SOUTHERNSKIES ENVIRONMENTAL

EROSION AND SEDIMENT CONTROL ASSESSMENT REPORT

MAITAHI VILLAGE

Prepared for CCKV Maitahi Development Co LP

Document History and Status

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1. INTRODUCTION

CCKV Maitahi Development Co LP (the Applicant) seeks resource consent to undertake earthworks as a part of the Maitahi Village development within the Kākā Valley, Nelson.

The Maitahi Village (Project) is a fully integrated and comprehensive subdivision and development that will provide for a range of housing needs, within an enhanced cultural, ecological, landscape and recreational setting in close proximity to Nelson City.

This Erosion and Sediment Control Assessment Report (ESCAR) is provided to support the resource consent application. It details how the earthworks will be managed to minimise the effect of sediment laden runoff on the receiving environment. Sediment effects generated during earthworks operations can be significantly detrimental on the receiving environment if not appropriately minimised and mitigated. This ESCAR provides overarching detail on how erosion and sediment control (ESC) will be utilised on site to minimise and mitigate those potential effects.

This ESCAR provides:

- the overarching ESC principles and procedures for the earthwork activities associated with the Applicant's Maitahi Village Project (the Project);
- an assessment of the effectiveness of those ESC principles and procedures in minimising potential sediment discharges to an acceptable level; and
- concepts that inform the development of the Site-Specific Erosion and Sediment Control Plans (SSESCPs).

It is to be read in conjunction with the following appended documents:

- Chemical Treatment Management Plan (ChemTMP);
    - Chemical Analysis and Reactivity Test Report (CART);
- Erosion and Sediment Control Monitoring Plan; and
- SSESCPs.

The ESCAR and supporting documents address the management of soils that are to be exposed and placed during the Project development.

Draft SSESCPs for the initial stages have been prepared and are appended to this document. Prior to the commencement of earthworks within each stage, and within future stages, the corresponding SSESCP will be finalised or updated and provided to Nelson City Council (NCC) for review and certification. This approach allows for flexibility, fine tuning and ownership of the ESC measures and methodologies by the Project Manager and Contractor.

2. PROJECT DESCRIPTION

2.1. Overview and Site Description

The Project involves earthworks and streamworks over a footprint of approximately 67 hectares (ha) for a fully integrated subdivision and development within the Kākā Valley, Maitai, Nelson, referred to as the Maitahi Village.

The site is located along the floor of the Kākā Valley and on the adjacent hill slopes to the west and east. The Kākā Stream flows through the Project in a north to south direction and forms a tributary on the true right of the Maitahi River (also known as the Maitai River and Mahaitahi River). The confluence of the Kākā Stream and Maitahi River is located near the southern boundary of the site, with that juncture being a popular recreational swimming hole locally known as Dennes Hole.

The site is accessed via Maitai Valley Road and 7 Ralphine Way. The site is currently used as pastoral farmland.

Seven sub-area designations have been identified and described in the Proposed Maitai Village Subdivision Kākā Valley geotechnical report prepared by Tonkin and Taylor (T+T). These are briefly described as follows:

Area 1 – Kākā Lower Reach, Floodplain

Comprises the lower reaches of the Kākā Stream, which flows through the area and discharges to the Maitahi River at the south-western edge of the floodplain. The floodplain gently slopes to the south-west and is bounded by river terraces to the north-east and north-west.

Area 2 – Eastern slopes

This area comprises two moderately inclined ridges separated by a gully with moderately inclined side slopes. Land upslope of the eastern property boundary above approximate RL 250 m becomes steeply inclined towards the main ridge line and Kākā Hill.

Area 3 – Eastern debris fan

This area comprises an ancient debris fan and narrow gully source area (Gully 11) extending upslope to approximately RL 380 m. The toe of the fan and the side slopes above erosion Gullies 9 and 12 are moderately inclined, becoming gently inclined through the main body of the fan. This relatively gentle gradient continues upslope from the mouth of Gully 11 and becomes very steeply inclined in the source area at the head of the gully and upslope to Kākā Hill.

Area 4 – Kākā Upper Reach

This area extends upstream (north) from the Eastern Debris Fan to the northern extent of the proposed residential area on the upper terrace (TTL1), and on the eastern side (true left) of Kākā Stream. It comprises moderately to steeply inclined slopes that are generally south-west to north-west facing. A broad south-west trending erosion gully is present near the southern end of the area (Gully 8), and a smaller narrower erosion feature is present in the slope north of the proposed residential lots.

Area 5 – Mid valley terraces

This area comprises a gently sloping south-east facing alluvial terrace (TTR2) The existing homestead is located at the south end of this terrace. The terrace terminates against the moderately inclined toe of the West Valley slopes.

Area 6 – West Valley slopes

This area comprises moderate to steeply inclined south to south-east to north-east facing slopes and numerous spurs and erosion gully features. The northern end of the slope above the mid-level terrace and the homestead is moderately inclined (14°) up to the farm track. Upslope of the farm track the slope steepens to approximately 33° above the track. The southern part of Area 6, upslope of the Homestead and terrace, is also steeply inclined.

Area 7 – Valley Fill area and unsuitable disposal areas

This area is located approximately 50m north (upstream) of Area 4 on the true left of Kākā Stream and comprises a gently sloping stream terrace and the toe of the moderately to steeply inclined hillslope above. The Valley Fill area is bounded at the downstream margin by a moderately steeply inclined (24°) gully. The gully mouth flattens towards the terrace and the gully channel is deeply incised. The gully mouth has the appearance of an old distal fan, however, the proximal fan has been truncated by the stream terrace.

Topographical features of the site are indicated on Tonkin + Tayor's '*Engineering Geology Plan*' Drawing 1012397.1000-GT-F03 provided in the Geotechnical Assessment Report.

2.2. Earthworks

The extent and scale of the earthworks is shown on Davis Ogilvie & Partners (DOP) drawing '*Overall Earthworks Plan – Volumes*', Drawing C100, Rev P7.

Approximate earthworks areas and volumes are provided in Table 1.

Table 1: Earthworks areas and quantities (Source: Davis Ogilvie & Partners).

	Area (m^2)	Cut (m^3)	Fill (m^3)
Phase 1	191,450	371,870	267,180
Phase 2	41,870	72,770	25,480
Phase 3	93,770	155,150	92,020
Phase 4	18,670	420	88,000
Valley Fill Area	29,020	1,320	142,240
Unsuitable disposal area	10,650	0	49,440
Total	**376,980**	**601,830**	**666,720**

Earthworks will be required for the construction of the road extension of Ralphine Way, the creation of subdivision roading, the Kākā Stream realignment, infilling Gullies 7, 12 and 13 and for the creation of the building platforms, in particular filling to raise the ground level for the Arvida retirement village complex on the flood plain area.

The '*Preliminary Earthworks Plan*', prepared by DOP shows the proposed earthworks phasing which includes four general phases of earthworks, a Valley Fill area, an Unsuitable Disposal Area and a future road phase. A detailed description of the proposed earthworks is provided in the *'Earthworks Management Plan',* prepared by DOP.

Phase 1 works comprise the eastern slope, the lower Arvida building platform and realignment of the Kākā Stream. Phases 2 and 3 comprise the western slope area and the future road phase further to the west. Phase 4 comprises the northern reach of the development along the left back of the Kākā Stream.

The earthworks phases are to be supported by the Valley Fill area that has been designated to provide a suitable place for excess suitable fill material and the Unsuitable Disposal Area at the northeastern extent of the site that is nominated to receive unsuitable fill materials.

The surplus fill from the lower valley excavations will be placed as controlled fill in the upper ‘Valley Fill Area’ with provision made for a separate stockpile for topsoil and any fill material that is unsuitable to place as engineered fill.

As detailed design progresses a more accurate cut and fill volume estimate will be developed with an aim to minimise cuts where access grades permit and by beneficial use of remaining surplus fill for landscape enhancement and stability mitigation.

Contaminated soil will be managed in accordance with the Site’s Contaminated Soil Management Plan and Detailed Site Investigation Report, prepared by Envirolink.

2.3. Streamworks

It is proposed to realign the lower reach of the Kākā Stream, moving it to an increased channel length along the western side of the valley floor. This will then allow development of the lower gradient areas of the central and eastern side, as well as providing space for permanent stormwater treatment wetlands to service the permanent development. The realigned channel will tie in with the downstream end of the existing alignment (across land owned by NCC) and discharge to the Maitahi River at the existing location (Dennes Hole). The existing and proposed stream alignments are shown on Figure 1.

Refer to the Kākā Stream Diversion SSESCP for details of the construction methodology for the stream diversion, which will isolate those works from the existing stream until fully stabilised. Once stabilised, the stream flows will be diverted into the new channel, and the old channel isolated and incorporated into the general site earthworks. Prior to the permanent Kākā Stream Diversion being made live, the stream morphology and stabilisation will be signed off by the Project Ecologist.

Minor tributaries of the Kākā Stream will need to be diverted either permanently or temporarily as part of the earthworks design. If streamworks are required, they will be clearly identified in the relevant SSESCP. The SSESCP will detail the extent of stream works required, methodology for diverting the stream and required ESC measures to prevent sediment discharge to the live streams.

Figure 1: Existing and proposed Kākā Stream alignment (Source: Tonkin + Taylor, Geotechnical Assessment Report, Figure 4.1).

3. EXISTING ENVIRONMENT

The following is an overview of the existing topography, freshwater environments, geological settings and geological characteristics of the Project area. A detailed overview of the existing environment and the freshwater ecological characteristics of the receiving environment are detailed in the *Ecological Assessment Report*, prepared by Robertson Environmental and are briefly described below.

The Project area primarily occupies lowland flats and lower hillslopes of the Kākā Valley above the modified flood plains of the Maitahi River to the south. The project impacts the Kākā Stream and its tributaries, which are within the Maitahi River catchment.

A mixture of regenerating native and exotic vegetation occupies the land on the steeper hillslope flanks to the east of Kākā Hill. The Kākā Hill Tributary (Kākā Stream) and its tributaries are the initial receiving environment for runoff from the project area. The Kākā Stream runs into the Maitahi River and ultimately the Nelson Haven.

The Nelson Haven is approximately 3.5km channel length downstream of Dennes Hole.

Dr. Ben Robertson has also provided information regarding the Nelson Haven. It is classified as a shallow intertidal type of estuary with high ecological and human use values. Notwithstanding significant historical reclamation and modification and consequent habitat loss (principally saltmarsh vegetation from its margins), the estuary still supports a variety of important intertidal/subtidal habitats (e.g. saltmarsh, seagrass/macroalgal beds, unvegetated mud/sand flats) and inhabitant biological communities (e.g. macroinvertebrates, fish and birds). The overall ecological vulnerability of Nelson Haven has been assessed as ‘moderate-high’ (Stevens and Robertson 2017) with the main pressure identified as elevated fine sediment (grain size <63 um - mud) from catchment runoff.

Within the Project area, the Kākā Stream flows southward in a predominantly incised channel along the valley floor and floodplain. In its upper catchment, the watercourse follows a permanent, steeper gradient with limited riparian vegetation. The lower reach of the Kākā Stream is flatter and historically meanders through the floodplain before reaching the Maitahi River.

The waterways have been assessed by Robertson Environmental as having limited habitat quality, being subject to degradation from elevated nutrient and sediment inputs associated with surrounding land use, pollution tolerant macroinvertebrate assemblages, a low diversity of fish species and common native fish species, and impaired stream function.

Table 3-1 of NIWA 2017[1] identifies the Kākā Stream as having a catchment area of 267ha, being 3% of the Maitahi River catchment.

The main sources of sediment contributing to the Kākā Stream derived from bank erosion (39%), gorse and broom (36%), pasture (17%), and harvested pine (8%).

Grazed pasture and rank grass vegetation dominate the riparian margins along the stream. Minimal protection from stock access to the stream is currently provided and extensive pugging and animal tracks can be observed. The majority of the stream banks have been contoured recently and lack vegetation cover, while the remaining banks are generally steep, incised, and contain some areas of bare ground. Bank slumping has been observed, indicating a high potential for erosion on both sides, particularly during higher flow events.

The Ecological Assessment Report notes that all streams within the Project area have been modified from their original natural condition, including diversions of the Kākā Stream. In some cases, the active channel has been widened, straightened or deepened. Based on that assessment, the stream sites on the main Kākā Stream were assessed to have moderate ecological value, while the sites on the smaller hillslope tributaries were low.

Table 2: Freshwater ecological features and overall ecological value (Robertson Environmental).

Freshwater habitat/ species assessment	Lower Kākā Hill Tributary (Site A)	Lower Kākā Hill Tributary (KHT1)	Upper Kākā Hill Tributary (Site B)	Unnamed Tribuary on Eastern Hillslope (KHT2)	Unnamed Tribuary on Eastern Hillslope (KHT3)	Unnamed Tribuary on Western Hillslope (KHT4)
Overall value	Moderate	Moderate	Moderate	Low	Low	Low

Two wetlands meeting the definition of the NPS:FM have been identified within the Project area. Both wetlands are dominated by exotic plant species and have been severely degraded due to various factors such as vegetation removal and livestock grazing. Their ecological value is

[1] CSSI-based sediment source tracking study for the Maitai River, Nelson; NIWA, June 2017.

considered to be moderate. The Project proposes to protect, restore and enhance the ecological values of these identified wetland features.

Automated turbidity monitoring

In July 2023 a fully automated and telemetered turbidity sensor and rain gauge were installed in the Kākā Stream. The location is shown in Figure 2. The purpose of the monitoring equipment was to obtain a continuous, long-term record of fluctuations in turbidity in response to rainfall.

The data has shown that during periods of minimal to no rainfall the Kākā Stream records a turbidity generally less than 20-30 NTU. An example is shown in Figure 3.

During rain events (>10mm in 24hrs) the turbidity of the stream increases. Two examples of rain events have been provided which consider how the turbidity reacts to rainfall.

Figure 2: Approximate location of Kākā Stream rainfall and automated turbidity monitoring station.

Photo 1: Automated monitoring station - Kākā Stream.

Photo 2: Turbidity sensor installed in the Kākā Stream.

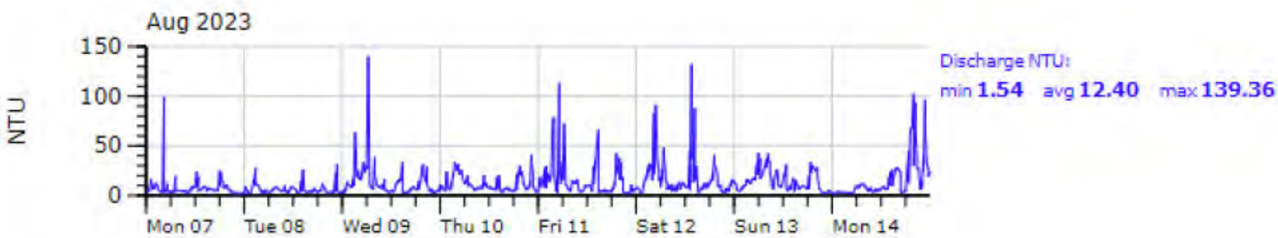

Figure 3: Turbidity recorded during a period of minimal rainfall.

Example 1

Rain event recorded from the 11th of April to 14th of April 2024. The event recorded a maximum 24hr rainfall rate of 97mm and a maximum 1-hour intensity of 17.6mm (Figure 4)

During the heavy rainfall period reported in Figure 6, the average turbidity was 338.76 NTU and the maximum turbidity reached was 1576.80 NTU. Soon after the rain event the turbidity fell back down to below 30 NTU.

