson RMP.

9.3.2 Principles of Erosion and Sedimentation Control

- a) Erosion is the process whereby the land surface is worn away by the action of water, wind, or any other geological process. The resultant displaced material is sediment. Sedimentation is the deposition of this eroded material.
- b) The principles that should be considered when preparing an Erosion and Sedimentation Control plan are:

9.3.2.1 Minimise disturbance

- a) Design the project with a view to limiting the disturbed land area. Programme the works to keep forward clearing of vegetation to a minimum. Identify in the E&SCP staged vegetation clearance areas and ensure the boundaries of these areas are clearly identified on site using fences, signs and flags.
- b) Erosion from temporary earth stockpiles formed on site should also be addressed in the E&SCP.

9.3.2.2 Stage construction

- a) As much as practicable stage construction to minimise the time and area that soil is exposed and prone to erosion.
- b) Ensure that control measures are installed before commencement of the land disturbing activity for each stage.

9.3.2.3 Protect steep slopes

- a) Slope length and slope angle are critical factors in erosion potential because they play a large part in determining the speed of run off. Long continuous slopes allow run off to build up speed and to concentrate flows, which produces rill and gully erosion.

- b) Where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%) and the land is to:

- 1) Have measures taken for the land to be stabilised within 14 days, then temporary contour drains (SD 903) will be required, draining to temporary earth bunds (SD 915), until the land is stabilised; or
- 2) Have no measures taken for the land to be stabilised within 14 days, then temporary contour drains are required, draining to a sedimentation pond (SD 907), until the land is stabilised.

- c) Where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%) and the land is to:-

- 1) Have measures taken for the land to be stabilised within 14 days, then temporary benched slopes (NCC Standard Drawing No. 904) will be required, draining to temporary earth bunds, until the land is stabilised; or
- 2) Have no measures taken for the land to be stabilised within 14 days, then temporary benched slopes are required, draining to a sedimentation pond, until the land is stabilised.

- d) For slopes steeper than 1 in 1.43 (70%) or less, depending on earth conditions and circumstances, permanent benched slopes may be required.

- e) Divert clean water run off from above steep slopes, away from worked areas and keep separate from sediment prone water.
- f) Compact all fills to reduce erosion and sedimentation.

9.3.2.4 Stabilise exposed areas rapidly

- a) Vegetated ground cover is the most effective form of erosion control. Vegetation shields the soil structure from rain drop impact, slows the velocity of run off, holds soil particles in place and maintains the soil capacity to absorb water.
- b) Save topsoil and re-spread on disturbed areas as soon as possible.
- c) For disturbed land sloping less than 1 in 20 (5%), revegetate or otherwise protect from erosion as soon as practicable, and not later than 12 months from the date of disturbance.
- d) If permanent rehabilitation / stabilisation is delayed then temporary measures such as mulching will be required.
- e) Keep machinery off areas that have been stabilised.

9.3.2.5 Protect Watercourses

- a) Vegetation clearance and soil disturbance is not permitted within 5m of the banks of any river or within 20m of the coastal marine area without resource consent. The realignment of a natural watercourse is not permitted without resource consent.
- b) Identify all watercourses in the E&SCP and address: -
 - 1) how these watercourses will be protected;
 - 2) how sediment laden water will be prevented from flowing into the watercourse;
 - 3) how watercourse crossings will be constructed to prevent erosion;
 - 4) watercourse includes every river, stream and channel whether natural or not, through which water flows, whether continuously or intermittently, during the duration of construction.

9.3.2.6 Install perimeter controls

- a) Install diversion drains, silt fences and earth bunds to divert clean water run off away from worked areas and keep separate from sediment prone water.

9.3.3 Erosion Control

When developing the E&SCP, emphasis should be placed on erosion control to prevent sediment generation rather than attempting to catch unnecessarily generated sediments downstream. Below is a list of the main techniques that should be considered. There are many more techniques not listed here, which may be used subject to approval.