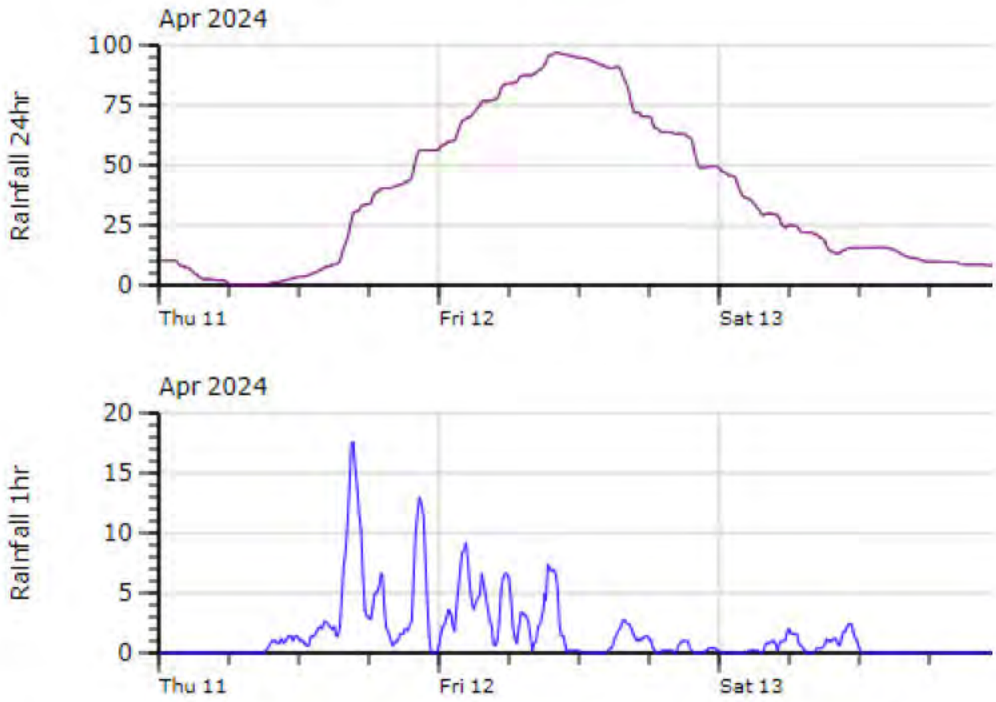

Figure 4: Rainfall recorded from 11 April to 14 April 2024. The maximum 24-hour rainfall rate was 97mm and the maximum 1-hour rainfall intensity was 17.6mm.

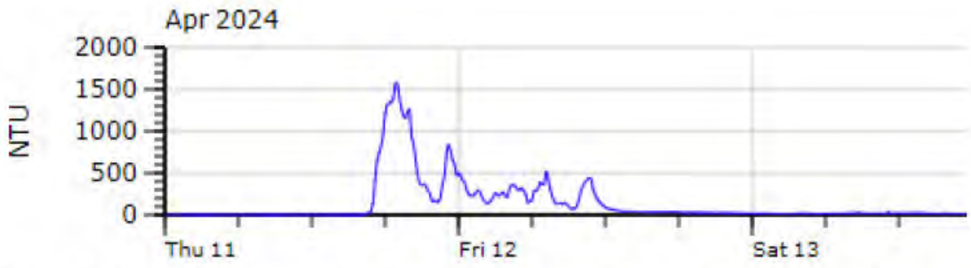

Figure 5: Turbidity recorded in the Kaka Stream during the rain event from 11 April to 13 April 2024.

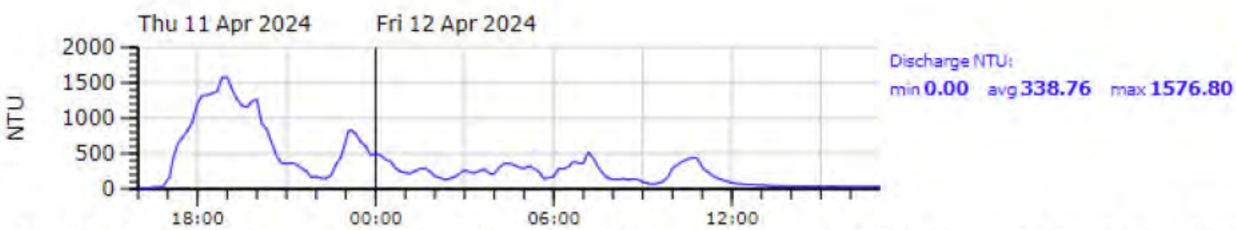

Figure 6: Turbidity recorded in the Kaka Stream during the heavy rainfall period 11 April from 16:00 to 12 April 17:00.

Example 2

Rain event recorded from the 22nd of June to the 24th of June 2024. The event recorded a maximum 24hr rainfall rate of 38.6mm and a maximum 1-hour intensity of 6.0mm (Figure 7)

During the heavy rainfall period reported in Figure 9, the average turbidity was 81.61 NTU and the maximum turbidity reached was 481.92 NTU. Soon after the rain event the turbidity fell back down to below 30 NTU.

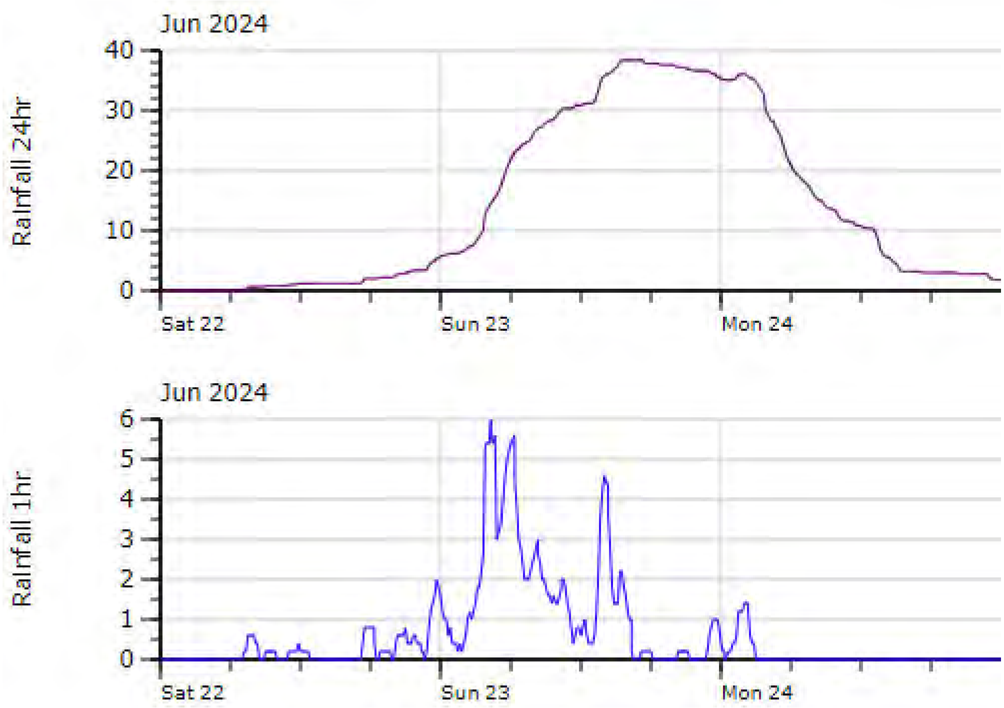

Figure 7: Rainfall recorded from 22 June to 25 June 2024. The maximum 24-hour rainfall rate was 38.6mm and the maximum 1-hour rainfall intensity was 6.0mm.

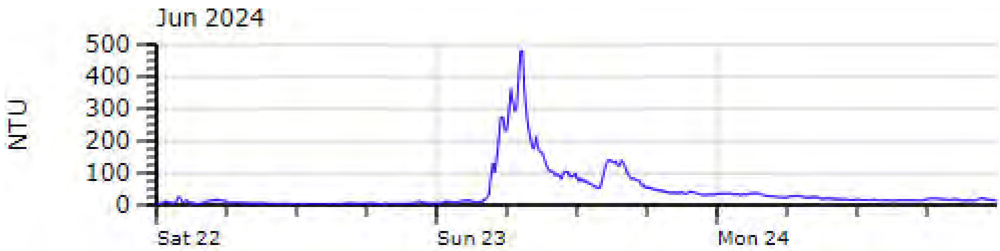

Figure 8 Turbidity recorded in the Kaka Stream during the rain event from 22 June to 24 June 2024.

Figure 9: Turbidity recorded in the Kaka Stream during the heavy rainfall period 23 June from 00:00 to 23 June 06:00.

3.1. Geology and Soils

The Geotechnical Assessment Report, prepared by Tonkin + Taylor describes the underlying geology as:

> *"The New Zealand Geological survey, Dun Mountain 1:50,000 scale geology map[2] shows five basement rock types Botanical Hill Formation, Wakapuaka Phyollonite, Grampian Formation and Kākā Formation predominate across the site. Excluding the Wakapuaka Phyollonite, these basement rocks are principally strong to very strong breccia, tuff and tuffaceous sandstone. However, Kākā Formation is noticeably stronger. The weaker nature of the Wakapuaka Phyollonite has led to more subdued topography and more evidence of ancient slope instability.*
>
> *In addition, geologically young river alluvium and fan gravels are mapped within the Kākā Valley floor."*

The engineering geological model is based on the seven areas as described in Section 1.1. Section 3.1 of the Geotechnical Assessment Report provides a description of the subsurface conditions for each area. Typical descriptions include cobbles, gravels, silts, silty gravels, clayey silts and sand.

4. EROSION AND SEDIMENT CONTROL PRINCIPLES

The ESC design approach is illustrated in Figure 10. This ESCAR provides the overarching principles of the ESC implementation, and the various procedures that will be implemented, including ESC Monitoring Plan and confirmation of the appropriate minimum ESC design standard. The ESCAR is developed in conjunction with other technical assessments and statutory provisions and informs the consenting process and the preparation of consent conditions. The consent conditions in conjunction with the relevant design standards inform the development of the SSESCPs.

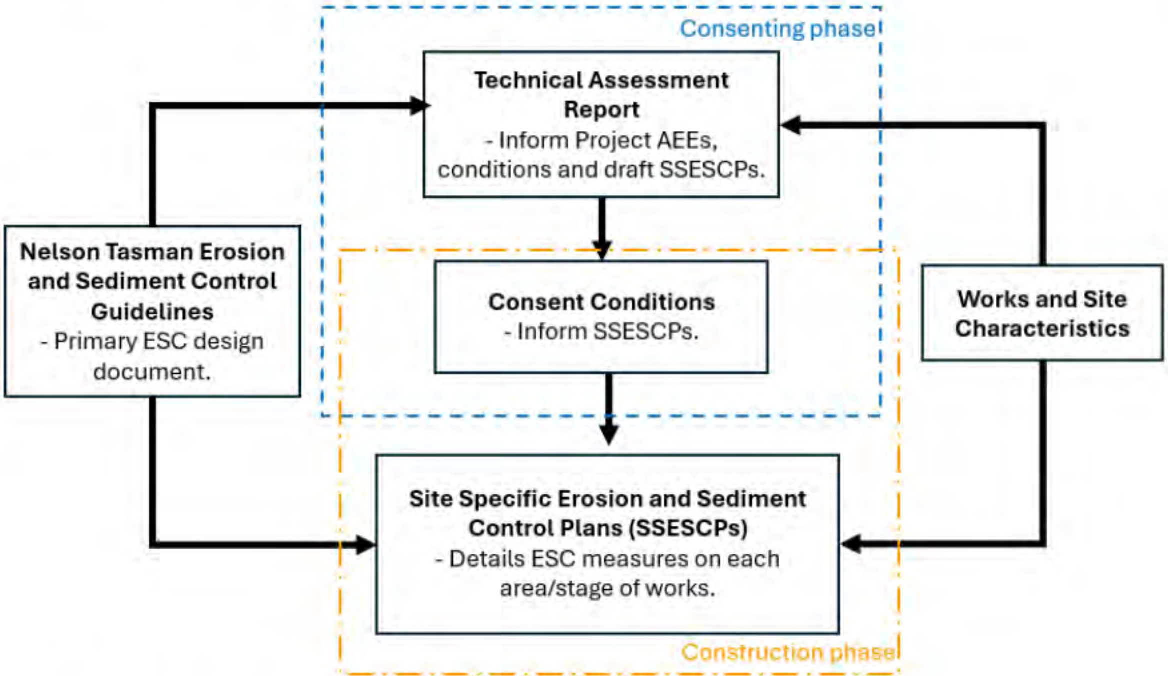

Figure 10: Erosion and sediment control design process.

4.1. Design Standard

The principles of the Nelson/Tasman *Erosion and Sediment Control Guidelines,* July 2019 (NTESCG) have been adopted for the design, construction, maintenance, and decommissioning of ESC measures.

If deviations from the standards detailed in the guidelines are required, the alternative approach will be detailed in the corresponding SSESCPs and will be designed to achieve the same or better outcome than a NTESCG compliant approach.

4.2. Construction Water Management Objectives and Principles

Management of construction water will seek to achieve the following objectives:

- Minimise the potential for sediment generation and sediment yield by maximising the effectiveness of ESC measures; and
- Take all reasonable steps to avoid or minimise potential adverse effects on freshwater environments within or beyond the Project works boundary, with particular regard to reducing opportunities for sediment generation and discharge.

The following principles will apply and will be reflected in the SSESCPs prior to construction activities commencing:

1. Emphasis will be given to the importance of erosion control at all sites to minimise the risk of sediment discharge. This will be achieved with structural (physical measures) and non-structural (methodologies and construction staging) erosion control measures.
2. Sediment control will be utilised to treat sediment-laden runoff from all exposed earthworks areas.
3. Earthworks and construction water management measures will be confirmed in the SSESCPs which will allow for flexibility and practicality of approach to ESC and allow the ability to adapt appropriately to specific site conditions.
4. Progressive and rapid stabilisation, both temporary and permanent, of disturbed areas using mulch, aggregate and geotextiles will be on-going during the earthworks phase. Temporary stabilisation will apply particularly with respect to stockpiles, ground improvement locations where topsoil is removed, concentrated flow paths and batter establishment. Stabilisation is designed for both erosion control and dust minimisation.
5. Streamworks and works in the vicinity of streams will be undertaken in a manner that recognises the higher risk of this activity from a sediment generation and discharge perspective, and the sensitivity of the receiving environments. Works within active stream channels will be undertaken in a “dry” environment by working off-line or diverting upstream flows.
6. Comprehensive site monitoring and management will allow for continuous improvement in response to monitoring outcomes on an ongoing basis. Monitoring will include visual inspection of the construction water management devices and the downstream environment.

4.3. Design of Erosion and Sediment Control Devices

4.3.1. Erosion Control - Construction Staging and Sequencing

The extent of exposed soil and length of time an area is exposed for directly influences the sediment yield from a particular area. Earthworks and construction activities will be staged and sequenced in order to minimise open areas at any given time to the greatest extent practicable. Open earthworks areas will be progressively stabilised to reduce the potential for erosion to occur.

The staging proposed is based on a variety of factors, including the earthworks and engineering design, location of cut and fill areas, economic and subdivision agreements, and pre, during, and post sediment load predictions completed as part of the USLE assessment (refer to Section 7.2).

The SSESCPs and USLE calculations have been developed in accordance with the following staged assumptions described below. Within each of the four main stages enabling works and progressive stabilisation will be undertaken reducing the exposed earth worked areas at any given time.