9.3.3.1 Diversion channel or bund

- a) Diversion channels and bunds are to be used to divert clean or sediment laden run off.
- b) Designs are to be submitted with the E&SCP to include:
- c) Calculations showing that the channel will contain a Q15 return period peak flood flow from the catchment, plus 300mm freeboard.
- d) Calculations showing the maximum design velocity. Where channel velocity is greater than 1m/s stabilisation measures such as geotextile, rock check dams or pipe drop structure will be required to prevent channel erosion.
- e) Channels are to be of a trapezoidal cross sectional shape.
- f) Avoid abrupt changes in grade / direction, or design structure to allow for sediment deposition or super-elevation.
- g) Incorporate erosion proof outfall, such as a level spreader to prevent scour and reduce outfall velocities.
- h) Where there are critical downstream structures, secondary flow path measures may need to be considered.
- i) Refer to SD 901 and 902

9.3.3.2 Contour drain or benched slopes

- a) Contour drains and benched slopes are to be used to prevent overland flow velocity build up on long continuous, and steep slopes and convey sediment loaded water across sloping land on a minimal grade to sediment retention structure(s), probably via runoff diversion channels / bunds.
- b) Contour drains should be used where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%). The spacing of the drains should be in accordance with the table below. The drains gradient should not exceed 1 in 50 (2%).

Slope of land (%)	Spacing of contour drains along the slope (m)
5 to 10	50
10 to 15	40
15 to 20	30

- c) Benched slopes should be used where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%). The spacing of the benched slopes should be in accordance with the table below and located to divide the slope evenly. Careful consideration of the diversion channel design draining the benched slopes is required.

Slope of land (%)	Vertical height between benches (m)
20 to 33	20
33 to 50	15
Greater than 50	10

- d) Designs are to be submitted with the E&SCP to include: -

- 1) 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.
- 2) The benched slope gradient should not exceed 1 in 50 (2%).
- 3) Benched slopes are to be a maximum 250m long.
- 4) Install additional drainage where natural seepage is present which may affect slope stability or create excessive run off
- 5) Consider risk of erosion, sedimentation, slippage, settlement, subsidence and rotation of the slope on downstream land.
- 6) Consider design of diversion channel draining the benched slopes.
- 7) Refer to SD 903 and 904

9.3.3.3 Stabilisation techniques

- a) Stabilisation of disturbed and exposed earth will protect the earth from erosion by the action of water, wind, or any other geological process and reduce sediment and run off. 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 February and 15th May and between 15th August and 31st November.
- c) For slopes greater than 1 in 4 (25%) mulching must be used in conjunction with seeding. Consideration of using sheep foot roller compaction should be considered on slopes steeper than 1 in 2.14 (47%).

- 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 2 months after sowing.
- 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, an adhesive and fertilizer applied at a minimum rate of 4,000kg per ha spread uniformly to a minimum depth of 60mm.
- h) In some circumstances, consideration of ground conditions and the season should be taken into consideration when considering 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 limits of application and specification proposed should be specified by the supplier for approval. Hydroseeded disturbed land is considered stabilised when 2 months after application.
- k) Turf may be used where immediate cover is required (i.e. run off diversion channels and beside watercourses). Turf reinforced with geosynthetic matting should be considered for areas of high erosion potential.
- l) Turf is to be installed in accordance with the supplier's recommendations.
- m) 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. Systems should be designed, specified and installed in accordance with the manufactures recommendations and submitted with the E & SCP for approval.
- n) For all techniques the following design factors shall be considered:
 - 1) Site preparation – Install all necessary erosion and sedimentation control structures prior to stabilisation
 - 2) Irrigation – Address water supply measures for seed germination and plant growth. Control irrigation to prevent erosion.

- 3) Protection – Protect re-vegetated areas from traffic and other ground disturbing activities.
- 4) Maintenance – Reseed where erosion or germination is unsuccessful prior to 31st May, otherwise consider mulching.

9.3.3.4 Stabilised construction entrance

- a) A stabilised construction entrance is required to prevent site access points becoming sediment sources. A stabilised construction entrance is required on all site entrances onto a public road or right of way.
- b) The stabilised construction entrance should be installed in accordance with the standard drawing and drainage should be provided to carry sediment laden runoff from the entrance to an appropriate sediment control measure such as an earth bund or sedimentation pond.
- c) 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.
- d) Refer to SD 905

9.3.3.5 Pipe drop structures

- a) A pipe drop structure is required to convey run off down an un-stabilised slope to prevent erosion of that slope. Pipe drop structures can be used as diversion channels where run off velocities are high.
- b) Designs are to be submitted with the E & SCP to include: -
- c) Calculations showing that the structure will contain a Q15 return period peak flood flow from the catchment.
- d) Materials, inlets and joints should be watertight.
- e) Secure the pipe drop structure to the slope at least every 4m.
- f) Careful consideration of the inlet and outlet is required to ensure no erosion occurs.
- g) The structure is placed on suitably compacted or undisturbed material.
- h) The structure is constructed in accordance with the standard drawing.
- i) Refer to SD 906

9.3.4 Sedimentation Control

Below is a list of the sedimentation control techniques that should be considered. There are more techniques not listed here, which may be used subject to Council approval.