Table 3: Proposed Earthworks Staging

ESC Stage	Season	DO Earthworks Phase	Area (ha)	Approx. time	Notes
Stage 1A	1	1A	2.7	4 months	Early start / enabling works required. Staged stabilisation.
Stage 1B	1	1A	2.9a	4 months	Stage 1B expected to commence approximately ½ way through Stage 1A.
Stage 1C	1	1A, 1B, 1C	8.8	6 months	Stage 1C expected to commence approximately ½ way through Stage 1B. Stage 1A will be complete.
Unsuitable Borrow site	1		0.75	6 months	Staged and required for initial stripping of each area.
Valley Fill Site					Not expected that it will be required for Stage 1.
Stream diversion cut / construction	1		0.3	3 months	Staged offline construction of the new Kaka stream alignment.
Stage 2	2	4	1.88	6 months	Stage 2 and Stage 3 to be undertaken concurrently.
Unsuitable Borrow site	2		0.75	6 months	Staged and required for initial stripping of each area.
Valley Fill Site	2		2.23	6 months	Staged and required for Stage 2.
Stage 3	2	2	4.5	6 months	Stage 2 and Stage 3 to be undertaken concurrently.
Stage 4	3	3A, 3B	6.8	7 months	Enabling works stage to complete Kaka 5A and 5B permanent stream. Initial bulk earthworks occurring at the same time. Remaining earthworks following completion of steam works. Some areas within the SRP catchments to remain untouched (no earthworks).
Unsuitable Borrow site	3		0.75	6 months	Staged and required for initial stripping of each area.
Valley Fill Site	3		1.5	13 months	Staged and required for Stage 3 and Stage 4.

The USLE sediment yield estimations have been assessed by the Project Ecologists. As a result, the Project team consider that the phasing and staging proposed are acceptable when considering the effect on the receiving environment

4.3.2. Erosion Control - Dirty Water Control

Dirty water diversions (DWDs) are diversion channels or bunds that will be used to divert dirty (construction) water runoff from the earthwork areas to the appropriate sediment control measures. The largest dirty water catchment area will be 5ha.

The peak flow from a 5ha catchment area is 0.34194 m^3/s. Figure 11: Dirty water diversion sizing details. below shows the calculations and sizing details.

In general, a minimum channel depth and/or bund height of 500mm will be constructed across the project for catchment areas up to 5ha. This includes an additional 10% freeboard.

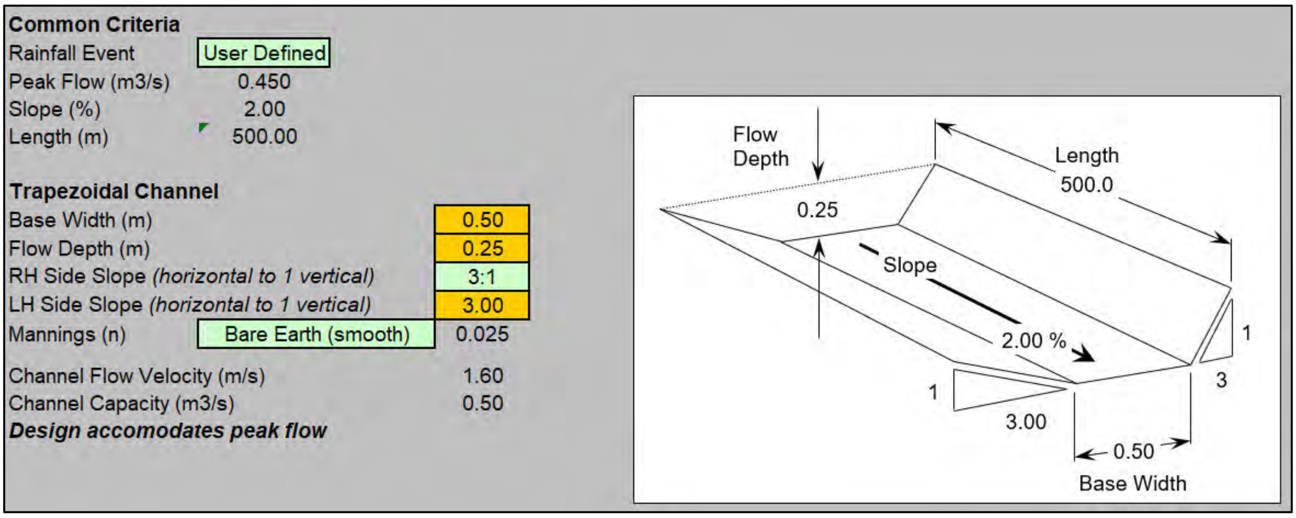

Figure 11: Dirty water diversion sizing details.

Where grades exceed 2%, additional erosion protection such as geotextile or rock check dams will be used to reduce erosion.

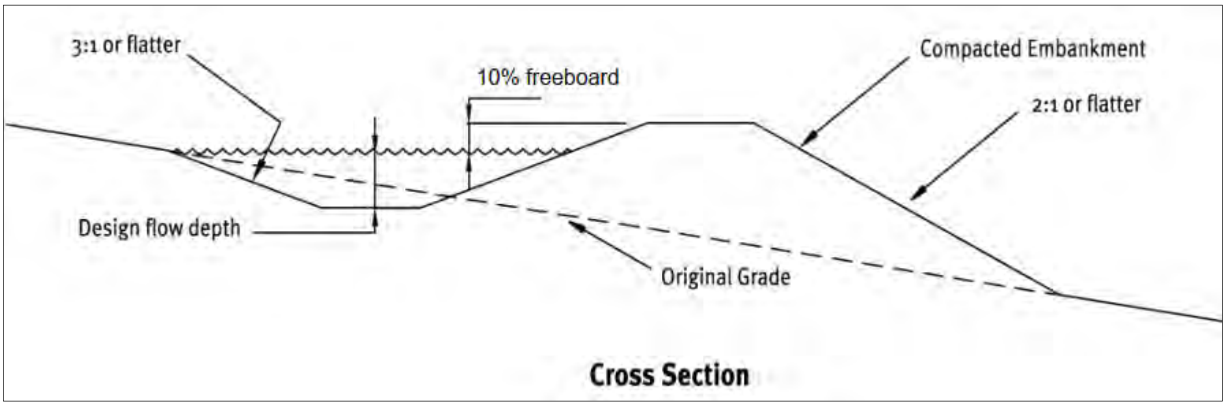

Figure 12: Cross-section of a dirty water diversion.

The location of DWDs will be detailed in the respective SSESCPs.

4.3.3. Erosion Control - Clean Water Control

Clean water diversions (CWDs) are diversion channels or bunds which divert clean water runoff away from and around the earthwork areas. Permanent and temporary CWDs will be used on the Project to prevent runoff from the undisturbed catchment above the works from entering the construction area to ensure the works are sufficiently protected from flows from the natural catchment outside of the work area.

The longitudinal grades of the clean water diversions will be, where practicable, less than 2%. All clean water diversions will be stabilised against erosion for example with grass, geotextile, aggregate, and/or rock.

The SSESCPs will state how each CWD will be constructed. Where a permanent CWD has been designed by Tonkin + Taylor, the diversion will be sized for the 1% AEP, plus a freeboard of 300mm. This exceeds the sizing requirement in the NTESCG.

For smaller clean water diversions with a catchment area up to 5ha, the following sizing details will be utilised.

The peak flow from a clean water catchment area of up to 5ha has a peak flow of approximately 0.17097 m^3/s. A C-factor of 0.3 has been used as the runoff coefficient for medium soakage soils with pasture and grass cover. Large portions of the clean water catchment areas are typically having bush and scrub cover.

Q =	0.17097	
C =	0.3	Med. Soakage pasture & grass cover
i =	41	1hr 20yr rainfall intensity
A =	5	Max. catchment area.

Figure 13: Peak flow discharge for clean water catchments of 5ha.

Common Criteria		
Rainfall Event	User Defined	
Peak Flow	0.171	
Slope (%)	2.00	
Length (m)	50.00	
Trapezoidal Channel		
Base Width (m)		0.30
Flow Depth (m)		0.25
RH Side Slope *(horizontal to 1 vertical)*		3:1
LH Side Slope *(horizontal to 1 vertical)*		3.00
Mannings (n)	Grassed	0.035
Channel Flow Velocity (m/s)		1.09
Channel Capacity (m3/s)		0.29
Design accomodates peak flow		
Clean water diversions are required to be stabilised		

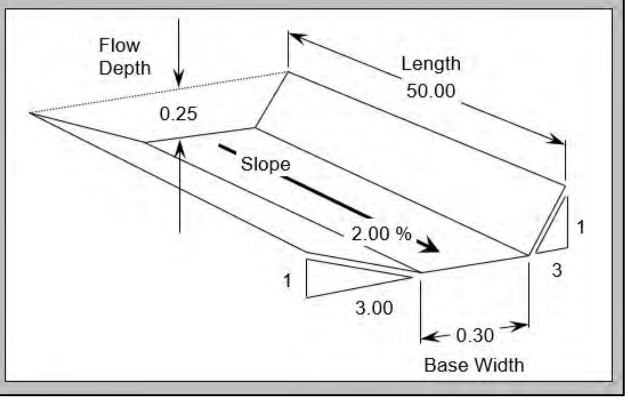

Figure 14: Clean water diversion sizing details for catchments up to 5ha.

In general, a minimum clean water channel depth and/or bund height of 500mm will be constructed across the project for catchment areas up to 5ha. This includes an additional 10% freeboard.

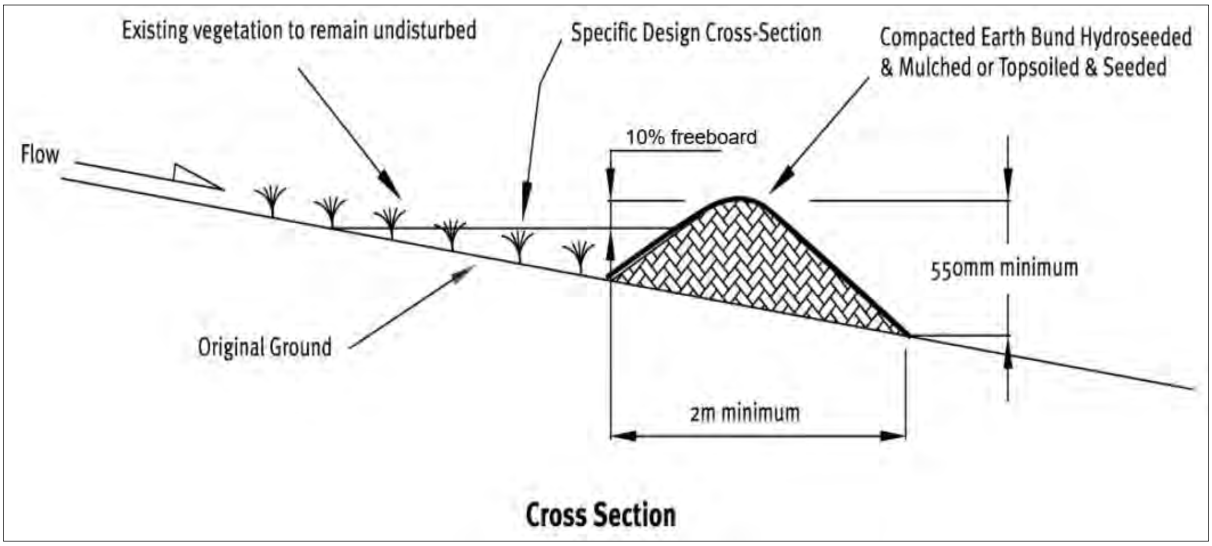

Figure 15: Cross-section of a clean water diversion.

The details of the temporary and permanent CWDs (including stream re-alignments) are described in the respective SSESCPs.

4.3.4. Sediment Control – Sediment Retention Ponds

Sediment retention ponds (SRPs) are impoundment devices that provide time for suspended solids to settle out before the runoff is discharged to the receiving environment. The key design criteria for all SRPs that are to be utilised across the Project are set out below.

- SRPs are sized in accordance with the Nelson/Tasman ESC guidelines. Details of the sizing of each SRP is provided as part of the SSESCPs. The SRPs will be constructed with an ideal length to width ratio of 3:1 but not exceeding 5:1. The Nelson/Tasman ESC guidelines recommended maximum contributing catchment of 5ha is acknowledged and adopted.
- Spillways formed to safely convey the 1% annual exceedance probability (AEP) rain event.
- T-bar floating decants with a mechanism to control outflow such as a manual decant pulley system or screw on end cap.
- Chemical treatment in accordance with the Chemical Treatment Management Plan (ChemTMP).

4.3.5. Decanting Earth Bunds

Decanting earth bunds (DEBs) will be utilised to treat sediment laden runoff from areas of up to 3,000m^2. The DEB volumes will be sized in accordance with the Nelson/Tasman ESC guidelines.

DEBs will be chemically treated in accordance with the ChemTMP.

4.3.6. Silt Fences and Super Silt Fences

Silt fences and super silt fences will be used to treat sediment-laden runoff from small areas that cannot be diverted to an alternative device.

4.3.7. Chemical Treatment

To maximise their efficiency, chemical flocculant will be added to the inflow of all SRPs and DEBs using a rainfall activated or flow activated system. A Chemical Analysis Reactivity Test (CART) report has been provided with the ChemTMP in Appendix A. Bench testing has been completed on three soils samples from the site. Results indicate that treating with polyaluminium chloride

(PAC) enhances the sediment removal efficiency, increases water clarity and decreases turbidity over the control tests to an extent that justifies the implementation of chemical treatment.

Chemical selection and the recommended dose rate are based on the bench testing of soils and is discussed further in the ChemTMP and CART. The set-up for each device will be provided with the as-built documents and will include details of the chemical type and dosing rate.

4.3.8. Dewatering and Pumping

Wherever possible, gravity flow into the various sediment retention devices will be used in preference to pumping. However, it may not always be possible to achieve gravity flow to sediment control devices during construction. Floating decants incorporated in the design of each sediment retention pond will be fitted with a mechanism to control outflow, such as a manual decant pulley system, which will enable the decants to be raised during pumping activities to these structures or the ability to close the device outlet pipe for example a shut off valve or bung.

During pumping the decants will only be lowered once an acceptable standard of discharge quality, assessed as not less than 100mm visual clarity, has been achieved.

The pumping rates and volumes to SRPs will be controlled so that the total pump volume can be fully captured within the retention structure.

4.3.9. Dust Control

The key potential environmental aspects and impacts relating to dust generation area:

Aspects	Impacts
Dust generation from earthworks, material movement, vehicle movements and bare soil particularly during dry, windy weather conditions.	Nuisance to site workers and residents from airborne dust and dust on local roads. Deposition of dust to surrounding terrestrial and aquatic habitats, contributing to sediment loads.

The Project team will apply a proactive approach to dust management.

To minimise potential dust nuisance:

- Earthworks will be staged (as far as practicable) so as to minimise the length of time that areas are exposed to drying;
- The route and speed of vehicles working on the site will be controlled appropriately; and
- Surface layers of exposed soil will be dampened (with water) to minimise dust generation.
- If the above proves to be inadequate (due to high winds etc) works will be ceased until conditions are favourable.
- For activities with a potential to generate dust relevant work methods will establish the controls to be applied. During the development of work methods, the following issues will be considered, although the main controls will be stabilisation and watercarts.

<u>Weather monitoring</u>

The Project Manager will obtain daily forecasts and circulate to key site staff and other appropriate Project staff. Dust control measures will be prepared if dry, windy conditions are forecast.

Bare Areas

The amount of bare area will be limited through the proposed staging and progressive stabilisation of work areas.

Provisions will be made for the damping or wetting of bare areas where required.

As far as practicable vehicle movements will be restricted to operational requirements within bare areas.

Progressive revegetation of the site will be undertaken after each portion of the works is deemed to be complete and no further disturbance of that area will be required for the duration of the works.

Material Movement, Delivery and Storage

Effective controls will be implemented during the delivery, storage and handling of all raw sand, aggregate and similar materials, to mitigate dust, if required. Controls could include wind fences, sprinkler systems, vegetation strips etc.

All stockpiles not being actively worked will be stabilised (e.g. hay mulched).

Hydrocarbons, such as hydraulic oils, shall not be used as a method of controlling dust.

Dust suppression chemicals may only be used when approved by the Nelson City Council prior to use.

Vehicle Movement

Where practicable, site access roads will be constructed of a material that will minimise dust/mud generation;

Vehicle speeds will be managed and restricted when required in order to minimise dust. Vehicle speed limits will be managed on site by the Project Manager in accordance with the Site's Health and Safety Plan and will give consideration to the weather conditions. For example, when the site is dry and dusty, vehicle speeds will be reduced.

Vehicles that have used unsealed areas of the site shall be subject to wheel washing prior to exiting the site onto a public road;

Detergents will not be used in wheel washes, unless there is a closed loop wash water recycling system in place;

A hard surface road shall be provided between any washing facilities and the public road.

Water Sources

Reticulated water supply.

Water retained in the sediment retention ponds can be pumped into water carts and used for dust suppressant, as required.

Dust Monitoring

Monitoring of dust effects will be the responsibility of all staff and plant operators onsite. Overall responsibility will lie with the Construction Manager as part of his environmental management systems.

Monitoring of dust effects will be undertaken continuously, as site conditions can change through the day.

Dust monitoring will predominantly rely on visual observation. Indicators of potential dust problems include:

- Dust particles rising higher than 0.5m above ground surface level in still wind conditions due to movement of machinery;
- Dust being picked up off the ground surface by wind without disturbance from moving machinery, particularly if wind direction is towards neighbouring properties.
- Frequent neighbour liaison shall also be an important part of the monitoring of dust effects. If dust discharges have occurred, there is potential for neighbours to sustain negative effects.

Daily site diaries will be maintained by construction supervisors. The diaries shall record the following as a minimum:

- Date;
- Wind strength: Nil, Light, Medium, Strong, Very Strong;
- Wind direction;
- Ground conditions in the area being worked: Wet, Damp, Optimum, Dry, Very Dry;
- Any areas where dust is being generated;
- Machinery and plant used to control dust and effectiveness of this;
- The frequency of watercart use and the volume of water applied;
- The volume of water used for dust suppression other than watercart usage;
- Whether dust is being discharged beyond the designation boundary to other properties;
- Any complaints received and the nature of the complaints.

Any complaints received will be investigated immediately and responded appropriately. All complaints will be recorded in the site diaries, along with details of subsequent action taken.

Upon receipt of any complaint the Project Manager will promptly investigate the complaint, and where appropriate remedy or mitigate the cause of the complaint and inform NCC as soon as practicable, detailing the nature of the complaint and the action taken.

4.3.10. Streamworks

The lower reach of the Kākā Stream that currently flows through the lowland floodplain will be diverted to the west to a new permanent and enhanced channel and corridor. The realignment includes widening and deepening followed by protection, restoration and enhancement of the Kākā Stream and several existing stream reaches within the property boundary.

The realigned stream reach will be approximately 900m^2 superseding approximately 630m^2 of the existing alignment. The ecological impact on the relevant ecological receptors is described in the Robertson Environmental Ecological Assessment Report.

The new stream reach will be constructed in stages, offline, so that the works are separated from the existing alignment. Once the new reach is completed and stabilised, the upstream section will be diverted into the new channel. After that, the previous channel that is now isolated from the new alignment will be incorporated into the general earthworks activities. Refer to the Stage 1 SSESCP for further information.

An additional 300 m of intermittent stream will be reclaimed along the entire length of the Unnamed Tributary on Eastern Hillslope (KHT2) stream. The ESC measures for the works are detailed in the corresponding SSESCP.

Other minor channel, overland flow path works, and temporary culverts will be required that will also adopt the off-line methodology. These aspects will be detailed in the relevant SSESCPs.

5. EROSION AND SEDIMENT CONTROL IMPLEMENTATION

5.1. Site Specific Erosion and Sediment Control Plans

The SSESCPs address the following information for each specific stage or work area:

i. the specific construction activity to be undertaken;

ii. the area of earthworks, and/or the nature of the stream works at specific locations, and identification of the downstream receiving environment;

iii. the locations of all earthworks and/or stream works;

iv. methods for managing construction water effects for specific activities;

v. the duration of the earthworks and/or stream works;

vi. the time of the year that the stream works are to be undertaken, and where applicable, the measures to be implemented to respond to any heightened weather risks at that time;

vii. stabilisation methods and timing to reduce the open area at key locations to assist with a reduction in sediment generation; and

viii. chemical treatment (flocculation) at SRPs and DEBs.

SSESCPs are provided as Appendix C. Each SSESCP will be finalised and submitted to NCC for certification prior to any earthworks occurring. Any deviation from NTESCG will be explained in the corresponding SSESCP.

5.2. Pre-construction Site Meeting

Pre-construction site meeting will be held between Project personnel (Project Manager, Contractor with Environmental support by an Environmental Advisor as required) and NCC staff before works commence on site or re-commence in each earthworks season.

5.3. Construction of ESCs - Supervisions

The construction of the controls will be overseen by the Project Manager with Environmental support by an Environmental Advisor/ESC Specialist.

Hold points for construction will be established for each control whereby the Project Manager (or Environmental Advisor ESC Specialist) will inspect the work completed, for example the installation of anti-seep collars or the installation of primary outlet.

5.4. As-built Certification

As-built certification of devices is a critical element of effective site management. As-built checklists and/or drawings will be prepared for all controls to ensure that they have been installed as designed. Works within the catchment of an ESC device will not commence until the as-built document for the device (or devices) has been certified by a suitably experienced and qualified ESC practitioner.

5.5. Monitoring and Maintenance

Refer to Section 6.

5.6. Decommissioning

Erosion and sediment controls will only be decommissioned when contributing catchment is stabilised.

6. MONITORING AND RESPONSES

6.1. ESC Monitoring

This ESCAR is based on a key focus on erosion control, maximising the use of chemically treated SRPs as the most efficient sediment control measures, and combination of other minor sediment controls and a staged construction methodology. The SRP efficiencies have been assumed as average, to vary throughout various rainfall events. This assessment does not assume or propose a specific discharge limit.

Monitoring of the ESC measures will be undertaken in accordance with the appended Erosion and Sediment Control Monitoring Plan (ESCMP) provided in Appendix B. The objective of this monitoring is to understand the performance of the Project's erosion and sediment control measures through a range of larger (but still relatively frequent) storm events, using clarity as a proxy for SRP performance and an overall ESC performance indicator.

The ESCMP provides a programme and methodology to ensure that ESC measures have been designed, installed, and managed in accordance with the ESC management structure described above, and to monitor the effectiveness of ESC for the duration of the construction phases of the Project.

Environmental compliance and performance will be achieved through appropriate location, design, installation, as-built certification, maintenance, and monitoring of ESC measures. ESC management in this context is not restricted to physical structures but also includes work practices and methodologies.

Regular monitoring will be undertaken by the Project Manager, or Environmental Advisor / ESC Specialist to ensure ESC measures are operating as designed and are maintained in accordance with the ESC guidelines and consent conditions. This monitoring underpins the successful implementation of the ESC management system, to achieve the anticipated environmental outcomes and ensure compliance with the resource consent conditions. This monitoring includes pre and post rainfall checks and maintenance and is considered "business as usual".

The monitoring will also provide continual feedback to ensure successful ESC performance and early detection of activities or problems that have the potential to result in an adverse environmental effect.

The frequency of the monitoring will vary throughout each construction phase and reflect areas of changing activity and risk within the Project. During active construction in a given area, the monitoring will be undertaken daily as well and pre and post rainfall events. Monitoring will report any repairs or issues that need to be addressed and the timeframe for completion of those actions.

The regular monitoring will be supported by monitoring of the chemical treatment systems, weather, rainfall events, and will include wet weather responses and contingencies.

6.2. Performance Targets

The ESC design seeks to meet the following targets listed below.

- Clarity of 100mm.
- pH between 5.5 and 8.5.

The parameters would be measured by manual measurement in response to a rainfall trigger event of 25mm / 24 hours. That event is of a size that begins to place stress on the SRP i.e. it is ‘working hard’.

These targets should not be adopted as compliance standards as doing so would be inconsistent with the function of NTESCG compliant devices and would be unnecessary to achieve overall acceptable water quality performance.

The assumed efficiency of SRPs is based on measured[2] average performance throughout storms and across a range of storms. The actual performance at any given stage of a storm varies in response to a range of factors, including:

- Intensity and duration of the rainfall event. Small events may not cause a discharge. Conversely, as larger events engage multiple decants, primary and sometimes secondary spillways, runoff residence time in the pond reduces. As a result, the sediment retention efficiency reduces with the rising limb of the event and then increases again through the falling limb as the inflow rate to the pond increases. For the larger rain events, the corresponding pond efficiency progressively decreases and then increases with the rising and falling limbs of the storm hydrograph.
- Antecedent soil condition i.e. drier soils generally absorb more rain such that less enters the pond, as well as causing a longer lag period before runoff reaches a pond.
- Surface roughness i.e. generally runoff flowing across rough surfaces generates less sediment than that across smooth surfaces.
- Period between rainfall events i.e. the extent that the live storage has drained down before the event. Summer conditions also provide evaporative reduction in dead storage levels.
- Pond maintenance and available capacity i.e. the level of sediment accumulation within the pond.
- Gradient and length of contributing slopes i.e. steeper and longer slopes have greater erosion potential.
- Erosion control practices i.e. less sediment entering the pond means less discharging from the pond for a given efficiency.

As a result, a compliance trigger such as 100mm clarity is appropriate as a response trigger but is not suitable as compliance limit.

This approach is well accepted and adopted within the Auckland region and has also been accepted and adopted by the Environment Court and Horizons Regional Council in the consenting of the Te Ahu a Turanga; Manawatū Tararua Highway Project.

7. ASSESSMENT OF EFFECTS

This ESCAR follows an overall Best Management Practice (BMP) approach to the earthworks activities which combines the minimum design standard with appropriate staging and other controls, based on the characteristics of the individual component areas.

[2] *Performance of a Sediment Retention Pond Receiving Chemical Treatment*; Auckland Regional Council, July 2008
On-site monitoring at Ara Tūhono - Pūhoi to Wellsford Road of National Significance: Pūhoi to Warkworth Section
On-site monitoring at Milldale Stages 2 – 4, Wainui.

The following sections discuss the potential impacts of the Project work from sediment related discharges from construction water.

7.1. Erosion and Sediment Control Processes

Erosion occurs when the surface of the land is worn away (eroded) by the action of water, wind, ice, or geological processes. Through the erosion process, soil particles are dislodged, generally by rainfall and surface water flow. As rain falls, water droplets concentrate and form small flows. As this flow moves down a slope, the combined energy of the rain droplets and the concentration of flows has the potential to dislodge soil particles from the surface of the land. The amount of sediment generated through erosion depends on the erodibility of the soil, the energy created by the intensity of the rain event, the site conditions (for example, the slope and the slope length) and the area of bare earth or unstabilised ground open to rainfall (referred to as "open" areas).

Sedimentation occurs when these soil particles are deposited. This occurs when runoff velocities become low enough for sediments to fall out of suspension. With the exception of filter socks and filter bags, sediment retention devices act as low velocity depositional environments by impounding water long enough for sediments to fall out of suspension.

Erosion control is based on the practical prevention of dislodging and mobilising sediment in the first instance. If erosion control measures and practices are effective, then sediment generation will be minimised and the primary reliance on the sediment control measures is reduced, and the overall efficiency of the ESC management system is maximised.

Sediment control refers to management of the sediment after it has been generated. It is inevitable that sediment will be generated through land disturbance activities even with industry best practice erosion control measures in place. Sediment control measures are designed to capture this sediment to minimise any resultant sediment-laden discharges to waterways. No sediment control measures are 100% efficient i.e. there is always a residual discharge of treated sediment-laden water. Hence, erosion control is critical to minimise the amount of sediment generated that needs to be captured and retained within the sediment controls. Reducing the sediment load reaching the sediment controls also allows them to service more rain events between cleanouts and reduces maintenance cost.

The overall effectiveness of the ESC management measures will have a direct effect on the sediment yield that discharges from the site and into the receiving environment.

7.2. Estimate of Sediment Yield

7.2.1. Predicted and Actual Sediment Yield and ESC Performance

The Universal Soil Loss Equation (USLE) is the most common tool used in New Zealand for estimating sediment yields for earthworks projects and is adopted for this Maitaihi development assessment. The overall estimate of the yield is indicative of the magnitude of sediment likely to be discharged, the range of assumption required in the USLE calculation means that it should not be relied on as an accurate assessment of the actual total yield.

The USLE is used to support the preparation of ESCPs, identify higher risk areas and variation in potential sediment generation within a site, and also provide an indication of overall sediment yield.

The estimate of sediment yield generated by the Universal Soil Loss Equation (USLE) takes account of the following variables:

- Slope length and gradient
- Soil type
- Rainfall

- Surface cover
- Surface roughness
- Earthworks area
- Time of exposure

The USLE has been adopted extensively on projects throughout the Auckland Region since about 1998, and on other projects throughout the country in more recent years. This has provided a sound understanding of its application and applicability to various environments. The adoption of the USLE in the project design and then project delivery stages of the Puhoi to Warkworth (P2W) extension of the Auckland northern motorway give a good level of confidence in the likely sediment yields, compared with those predicted.

During that project, the project team undertook an analysis of trends in SRP performance from an extensive monitoring programme. The project analysed the monitoring data by comparison with previous periods, different ponds and with the original estimated sediment yield calculation for each stage of works (as extrapolated from the yield predicted in the CWAR for the relevant focus areas). A summary of the results is given in Table 4 below, which shows that the measured sediment yields for specific storms was significantly lower than that predicted.

Table 4: Sediment yield ranges P2WK.

Catchment	Lowest range measured (t/ha/yr)	Highest range measured (t/ha/yr)	Predicted (t/ha/yr)
Mahurangi flat country	0.41	6.18	22.9
Mahurangi hill country	2.99	16.9	49.1
Puhoi hill country	1.05	17.61	49.1

7.2.2. Estimate of Sediment Yield for the Project

USLE estimates of sediment yield have been undertaken for each stage of earthworks that have been designed to date. The USLE calculations have been undertaken for the predevelopment (existing) landform and surface condition, during periods of exposed earthworks, and then a stabilisation period to provide a comparative figure for a 12-month period.

An assessment of the pre-development greater Kaka Stream catchment has also been undertaken to provide context and to allow the sediment yield estimates for the construction period to be compared with that of the existing land use at a catchment scale.

To the greatest extent practicable, runoff from earthworks areas will be treated by chemically treated SRPs, which are the most efficient sediment retention device. Areas of restricted space or small isolated catchment areas that cannot be directed to a SRP will be treated by an alternative device such as a DEB or silt fence.

7.2.3. USLE assumptions

The USLE values reported above include the following assumptions:

(a) Soil composition based on geotechnical investigations[3].

- 15% clay, 15% silt, and 70% sand within the upper 700mm of the soil profile. Below that lies sands and gravels to up to 2m depth.

(b) Estimated as an average soil composition that will be exposed. The use of contour drains to break up flow lengths has been assumed, but at a spacing that is greater than that

[3] Soil composition characteristics, based on Sandy Loam soil type (Table 13-10 Nelson/ Tasman Erosion and Sediment Control Guidelines – June 2019. Sandy Loam soil type confirmed by Mark Foley of Tonkin & Taylor.

recommended in the NTESCG. This means the effectiveness of the contour drains assumed in the USLE calculation is less that what will be achieved in practice on site when using compliant spacings (or better). On that basis the assumption used in the USLE is conservative.

(c) Assumed 95% average treatment efficiency for chemically treated SRPs[4]. This value has been generally accepted for NZTA and other earthworks projects throughout New Zealand and is supported by real-time automated monitoring of ponds within various projects[5]. Its use is also justified by the composition of site soils and as detailed in the CART, where bench testing of soils has shown a good response to chemical treatment.