9.3.4.1 Sediment retention pond

- a) A sediment retention pond is a temporary structure designed to treat sediment laden run off by dewatering the pond at a rate that allows suspended sediments to settle out. The pond should be designed so that larger run off events will receive partial treatment, while smaller events will receive a high level of treatment. To achieve this, the energy of the inlet water needs to be low to minimise re-suspension of sediment, and the decant rate at the outlet also needs to be low to minimise water currents and to allow time for the suspended sediments to settle.
- b) Design calculations and drawings shall be submitted with the E&SCP.
- c) A sediment retention pond shall be designed in accordance with the following requirements and figures:-
- d) 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, i.e. 100m³ for each ha of contributing catchment.
- e) for any activity where the disturbed land slopes greater than 1 in 10 (10%) and/or greater than 200m in length the pond shall be designed with a minimum volume of 2% of the contributing catchment, i.e. 200m³ for each ha of contributing catchment.
- f) For any activity where the disturbed land slopes greater than 1 in 2.14 (47%) and greater than 200m in length the pond shall be designed with a minimum volume of 3% of the contributing catchment, i.e. 300m³ for each ha of contributing catchment.
- g) 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.
- h) Ensure base of pond is level, between 1m and 2m deep and between 3 to 5 times longer than wide. The distance between the pond inlet and decant structure should be as great as possible.
- i) The decant system should be carefully designed to ensure approximately 30% dead storage at the bottom of the pond to dissipate energy flows.

- j) 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 4.5ha, 3 decants required, one through the whole live storage, the second through upper 2/3's and the third through upper 1/3rd of live storage.
- k) A decant should be provided for each 1.5ha catchment with 6 rows of 10mm diameter holes at 60mm spacing (200 holes) along the 2m long decant arm. For catchments less than a multiple of 1.5ha, the appropriate number of holes should be sealed off (i.e. for 1ha catchment drill 133 holes in decant), one 10mm diameter hole per 75m² of contributing catchment.
- l) 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.
- m) The discharge pipe should be installed with anti-seep collars.
- n) The pond inlet should utilise a level spreader to maximise the pond capacity. The level spreader should be the same width as the pond floor. The inlet slope, below the level spreader should be protected from erosion with geotextile and at a slope no greater than 1 in 3(33%).
- o) The level spreader weir should be set 100-200mm above the invert of the emergency spillway.
- p) Incorporate a 1m deep by 2m wide fore bay in front of the level spreader weir.
- q) Silt fences should be installed below the pond prior to construction to prevent downstream sedimentation until the pond batters are stabilised.
- r) Stabilise the pond batters, and any other disturbed areas, immediately after construction
- s) 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 Q15 return period peak flood flow from the catchment.
- t) An emergency spillway must be installed on all sediment retention ponds, designed for a Q50 return period peak flood flow from the catchment. The spillway requires adequate stabilisation to accommodate a Q50 flow and should be a minimum 6m 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.
- u) Fence sediment ponds as necessary in accordance with site safety management plan.

- v) 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.
- w) Identify sediment disposal locations where there is no risk of erosion.
- x) Chemical treatment of the pond, promoting flocculation to increase the rate of sediment settlement may be considered, subject to council approval, in circumstances where the pond volume cannot be achieved, where there are high levels of downstream sensitivity, or high proportion of clays in the disturbed land.
- y) Refer to SD 907 to 912

9.3.4.2 Silt fence

- a) Silt fences should be used to detain sheet flow run off so that sedimentation can occur through settlement. They should be used on low gradient sites, or for confined areas where the contributing catchment is small (less than 0.5ha.). Silt fences should not be used as velocity checks in channels or watercourses or to intercept concentrated flows.
- b) Silt fences shall be designed in accordance with the following requirements and figures, but alternative designs may be acceptable, subject to approval:

- 1) The maximum slope length, spacing of returns and gradients for silt fences is shown in Table 9-2 below.
- 2) The silt fences should be constructed in accordance with the standard drawing and should be positioned along the contour, where possible. Where this is not possible, or for long lengths of fence, install short silt fence returns (minimum 2m long) to minimise concentration of flows.
- 3) 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.
- 4) Where water may pond behind the fence provide extra support.
- 5) The fence fabric shall have minimum tension strength of 0.345pa, minimum tensile modulus of 0.140pa and apparent opening size of 100µm.
- 6) Fence supporting posts shall be a minimum 50mm square of tanalised timber or steel waratahs, a minimum 2m apart.
- 7) The top of the fence fabric shall be reinforced with 2.5mm galvanised wire, tensioned and tied.