The USLE calculations have been separated into four stages listed earlier in the report and separate calculations for the Valley Excess Fill area and the Unsuitable Fill area.

Within Stage 1 and Stage 4, the works will be further staged, as enabling works are required to the main earthworks across the stages.

The USLE calculations provide an indication of sediment yield from the individual areas and the effect on the Kaka Stream Catchment.

7.2.4. Kākā Stream pre-development USLE assumptions

The land use in the Kaka Stream Catchment is described in Section 3.4.1 and in Table 3.1 of the T&T Stormwater Assessment report[6] as:

> *The existing (pre-developed) catchment land use in the Kākā catchment is typical of a rural catchment, with portions of pastoral land, scrub and a small area of exotic forest. A breakdown of this land use, based on Landcare Research's New Zealand Land Cover Database (version 5.0, last updated Nov 2021), site investigations (shown in Appendix A) and the latest 2024 aerials from Google is shown in Table 3.1: Pre-development land use.*

This description aligns with observations made on site by Campbell Stewart of SouthernSkies on 18th April 2024.

Table 3.1 from the T&T Stormwater assessment report is included below as Table 5.

Table 5: Pre-development land use (Source: T&T, Stormwater Assessment, Table 3.1).

Land use	Area (ha)
Brush (Manuka/Kanuka and Gorse/Broom)	123.3
Brush/Grass	22.0
Woods (Indigenous and exotic forest)	4.5
Woods/Grass	2.9
Pasture (High and low producing grassland)	90.4
Dirt (Access roads)	1.6
Newly Graded Area (Harvested exotic forest)	9.8
TOTAL	254.4

[4] Auckland Regional Council Technical Publication 227 – *'The Use of Flocculants and Coagulants to Aid the Settlement of Suspended Sediment in Earthworks Runoff : Trials, Methodology and Design, June 2004'.*
[5] P2WK; Milldale Development Stages 1 and 2.
[6] CCKV Stormwater Assessment Report, Maitahi development, kaka valley, Nelson, March 2024, prepared by Tonkin and Taylor Ltd

The Kākā Stream is a steep catchment in its upper reaches beyond the project area, rising to an elevation of over RL400 in some parts with steep slopes descending to the Kākā Stream valley. Many of the slopes exceed 40% in the upper catchment.

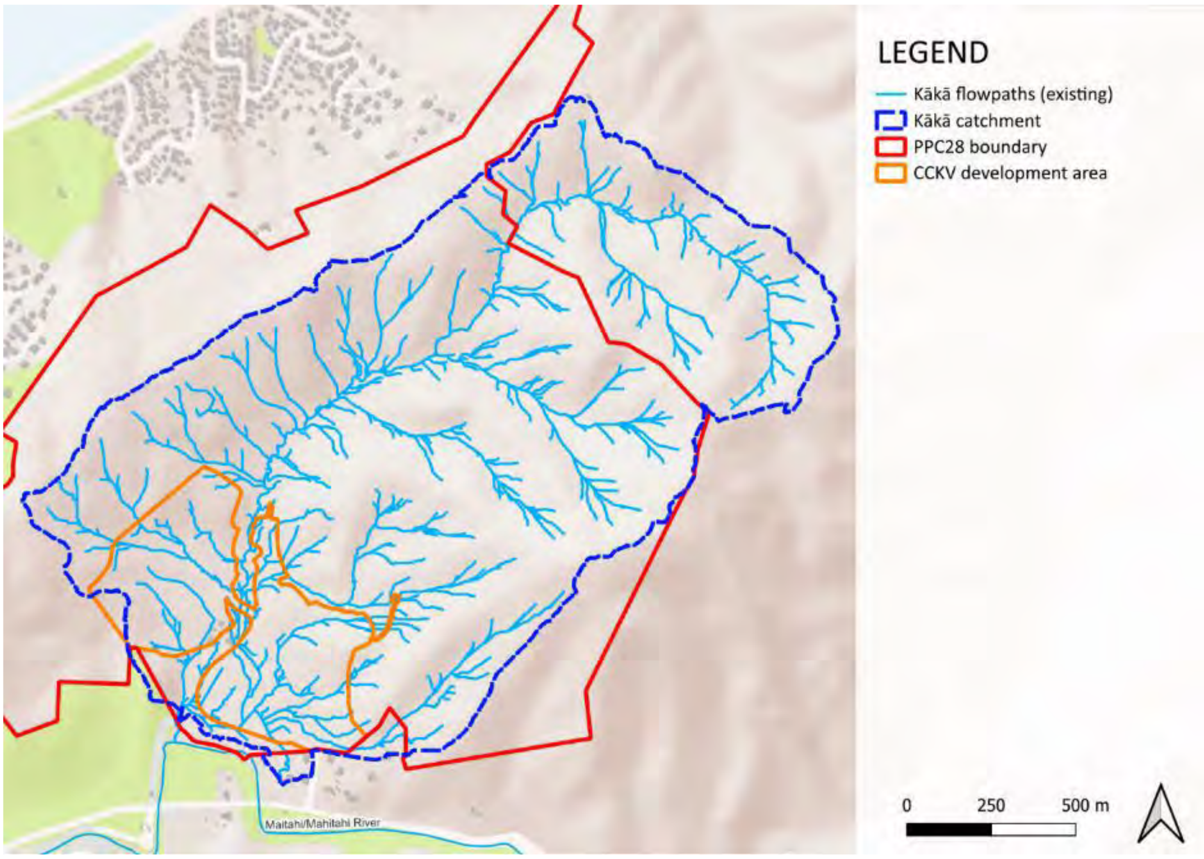

Figure 16: Kākā Stream catchment and flow paths based on 2021 LiDAR data. Basemap: TOSM.

A pre-development USLE assessment has been undertaken using the land use descriptions and areas from the T&T report Table 3.1. The estimated sediment yield from the USLE model was initially significant due in large part to the approximate 10ha of harvested forest. It was decided to remove the "Harvested Forest" land use from the model as that is a cyclic activity that is now stabilised. Instead, the 10ha was assumed to be split into the pasture and native bush land use. This halved the estimated sediment yield from the total Kākā Stream catchment and is inherently conservative, given that the forest harvesting did occur.

We acknowledge the results reported in the NIWA 2017 report suggest the sediment load from the CSSI data model from the Kākā Stream is 41.7 t/y. This is orders of magnitude less than the USLE estimate for the existing catchment.

The '*Private Plan Change 28, Impact of geology on sediment yield'*, dated 10 June 2022 written by Mark Foley of Tonkin & Taylor also suggests that the geology of the area is 'significantly different when compared to the bedrock geology in the vast majority of Nelson's Hillside slopes'. Mr Foley also states that the underlying geology is stronger and more erosion resistant than the underlying rock in the majority of urban areas in New Zealand where the bedrock is softer, and soils typically dominated by silt and clay sized fractions.

Mr Foley states that in his experience in land development in Nelson, the USLE calculations can significantly overestimate sediment yield in areas of hard rock compared to soft rock geology. This is due to the USLE being modified from and estimator tool derived for agricultural use application in North America where land disturbance typically involves ploughing and harrowing to shallow depths in soils where no hard bedrock is at shallow depth.

In the case of the USLE calculations provided in this report, the estimate of sediment yield is based on the information that we have available and have compared the results of the existing catchment to the calculations provided for the earthworks. Consequently, it is our comparison between the pre-construction and during-construction phases using consistent parameters that is critical, rather than the actual values derived.

7.2.5. USLE Results

Table 6 below provides a summary of the estimated sediment yields (t/ha/yr), and loads (t/yr) derived from the USLE. It presents the sediment yield estimated on an annual basis for each stage and each SRP catchment based on the footprint of earthworks within the catchment, a corresponding estimate of sediment yield for that same footprint under the existing land use and presents the additional load that is predicted by the model to result from the earthworks over that period.

In addition, for comparative purposes, the existing land use estimated sediment yields have been extrapolated to include the area of each catchment that lies beyond the works footprint, the Kaka Stream catchment, which the project area is entirely within. This provides an indication of the potential change in sediment load to the receiving environments beyond the site; the Maitahi River and Nelson Haven.

The USLE calculations reflects the proposed staging programme to be undertaken to develop the project. As anticipated, potential sediment yields are higher on steeper slopes, and this is addressed through specific ESC methodologies to reduce that potential to the extent practicable.

The comparison of sediment yield within each individual stage compared to the calculated pre-development (or existing) is relatively low in volume but can appear to be a relatively high percentage change. For example, the 2.7ha Stage 1A pre-development estimate is 2.74 t/ha/yr, while during development it is predicted to be 3.23 t/ha/yr, representing a change of 18% but only 0.49 tonnes (approximately half a cubic metre). However, when assessed against the sediment load in the Kākā Stream catchment the change is 0.22%.

This is generally reflected in all stages. The project site is within the lower extent of the Kākā Stream catchment. The steeper sections of the project area are in many cases significantly less steep than the upper reaches of the Kaka Stream catchment, which has the highest sediment generating potential under current land use.

Overall, the predicted worst-case difference in sediment load from the Kākā Stream to the Maitahi River during the earthworks phases of the development is 2.573 tonnes (Stage 4 plus fill sites) i.e. 1.12% increase.

In summary, the proposed earthworks will result in a small increase in sediment yield to the Kākā Stream and Maitahi River during the earthworks phase. With the implementation of best practice ESC measures, the USLE predicts minor estimated increase of sediment yield, assuming the earthworks are completed in a staged and progressive manner in accordance with the proposed staging.

Table 6: USLE Summary Sheet.

Catchment/Stage	Description of Area	Ground Cover of Stage Area	Period of time for ground cover in relevant stage (months)	Earthworks area total (ha)	Total Stage Area (ha)	Calculated Sediment Yield for Earthworks Area and Period of State	Annual Comparative Yield per ha for each area (t/ha/yr)	Combined Annual Comparative Yield per ha per stage (t/ha/yr)	Volume Change in Sediment Yield per Sub-Catchment (t)	Percentage Change in Sediment Yield per Sub-Catchment (%)	Kaka Stream Catchment (ha)	Catchment Sediment Load (based on USLE existing land assumptions)	Average Annual Catchment Sediment Load per ha (t/ha/yr)	Catchment sediment load increase (catchment sediment load + sediment load difference)	Catchment Increase (%)	Average Catchment (t/ha/yr)	Earthworks area as percentage of catchment (%)
Kaka Stream Catchment (Pre-Development)											254.5	223.28	0.88				
Stage 1A (Pre-Development)	Fill Area	Stabilised	12	1.50	2.70	2.3667		2.74	NA	NA							
	Cut Area	Stabilised	12	1.2		0.3691											
Stage 1A	Cut Area	Open Earthworks	4	1.50	2.70	2.0291	2.8832	3.23	0.49	18.0%				223.77	0.22%	0.88	1.1%
		Stabilised	8	1.50		0.8541											
	Fill Area	Open Earthworks	4	1.20		0.2768	0.346										
		Stabilised	8	1.20		0.0692											
Stage 1B (Pre-Development)	Fill Area	Stabilised	12	1.00	2.90	0.271		5.49	NA	NA							
	Cut Area	Stabilised	12	1.9		5.2162											
Stage 1B	Cut Area	Open Earthworks	4	1.90	2.90	3.8728	5.8589	6.12	0.63	11.6%				223.91	0.28%	0.88	1.1%
		Stabilised	8	1.90		1.9861											
	Fill Area	Open Earthworks	4	1.00		0.2033	0.2624										
		Stabilised	8	1.00		0.0591											
Stage 1C (Pre-Development)	Fill Area	Stabilised	12	4.10	8.80	0.5135		9.01	NA	NA							
	Cut Area	Stabilised	12	4.7		8.498											
Stage 1C	Cut Area	Open Earthworks	4	4.70	8.80	9.4642	9.6465	10.04	1.02	11.4%				224.30	0.46%	0.88	3.5%
		Stabilised	8	4.70		0.1823											
	Fill Area	Open Earthworks	4	4.10		0.2627	0.3899										
		Stabilised	8	4.10		0.1272											
Kaka Stream Catchment (Development of Stage 1)											254.5	223.28	0.88	225.43	1.0%	0.89	5.7%
Kaka Stream Catchment (Pre-Development)											254.5	223.28	0.88				
Stage 2 (Pre-Development)	Fill Area	Stabilised	12	1.78	1.88	0.152	0.1887	0.19	NA	NA							
	Cut Area	Stabilised	12	0.1		0.0367											
Stage 2	Cut Area	Open Earthworks	5	0.10	1.88	0.0477	0.0514	0.25	0.06	31.6%				223.34	0.03%	0.88	0.7%
		Stabilised	7	0.10		0.0037											
	Fill Area	Open Earthworks	4	1.78		0.1861	0.197										
		Stabilised	8	1.78		0.0109											
Kaka Stream Catchment (Development of Stage 2)											254.5	223.28	0.88	223.34	0.03%	0.88	0.7%
Kaka Stream Catchment (Pre-Development)											254.5	223.28	0.88				
Stage 3 (Pre-Development)	Fill Area	Stabilised	12	1.50	4.50	0.1302	1.7508	1.75	NA	NA							
	Cut Area	Stabilised	12	3.00		1.6206											
Stage 3	Cut Area	Open Earthworks	6	3.00	4.50	1.8232	1.9245	2.07	0.31	17.9%				223.59	0.1%	0.88	1.8%
		Stabilised	6	3.00		0.1013											
	Fill Area	Open Earthworks	6	1.50		0.0945	0.1405										
		Stabilised	6	1.50		0.046											
Kaka Stream Catchment (Development of Stage 3)											254.5	223.28	0.88	223.59	0.1%	0.88	1.8%
Kaka Stream Catchment (Pre-Development)											254.5	223.28	0.88				
Stage 4 (Pre-Development)	SRP-7 Area	Stabilised	12	5.00	9.70	3.8328	10.0338	10.03	NA	NA							
	SRP-8 Area	Stabilised	12	4.70		6.201											
Stage 4	SRP-7 Area	Open Earthworks	7	5.00	9.70	3.5549	4.5257	12.57	2.53	25.3%				225.81	1.1%	0.89	3.8%
		Stabilised	5	5.00		0.9708											
	SRP-8 Area	Open Earthworks	6	4.70		6.2945	8.042										
		Stabilised	6	4.70		1.7475											
Kaka Stream Catchment (Development of Stage 4)											254.5	223.28	0.88	225.81	1.1%	0.89	3.8%
Kaka Stream Catchment (Pre-Development)											254.5	223.28	0.88				
Unsuitable Fill Site (Pre-Development)	Fill Area	Stabilised	12	0.75	0.75	0.0580	0.0580	0.0580	NA	NA							
Unsuitable Fill Site	Fill Area	Open Earthworks	9	0.75	0.75	0.0588	0.0609	0.0609	0.003	5.0%				223.28	0.00%	0.88	0.3%
		Stabilised	3	0.75		0.0021											
Valley Fill Site (Pre-Development)	Fill Area	Stabilised	12	2.23	2.23	0.2063	0.2063	0.2063	NA	NA							
Valley Fill Site	Fill Area	Open Earthworks	9	2.23	2.23	0.2376	0.2473	0.2473	0.04	19.9%				223.32	0.02%	0.88	0.9%
		Stabilised	3	2.23		0.0097											
Kaka Stream Catchment (Development of Fill Sites)											254.5	223.28	0.88	223.32	0.02%	0.88	1.2%

7.3. Potential Adverse Effects

The potential adverse effects of sediment laden discharges from the Project include direct impacts on water quality, freshwater and marine biodiversity, values of specific interest to mana whenua, other cultural values and values such as natural character. These potential impacts of accelerated erosion and sediment discharge are well documented.

Where appropriate ESCs are not implemented, there is potential for a range of adverse effects on the social, natural, environmental, cultural and economic wellbeing of the area. There could include:

- Ecological values associated with direct and indirect impacts on flora and fauna on land and in adjacent freshwater and marine waterbodies, such as:
  - Smothering.
  - Deterioration of habitat from discharge of sediment and pollutants and sedimentation (e.g. stream blockage, reduced light levels, weed growth).
  - Abrasion and direct impact to fish, stream insects, shellfish and other bottom-dwelling organisms.
- Water quality for consumable water resources.
- Aesthetic and recreational values of land and waterbodies.
- Property and public utilities.
- Cultural matters of significance to mana whenua, including the mauri of water, mahinga kai, customary rights and kaitiaki initiatives.

In general, and as illustrated in Table 6 above, the sediment loads predicted are only a small portion of the overall load that will enter a given stream during a rain event, as the Project earthworks footprint is only a relatively small proportion of the Maitahi River catchment systems.

The USLE calculation indicates sediment load increase within each individual stage vs the calculated pre-development (or existing) is relatively low in volume, although can appear to be a relatively high percentage change. However, when assessed against the sediment load in the Kākā Stream catchment receiving environment the change the percentage changes are minor

While most of the stream catchment include regenerating scrub forest in the upper catchments and pastoral farming. Sediment sources within the catchment will include sediment laden runoff from existing pasture, scrub forest, stream bank and stream bed erosion, land slips, tracking, and sundry other sources. Hence for most of the catchments, the Project represents a small portion of the USLE calculated estimated sediment load.

The potential adverse effects of the predicted sediment yield from the Project on the freshwater receiving environments are assessed and reported on in the Ecological Impact Assessment.

With the implementation of the best-practice ESC methodologies as summarised above, construction of the Project is unlikely to result in significant sediment-related adverse effects downstream of the Project area.

Adverse effects are anticipated to be temporary and minor. This conclusion is based on the observed performance of other projects that have implemented the same standard of ESC practice, the Project emphasis on proactive monitoring to maintain the performance of all ESC devices, and the conservatism in the USLE estimates, including lower erodibility of the geology and soil of the site. There are no unusual or specifically high-risk elements of this proposal that would prevent a NTESCG compliant ESC methodology being successfully implemented.

ESC management can be designed, operated, and maintained to a high standard in accordance with the best-practice requirements of the NTESCG.

Prior to earthworks commencing in each works area, a SSESCP will be developed for those works. This could be in the form of a series of plans for the various activities to occur during construction or based on specific chainages of works that need to occur. This approach allows for flexibility, fine tuning and ownership of the ESC measures and methodologies by the contractor.

A specific SSESCP has been prepared for the Kākā Stream diversion which makes up a large portion of the proposed stream works. The developed methodology seeks to ensure the works can be undertaken off-line and 'in the dry'. The ESC methodologies in accordance with NTESCGs will ensure that the values of the freshwater environments are not compromised below the extent of works.

8. CONCLUSION

The earthworks proposed as a part of the Maitahi Village Project have the potential to result in changes to water quality during the construction phase as a result of the discharge of sediment from earthworks during both rain events and streamworks.

As part of the Project earthworks activities, the ESCs will be implemented to minimise sediment-related effects to an acceptable level.

To ensure that final construction management input is provided for and to also allow for flexibility with the specific ESC implementation on site, final SSESCPs will also be provided prior to earthworks commencing in a given works area. The final SSESCPs will confirm the detailed design, specific ESC locations, and the staging and sequencing of works for that location or activity and will provide a staged approach to the works within a site and across the Project.

The implementation of SSESCPs will enable the construction team to have ongoing input into the ESC design prior to and during construction, subject to compliance with the design and implementation standards specified in this report.

The Project will utilise best-practice ESC measures that meet or exceed the outcomes anticipated by the NTESCG. The staging approach and progressive stabilisation are estimated to result in small increases in sediment load within the respective catchments and the greater Kākā Stream catchment.

An ESC management structure and monitoring plan will be adopted to ensure that the ESC measures are designed, constructed, maintained, and decommissioned in accordance with best practice and as anticipated by this ESCAR.

Overall, it is anticipated that the proposed ESC management approach will ensure that the sediment yield from the works will be minimised to an acceptable level and that any adverse sediment-related effects will be temporary and minor, and consistent with the NPS:FM and the relevant plan provisions.

APPENDIX A: CHEMICAL TREATMENT MANAGEMENT PLAN

Chemical Treatment Management Plan

Document Number	ChemTMP
Revision	A
Date	21 January 2025

Document Control

Document History and Status

Revision	Date Issued	Author	Reviewed By	Approved By	Status
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Revision Details

Revision	Details
A	Draft for submission of fast track application.

Table of Contents

1 Introduction

1.1 Purpose and Scope

This Chemical Treatment Management Plan (ChemTMP) applies to the earthwork's operations associated with the construction phase of the Maitahi Development (the Project) in Nelson.

The ChemTMP sets out the methodology for determining the effectiveness and dosing rates for chemical treatment to enhance the sediment retention efficiency of the sediment retention ponds (SRPs) and decanting earth bunds (DEBs) that will be used throughout the Project.

The ChemTMP shall be implemented for the duration of the earthwork operations associated with the construction of the Project. It will support the overall erosion and sediment control (ESC) principles and methods described in the Erosion and Sediment Control Assessment Report (ESCAR) and will inform the development of Site-Specific Erosion and Sediment Control Plans (SSESCPs).

1.2 Implementation and Operation

Table 1 details the roles and responsibilities that will apply to the implementation and management of the chemical treatment systems across the Project.

To be updated prior to commencement of earthworks.

Table 1: ChemTMP - roles and responsibilities.

Name	Role	Contact details	Responsibility
	Project Construction Manager		Overall project responsibility
	Civil Construction Manager		Includes responsibility for earthworks
	Earthworks Manager		
	Construction Environmental Manager		Overall responsibility for Environmental Management and Performance
	Erosion and Sediment Control Advisor		Suitable qualified and experienced erosion and sediment control specialist who prepares the erosion and sediment control plans and audits their implementation.

2 Methodology

In accordance with industry best practice, it is proposed to chemically treat the SRPs and DEBs, where necessary, to maximise sediment retention efficiency and ensure the quality of water discharging from the device is within the range anticipated in the assessment of effects for the Project (refer to Erosion and Sediment Control Assessment Report).

Soil sampling and bench testing (laboratory testing of chemical responses), and the management of the chemical treatment systems will be undertaken in accordance with Appendix F1 and Section F2.0 of Auckland Council Guideline 2016/005 *Erosion and Sediment Control Guideline for Land Disturbing*

Activities in the Auckland Region (GD05) as the Nelson City Council (NCC) guidelines do not currently address chemical treatment.

Preliminary soil samples and bench testing has been undertaken as part of early site investigations (refer to the Chemical Analysis and Reactivity Test (CART) Report in Appendix A) which indicates significant improvement of clarity and turbidity with the use of chemical treatment.

Ongoing soil sampling and bench testing will also be required as the earthworks progress. In this regard protocols have been established and are set out in Section 5.

Any sampling for bench testing of sub-soils (below topsoil) that is necessary will be taken from the contributing catchment of sediment controls devices to determine the optimum chemical response and dosing rate, balanced within an acceptable pH range.

Ongoing sampling will also be required as the earthworks progress.

Bench tests of soil samples will be undertaken using the following two chemicals supplied by IXOM Chemicals:

1. Polyaluminium Chloride (PAC - $[Al(OH)_aCl_b(SO_4)_c]_n$), The most common chemical widely used throughout New Zealand, a polymer originally tested and documented by the Auckland Regional Council during the construction of the ALPURT motorway extension development[1].
2. Superfloc – A synthetic polymer blend of PAC and PolyDADMAC (Polydiallyldimethylammonium chloride– $[C_8H_{16}NCl]_n$).

GD05 states the recommended chemical and dose rate will be that which achieves the best settlement rate within the acceptable pH range of 5.5 to 8.5 and will not change the baseline pH beyond +/-1.

3 Implementation

The CART Report confirms the efficacy of chemical treatment of typical site soils, based on the testing methodology described below and in the CART.

A SSESCP will be prepared for each works area. Each SSESCP will identify and provide the sizing calculations and drawings for all ESC measures to be implemented in the corresponding area. Once a SSESCP has been certified by NCC, the ESC measures will be constructed in that works area.

If the works are within an area or soil type already sampled and reported on in the CART, the chemical treatment systems will be initially set up based on the CART recommendations. If the works area is not within the extent of the CART report, additional soils sampling and bench testing will be undertaken in accordance with this ChemTMP.

Confirmation of the recommended chemical, dose rates, roof tray sizes and header tank outlet spacings for each device will be submitted to NCC with the as-built certification of the devices and Appendix D of this ChemTMP will be updated with the recommended dose rates for that SSESCP area.

The relationship of the various management plans and procedures that apply to the chemical treatment system is shown in Figure 1.

[1] Auckland Regional Council Technical Publication 227 – *'The Use of Flocculants and Coagulants to Aid the Settlement of Suspended Sediment in Earthworks Runoff : Trials, Methodology and Design'* June 2004

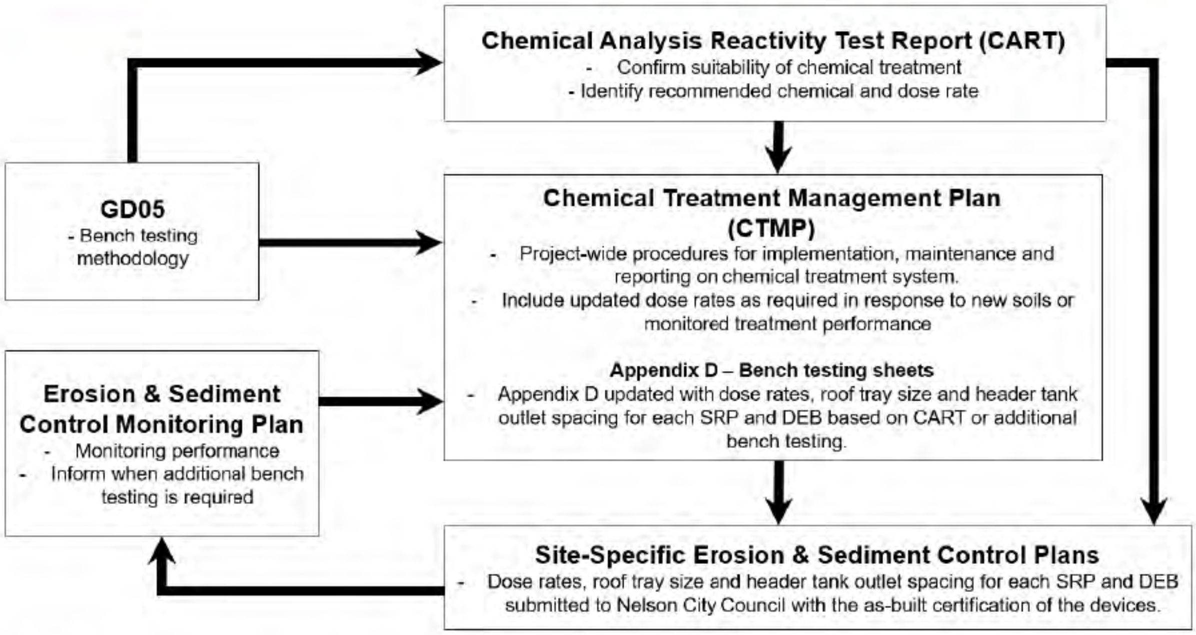


Figure 1: Implementation of the chemical treatment system.

4 Bench Testing Results

Bench testing has been undertaken on three soil samples derived from the site. The bench testing results for the three soils samples is provided below. An additional fourth bench test was completed on a combined sample of Sample 2 and 3 (the two track samples) which are of most relevance to the Stage 1 and 2 earthworks.

As additional bench testing is completed, the results will be provided in Appendix D and submitted to NCC.

Highlighted green rows indicate dose rates that could be used on site. Highlighted red rows should not be used on site due to the impact on the pH.

4.1 Sample 1

<u>Description: Piezo Bench, Nelson 2000 (400772.645, 800744.290).</u>

<u>PAC</u> *Initial pH: 5.95* *Initial turbidity: 7,632 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	5.91	2,561
2	25	40	40	5.75	356
4	70	90	100	5.56	88
6	100	110+	110+	5.31	66
8	90	100	100	5.12	106
10	75	90	90	4.96	139

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	5.91	2,561
2	60	70	70	5.77	153
4	90	95	100	5.56	108
6	50	50	50	5.36	257
8	40	40	40	5.15	476
10	30	30	30	4.98	658

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

4.2 Sample 2

Description: Track II, Nelson 2000 (401248.748, 800687.833).

PAC *Initial pH: 6.86* *Initial turbidity: 11,201 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.89	5,716
2	10	10	10	6.78	2,501
4	30	30	30	6.56	802
6	40	40	40	6.35	411
8	60	60	60	6.12	196
10	110+	110+	110+	5.99	57

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.89	5,716
2	10	15	15	6.75	1,327
4	30	35	35	6.56	338
6	60	70	70	6.40	137
8	110+	110+	110+	6.23	46
10	110+	110+	110+	6.14	44

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

4.3 Sample 3

Description: Track I, Nelson 2000 (401107.441, 800578.358)

PAC *Initial pH: 6.82* *Initial turbidity: 4,647 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.81	2,482
2	20	20	25	6.63	714
4	45	50	50	6.45	221
6	90	90	100	6.23	81
8	110+	110+	110+	6.07	39
10	110+	110+	110+	5.92	41

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.81	2,482
2	40	55	60	6.67	186
4	110+	110+	110+	6.49	67
6	60	65	70	6.28	157
8	40	40	45	6.11	303
10	30	30	35	5.97	433

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

4.4 Sample 4

Description: Combined Sample 2 and Sample 3 (Track I and Track II).

PAC *Initial pH: 6.99* *Initial turbidity: 4,691 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.97	2,315
2	20	20	25	6.79	611
4	40	50	50	6.58	191
6	75	80	90	6.34	94
8	100	110+	110+	6.13	48
10	100	110+	110+	5.96	50

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.97	2,315
2	55	60	65	6.81	162
4	70	70	80	6.62	121
6	40	45	50	6.40	274
8	30	30	35	6.26	481
10	20	25	30	6.01	553

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

5 Discussion

Various dose rates of Polyaluminium Chloride (PAC) and Superfloc (Superfloc BXS) were successful in providing an improvement in clarity and turbidity over the control test. PAC is the favoured chemical as a more widely used and sourced chemical.

The pH of the samples varied and in some bench test trials dropped outside of the recommended pH range of 5.5 - 8.5 as the dose rate increased.

The initial recommended dose rate for the Stage 1 and 2 earthworks is 8 milligrams of aluminium per litre. This is equivalent to 124mls of PAC to 1 cubic meter of sediment laden runoff.

Throughout the project, if poor clarity in a device is observed then the dose rate should be reviewed. Additional soil samples can be collected and retested to ensure that the project is using the correct dose rate. Adjustments to the dose rate will be made as required to optimise the use of chemical treatment.

Note: Different PAC products may have different aluminium content and specific gravity and thus, respond at different rates. The product tested has a specific gravity of approximately 1.2 and has greater than or equal to 10% Al_2O_3. If PAC is sourced from different suppliers, the specific gravity and aluminium oxide concentration should be checked and if differing from those tested, may need to be re-tested to confirm dosage rates.

It is recommended that the project utilises a rainfall activated dosing system for any runoff from the site. A batch dosing criteria and method is also provided.

In summary:

Chemical recommended: **PAC**

Dose rate: **124mls/m^3**

Dosing system: **Rainfall Activated Dosing System**

6 Chemical Treatment Dosing Systems

Two dosing systems detailed below could be used on site, these are activated by rainfall or flow.

The most common and cost-effective is a rainfall activated system where dosing is initiated by rainfall received at the dosing site.