- 8) Repair fences where bulges occur or when sediment accumulation reached 50% of the fabric height.
- 9) Silt fences shall remain in place until the catchment has been stabilised.

c) Refer to SD 913

Table 9-2 Silt Fence Design Criteria

Slope Steepness %	Slope Length (m) (maximum)	Spacing of Returns (m)
Flatter than 2%	Unlimited	N/A
2 – 10%	40	60
10 – 20%	30	50
20 – 33%	20	40
33 – 50%	15	30
> 50%	6	20

9.3.4.3 Stormwater sump protection

- a) Stormwater sump protection may be used only as a secondary control device to filter sediment laden runoff before it enters the stormwater reticulation system from small catchments less than 0.5ha. Additional measures are required such as diversion bunds, contour drains, benched slopes and silt fences to minimise the volume of sediment laden water reaching the stormwater inlet.
- b) Stormwater sump protection offers limited treatment because the flows arriving at them are concentrated. Their use may indicate poor erosion and sedimentation control and/or inadequate stabilisation following the activity.
- c) A silt fence can be erected around the inlet or course geotextile fabric wrapped around the cesspit grate with a layer of aggregate 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.
- d) Stormwater sump protection and sandbag check dams require high maintenance as the capacity for sediment storage is small. Address maintenance measures in the E&SCP.
- e) Refer to SD 914

9.3.4.4 Earth bund

- a) Earth bunds are used to intercept and detain sediment laden run off for disturbed land or exposed soils that are to be stabilised within 14 days, where the catchment area is less than 0.3ha. They are to be kept in place until stabilisation is complete.
- b) Earth bund outlets need to be designed as for a sediment retention pond decant system or by using a perforated pipe. The perforated 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 novacoil pipe) of 1m³ for every 100m² of contributing catchment.
- c) Refer to SD 915.

9.3.5 Controls on Small Sites

- a) For sites with less than 0.3 ha of disturbed land, outside sensitive areas, an E&SCP is not required although the following measures are still necessary to ensure that the activity complies with the soil disturbance and earthworks rules in the Nelson Resource Management Plan. These rules state that some soil disturbance and earthworks activities are permitted without resource consent provided:
 - *soil is contained on the site during the construction period and after, such that there are no adverse effects on adjoining properties or any water bodies;*
 - *all bare soil areas are revegetated or otherwise protected from soil erosion as soon as practicable and not later than 12 months from the date of disturbance;*
 - *no vegetative debris is positioned where it may dam or divert any river or stream or adversely affect instream habitats.*
- b) A stabilised construction entrance shall be installed in accordance with 9.3.3.4 above.
- c) Silt fences shall be used to trap sediment laden overland flows before they leave the site. Silt fences should be installed in accordance with 9.3.4.2 above.
- d) Earth bunds shall be used to treat sediment laden run off and should be constructed in accordance with 9.3.4.4 above.

Appendix A Erosion and Sedimentation Control Plan Preface

1) Project Details

Project title
Eng Plan No.
Site Address

2) Client Details

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person

3) Consultant Details (Architect / Surveyor)

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person

4) Contractor Details

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person
After hours contact telephone No.

5) Type of Development

6) Programme

- i) Activity commencement date
- ii) Activity completion date

7) Site Details

- i) Total property area (ha)
- ii) Maximum area of disturbed land or exposed soil that will be unvegetated for any one period during the activity.
- iii) Maximum slope of disturbed land or exposed soil for any period during the activity
- iv) Water body into which runoff will be discharged
- v) Is the activity in a sensitive area

8) Measures to be taken to ensure E & S controls are adequately maintained

- i) Person responsible for E & S site controls
- ii) Person responsible for E & S site inspections and the submitting of the checklists to Council
- iii) Frequency of inspections, - regular
 - before and after rain