The alternative option is a flow activated system, which activates by the flow rate entering the sediment control device. That type of system may be appropriate for areas where sediment laden water is pumped or piped from an excavation site to the treatment device.

6.1 Rainfall Activated Gravity Dosing System

The rainfall activated dosing system has been developed specifically for earthworks sites.

The system described below uses a rainfall catchment tray to capture rainfall with the size of the tray being determined by the required chemical dose and the land catchment size. It is the most widely used system and is robust and simple to operate. It does not require a power source.

The following provides the set up required for a rainfall activated gravity dosing system (floc shed, Floc Box, Portafloc, SediRad or similar).

Rainwater caught by the roof tray (catchment tray) is flows into the header tank, and then into a displacement tank which floats in a larger tank containing the flocculant filled to the level of an outlet pipe leading to the sediment laden diversion about 10m upstream of the sediment control device. The greater the rate of rainwater flow into the displacement tank the greater the flow of flocculant into the sediment laden runoff channel. The header tank is designed to provide for no dosing during initial rainfall of up to 12mm of rain under dry conditions, and for attenuation of the chemical flow during the initial stages of a storm and after rain has ceased at the end of a storm.

All water flowing into the sediment control device needs to be treated, and the rainwater roof tray size is determined by the recommended dose rate and the total land catchment area draining to the sediment control device including both the 'open' area and stable areas. If the catchment area is changed, then the catchment tray size should also be changed in proportion.

Roof tray size

The required tray size is <u>1.5 square metres per hectare of exposed land catchment</u> draining to the sediment control device. This is the area inside the upstand around the edge of the tray.

Header tank spacing

The distances provided are between the base of the header tank (or height from draining hose if the draining hose is higher than the base of the header tank) and the first dosing outlet which is equal to the volume of 12mm of rainfall on the roof tray (distance x). The distance between the first dosing outlet and the high flow outlet is the same (distance y).

Note, the distance is based on a specific dosing system (floc shed, floc box etc.) due to the varying diameter of the header tank between systems.

Header Tank management in summer months to be as per the GD05 guidelines:

- After 3 days without rain – reduce volume by 50%
- After 6 days without rain – empty completely.

Appendix C will be updated with each SSECSP, based on the specific catchment area to be serviced. That appendix will specify the treatment device, catchment area, roof tray size and header tank outlet size and spacing.

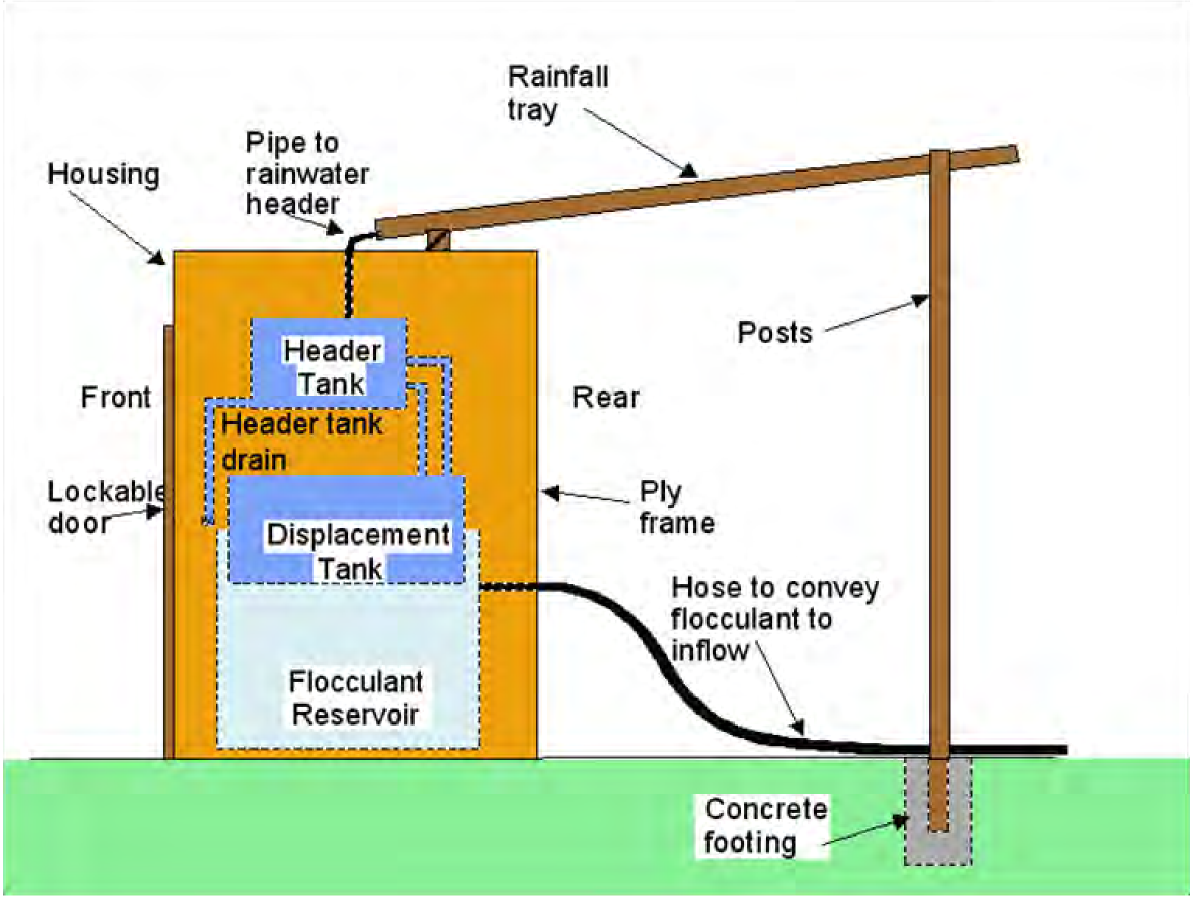


Figure 2: Traditional floc shed schematic.

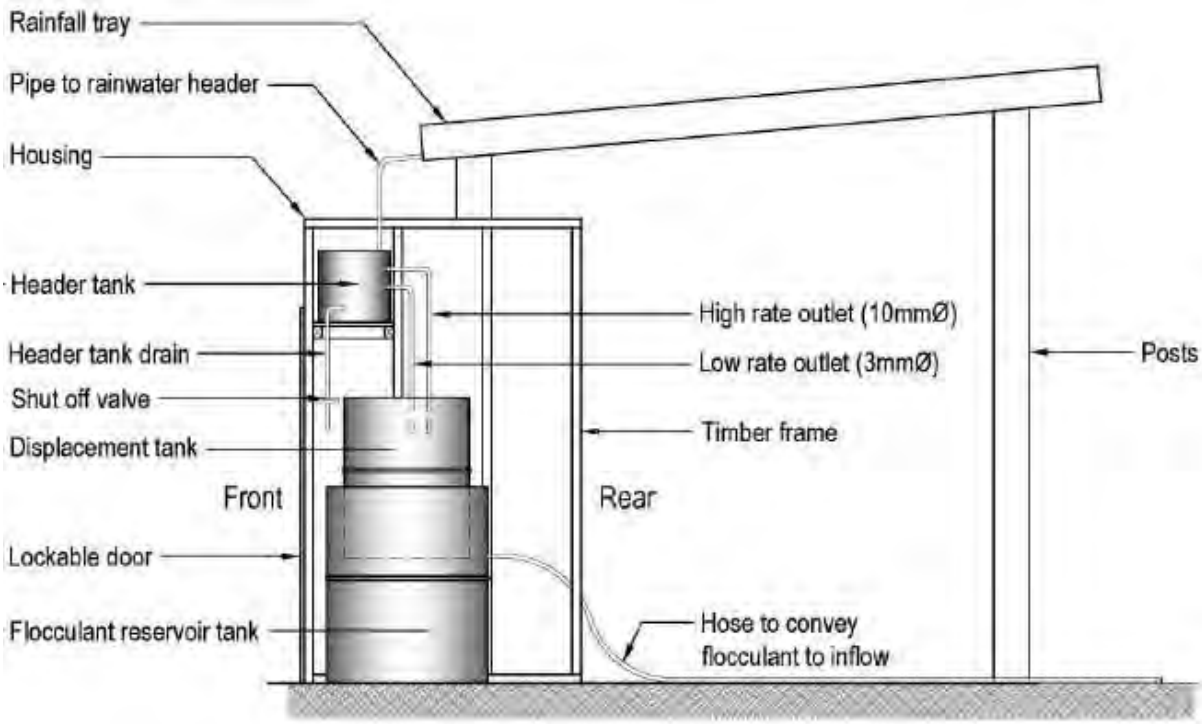


Figure 3: Components of the floc shed.

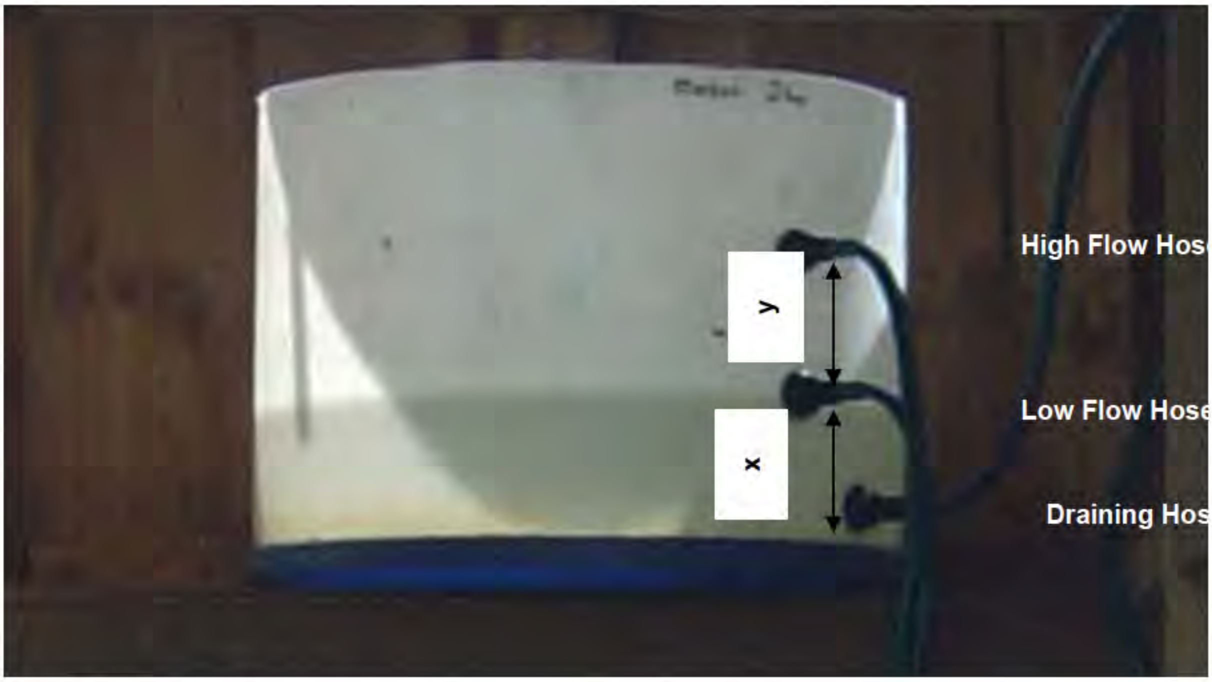


Figure 4: Header tank spacing.

6.2 Rainfall Activated Electronic Dosing System

The rainfall activated electronic dosing system (Autofloc or similar) should be set up by the supplier to achieve the recommended dose rate.

6.3 Sediment Laden Runoff Channel and Dosing Point for Rainfall Activated System

The chemical needs to be added to the sediment laden runoff channel to provide mixing with the sediment laden runoff before it reaches the area of ponded water of a DEB or forebay of a SRP.

All sediment laden runoff from the catchment should be combined into a single channel if possible before it reaches the chemical dosing point, which should be located 5-10m prior to the point where the runoff reaches the ponded water of the DEB/SRP, so the PAC can be added to and mixed with the total inflow.

The dosing point should be at a location where the chemical will fall into the sediment laden flow during periods of low flow. The end of the dosing tube should be only a few centimetres above the diversion channel to ensure that the chemical falls into the sediment laden runoff and is not blown away during periods of strong wind.

6.4 Flow Activated System

A flow activated dosing system (Goodrich's Electronic Dosing Device, Erosion Control's Dose Box or similar) should be set up by the supplier to achieve the recommended dose rate.

Like rainfall activated systems, the dosing point should be upstream of the sediment retention device to ensure full mixing of chemical within the inflow before it reaches the sediment retention device.

6.5 Batch Dosing

Batch dosing is not recommended as the primary dosing system. It can be utilised as additional dosing where adequate water quality has not been achieved, but with careful monitoring of pH.

The criterion to establish the need for batch dosing is the clarity of the sediment laden runoff. Clarity is measured using a black disk lowered vertically into the water to be tested. A small black disc of 50-80mm diameter is attached to a 1m long stick with a centimetre scale starting at the disc. The disc is lowered into the water until it disappears and then is raised until it just reappears. The depth of reappearance is recorded as the clarity of the water.

Water with a clarity of 100mm or greater is considered to be acceptable for discharge. Water with a depth of clarity of less than 60mm should be batch dosed. If the sediment laden runoff has clarity between 60-100mm after rainfall has ceased, it should be left for 48 hours to settle. If the clarity has not reached 100mm after 48 hours, or if sediment laden runoff has to be discharged within 48 hours because the pond is full, the sediment laden runoff should be batch treated.

6.5.1 Batch Dose Rate

The initial batch dose rate recommended is <u>124ml of PAC per m^3 of runoff.</u>

For example: If a SRP has 100m^3 of dirty water in it, the amount of PAC required would be 12.4L of PAC (124ml x 100m^3 = 12,400mls, which is equivalent to 12.4L).

Batch dosing rate based on volume of stormwater to be treated.

Volume of stormwater in pond (m^3)	Amount of chemical to be added (L)
1	0.124
50	6.2
100	12.4
200	24.8
300	37.2
350	43.4
400	49.6
500	62
1000	124
1250	155
1500	186

6.5.2 Application Procedure for Batch Dosing

The chemical dose should be applied evenly over the surface of the sediment control device as quickly as practicable. It is best to apply the dose in one application, rather than going over the surface of the water two or more times.

The total dose may be applied in one of two ways.

a) Spray
   The chemical can be applied to the surface of the pond using a sprayer that produces large drops.
b) Bucket
   Place approx. 1 litre of chemical in a 10-litre bucket and throw the chemical onto the pond surface so that the chemical divides into drops before hitting the surface.

Settlement generally requires 1-2 hours.

6.5.3 Timing

As impounded water often develops marked temperature gradients during the day, which can inhibit mixing of the chemical that is added to the surface of the impounded water and the settlement of coagulated solids, batch treatment should be carried out in the early morning to optimise mixing of the chemical with the sediment laden runoff and the subsequent settlement of coagulated solids.

7 Monitoring and Maintenance Requirements

7.1 Routine Management and Maintenance

Instructions for routine management and maintenance of the chemical treatment system are provided in Appendix B.

All monitoring records and maintenance checks and actions will be recorded on the monthly record sheet provided in Appendix C. The systems will be checked after each rainfall event, and during dry periods the systems will be checked weekly.

It is also noted that chemical treatment increases the sediment removal efficiency of the sediment controls. The sediment controls will need to be regularly desilted to ensure that the maximum volume is re-established after rain events.

7.2 Contingency Management

Contingencies could include poor performance of the treatment system, or effects of other influences on sediment laden runoff quality, such as reduced pH, that might make the use of chemicals inappropriate.

If the treated water in the sediment control device is consistently very clear it could indicate overdosing, and the possibility of lowered pH which can present a risk to receiving waters as a result of elevated free aluminium concentration in the discharge. If the treated water is consistently clear the pH of the water in the sediment control device will be tested.

Contingencies such as poor treatment performance or consistently very clear treated water should be dealt with as part of the day-to-day environmental management of the site.

A treatment chemical spill contingency procedure is provided in Section 7.6 below.

7.3 Record Keeping and Reporting

A copy of the maintenance record for the chemical treatment system will be kept on site (Appendix C).

A copy of the maintenance record for the chemical treatment system will be provided to NCC on request.

7.4 Procedure for Chemical Transportation

The use of flocculants and coagulants will be in accordance with the Project / Site Health and Safety Plan.

PAC and Superfloc will be delivered to the site by commercial carriers in accordance with current Hazardous Goods, Traffic and Transport regulation. These chemicals can be requested from the supplier generally in 20 litre containers, 200 litre drums and/or 1,000 litre IBCs. Drums of PAC and Superfloc weigh about 250kg and is most easily moved within the site in a loader bucket. Transport around the site will be via suitable vehicles or machinery and containers will be sealed and secured such that the containers cannot topple over.

7.5 Storage of Chemicals on Site

Chemicals will be stored in accordance with the Hazardous Substances procedure. Bulk PAC and Superfloc supplies will be held in secure storage. 200L polyethylene drums or IBCs of PAC and Superfloc will be held beside each chemical treatment shed / floc box, on level ground and secured so that the container cannot topple over. Those drums will be under the overall security and control of the site as a secure workplace. Drums of chemical will always be stored on end with the screw caps uppermost. Topping up of flocculant chemical will be made weekly as part of the regular inspection regime.

7.6 Chemical Spill Contingency Procedure

Spills will be manged in accordance with the Emergency Spill Response Procedure.

If there is a spill of PAC or Superfloc onto the ground it should be immediately contained using earth bunds to prevent it entering water. The spilt chemical should be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it should be mixed with a volume of soil equal to at least ten times the volume of spilt chemical. This will effectively neutralize the chemical. The soil with which the chemical has been mixed should be buried in the ground a minimum of 0.5 metres below the surface.

If there is a spill of chemical into ponded water, discharge from the pond to natural water should be prevented.

If there is any spill into flowing water:

1. The Nelson City Council should be advised immediately.
2. The volume of the spill should be recorded.
3. If possible, the water and spilt chemical should be pumped into a bund or sediment control device until all the spilt chemical has been removed from the watercourse.
4. If the chemical cannot be removed from the watercourse any downstream users should be identified and advised.

7.7 Chain of Responsibility for Monitoring and Maintenance

The Contractor will have overall responsibility for the chemical treatment systems.

The ESC Foreman and ESC Labourer(s) will check the effect of PAC and Superfloc dosing on the pH of the treated water once the pond has filled for the first time and monitor pH and overall performance throughout the duration of works.

7.8 Training of Person Responsible for Maintenance and Monitoring

If a person with experience in the monitoring and maintenance of the chemical treatment system is not available, the Environmental Manager will train a person nominated by the Project team to carry out the routine monitoring and maintenance of the chemical treatment system, and to keep the required records.

7.9 Procedure Modification

It is expected that as the Project progresses, performance checks of the chemical treatment systems may be required due to changing soil types etc. This will be undertaken following additional sampling and testing and approval from the Environmental Manager.

8 Appendices

Appendix A – Chemical Analysis and Reactivity Test Report (CART)

Chemical Analysis and Reactivity Test Report

Document Number	CART-01
Revision	A
Date	4/06/2024

Document Control

Document History and Status

Revision	Date Issued	Author	Reviewed By	Approved By	Status
A	4/06/2024	ZW	CS		
Role					
Signatures:					

Revision Details

Revision	Details
A	Draft for review.

Table of Contents

1 Introduction

1.1 Purpose and Scope

This Chemical Analysis and Reactivity Test (CART) Report applies to the earthwork's operations associated with the construction phase of the Maitahi Development Project (the Project).

The purpose of this report is to determine the effectiveness of chemical coagulants on common soil types identified within the Project area with the overall objective of minimising to the greatest extent practicable the discharge of suspended sediments into waterways during the construction phase of the project. It reports on initial testing undertaken, and the procedure for future testing to be undertaken during the Project.

Chemical treatment is now widely used throughout New Zealand to enhance the sediment removal efficiency of sediment retention devices implemented during the earthworks phase of infrastructure and development projects.

Chemical treatment is currently absent from the Nelson Tasman erosion and sediment control guidelines and therefore Auckland Council's Guideline Document 2016/005 *'Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region, Incorporating Amendment 1'* has been adopted.

Soil samples have been tested with two common cationic coagulants, which neutralise the negatively charged soil particles to improve flocculation and settlement within the sediment control device.

1. Poly Aluminium Chloride (PAC).
2. Superfloc (a blend of PAC and PolyDADMAC).

These coagulants contain aluminium and therefore pH monitoring must be monitored during testing and application. GD05 states that the following limitations apply to chemical treatment:

- pH must be tested as part of the bench testing methodology and should be used as a control baseline. Whatever flocculant is being used must not change that baseline pH beyond +/-1 and must not fall outside of the range of 5.5 – 8.5, as measured from the primary spillway.
- Treatment should cease when the above pH limits cannot be met.

This report presents the initial results of bench test trials undertaken to determine the effectiveness of the two coagulants. Clarity, turbidity, and pH measurements were undertaken and recorded for each bench test and the results used to determine the optimum chemical and dose rate for each sample provided.

1.1.1 Chemical Treatment Management System

The relationship of this CART report within the overall chemical treatment management system for the Project is shown in Figure 1 below. The CART has informed the development of the Chemical Treatment Management Plan (ChemTMP) developed for the Project. The ChemTMP provides detail on the management, maintenance, and reporting of the chemical treatment system to be implemented across the Project for the duration of earthworks phases. As the Project progresses, further bench testing will be undertaken as new areas are opened and earth worked. The ChemTMP contains additional bench testing sheets as an appendix for future tests to be completed and supplied to Nelson City Council (NCC). It will also detail the specific set-up details for the chemical treatment of each sediment retention pond (SRP) and decanting earth bund (DEB) to be implemented in an area i.e. roof tray and header tank outlet spacing.

Site Specific Erosion and Sediment Control Plans (SSESCPs) will be prepared for each earthworks stage or phase within the Project. The SSESCPs will be updated to provide the design details for all erosion and sediment control measure to be implemented within that area.

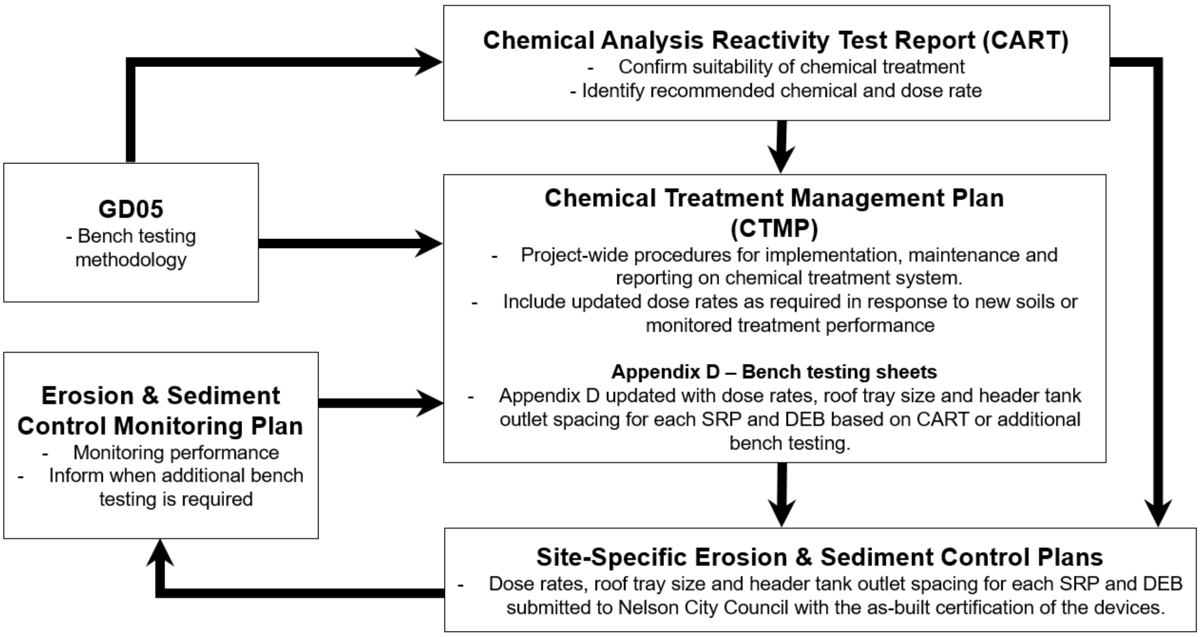


Figure 1: Chemical treatment management systems.

2 Methodology

The bench testing methodology provided in Appendix F1 of GD05 has been adopted. This methodology will be repeated for all future bench testing required in response to identified new soils, or where treatment performance is less than anticipated.

Testing of each sample involved the application of five dose rates (2mg/l to 10mg/l Al) and comparison to a control. Results are reported in the following tables.

2.1 Soil Samples

Three soil samples have been provided from the site, the Piezo Bench, Track I and Track II. The sample locations are shown in Figure 2. The samples have been taken from the main cut areas of the project as this material will be used as fill across the site.

Figure 2: Soil sample locations.

Additional bench testing of soil(s) acquired from other areas of the site will be tested to confirm the required dose rate prior to commencement of earthworks in that stage. Appendix D of the Chemical Treatment Management Plan will be completed for each new soil sample tested and results provided to NCC.

3 Bench Testing Results

Highlighted green rows indicate dose rates that could be used on site. Highlighted red rows should not be used on site due to the impact on the pH.

3.1 Sample 1

Description: Piezo Bench, Nelson 2000 (400772.645, 800744.290).

PAC *Initial pH: 5.95* *Initial turbidity: 7,632 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	5.91	2,561
2	25	40	40	5.75	356
4	70	90	100	5.56	88
6	100	110+	110+	5.31	66
8	90	100	100	5.12	106
10	75	90	90	4.96	139

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	5.91	2,561
2	60	70	70	5.77	153
4	90	95	100	5.56	108
6	50	50	50	5.36	257
8	40	40	40	5.15	476
10	30	30	30	4.98	658

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

3.2 Sample 2

Description: Track II, Nelson 2000 (401248.748, 800687.833).

PAC *Initial pH: 6.86* *Initial turbidity: 11,201 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.89	5,716
2	10	10	10	6.78	2,501
4	30	30	30	6.56	802
6	40	40	40	6.35	411
8	60	60	60	6.12	196
10	110+	110+	110+	5.99	57

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.89	5,716
2	10	15	15	6.75	1,327
4	30	35	35	6.56	338
6	60	70	70	6.40	137
8	110+	110+	110+	6.23	46
10	110+	110+	110+	6.14	44

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

3.3 Sample 3

Description: Track I, Nelson 2000 (401107.441, 800578.358)

PAC *Initial pH: 6.82* *Initial turbidity: 4,647 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.81	2,482
2	20	20	25	6.63	714
4	45	50	50	6.45	221
6	90	90	100	6.23	81
8	110+	110+	110+	6.07	39
10	110+	110+	110+	5.92	41

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.81	2,482
2	40	55	60	6.67	186
4	110+	110+	110+	6.49	67
6	60	65	70	6.28	157
8	40	40	45	6.11	303
10	30	30	35	5.97	433

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

3.4 Sample 4

Description: Combined Sample 2 and Sample 3 (Track I and Track II).

PAC *Initial pH: 6.99* *Initial turbidity: 4,691 NTU*

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.97	2,315
2	20	20	25	6.79	611
4	40	50	50	6.58	191
6	75	80	90	6.34	94
8	100	110+	110+	6.13	48
10	100	110+	110+	5.96	50

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

Superfloc

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0	10	10	10	6.97	2,315
2	55	60	65	6.81	162
4	70	70	80	6.62	121
6	40	45	50	6.40	274
8	30	30	35	6.26	481
10	20	25	30	6.01	553

Control 2mg/L 4mg/L 6mg/L 8mg/L 10mg/L

4 Discussion

The most efficient dose rate achieves the best balance between settlement response, pH response and cost of chemical throughout the duration of the Project.

The bench testing results provided in Section 3 indicate that chemical treatment provides significant benefit to aid settlement of mobile fine colloidal particles and improve water clarity and decrease turbidity.

Both PAC and Superfloc provided improved rates of settlement for the soil types tested. Either of these chemicals could be used on site. The recommended chemical and dose rate to be used on site will be confirmed in the ChemTMP.

Appendix B – Instructions for Maintenance of Rainfall Activated Treatment Systems

Reducing the Header Tank Water Volume

The header tank is used to avoid dosing during the initial stages of rainfall when site conditions are dry, and no runoff is to be expected.

The volume in the header tank is lowered using the lowest of the three outlet tubes.

- After 3 days without rain - reduce volume to 50%.
- After 6 days without rain - reduce volume to empty (level at lowest outlet).

Refilling the Chemical Reservoir

The chemical reservoir tank should be refilled when the white displacement tank is half full, or sooner if heavy rain is predicted. This is done by first emptying the white tank (baling with a bucket is efficient), and then refilling the black reservoir tank until the PAC or Superfloc level is at the lower edge of the outlet.

Observation of Water Quality in Sediment Control Device

The pond water quality will be observed at least weekly, and the clarity determined using a black disc and recorded on the monitoring sheet. pH shall be recorded once the pond has filled up to ensure that chemical dosing does not have an unacceptable effect.

Periodic System Checks

Check that the rainfall catchment tray is not leaking – especially along the lower edge of the tray. This should be done after rainfall has ceased.

Check the lower hose with the small tube outlet, from the header tank to the displacement tank, is not blocked.

Monitoring Records

A separate sheet is provided for monitoring records for each month (see Appendix C). The information to be recorded is as follows:

Visual check - Check the tray for leaks, the plumbing, and the hoses from the header tank. Record 'ok' or if maintenance is required write 'M' and note requirement in Notes column.

How full is the header tank (%)? This is the volume between the lowest and middle outlets. After rain this should be either 100% after 12mm or more rain, or between 0-100% after less than 12mm rain. In summer: 50% when lowered after 3 dry days; 0% when emptied after 6 dry days.

Depth in Displacement Tank (%) - Measure depth of water in cm. Reduces to 0 when emptied.

Chemical volume added - Record the PAC or Superfloc volume added. 1 drum = 200L, 9cm in the 200L drum = 20L. The volume can also be calculated from change in water level in displacement tank where 1cm change = 4 litres of chemical.

Water Clarity - Record using black disc near device outlet. (Refer above).

Appendix C – Chemical Treatment Monitoring and Maintenance Record

Site:

Sediment Control Device Name: Month: Maintenance Person:

Date	% Header Tank Full	Water depth in Displacement Tank (cm)	Chemical Volume Added	Water Clarity (mm)	pH	Notes on maintenance required or additional information	Initial
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Appendix D – Bench Testing Results Sheets

1 Introduction

Soil samples were taken from the contributing catchments of (insert description of devices and catchment).

These two chemicals were tested: (delete any chemical that was not tested)

1. **Poly Aluminium Chloride (PAC)**
2. **Superfloc (a blend of PAC and PolyDADMAC).**

Bench test flocculation trials were undertaken to determine soil reactivity to chemical treatment in accordance with the Auckland Council Guideline GD05.

2 Bench Test Trials

2.1 Results of PAC Bench Test

Initially, bench tests using PAC. The results of the bench tests are as follows.

Sample 1, Catchment 1 Initial pH = Initial Turbidity =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
2					
4					
6					
8					
10					

Sample 2, Catchment 1 Initial pH = Initial Turbidity =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
2					
4					
6					
8					
10					

2.2 Results of Superfloc Bench Tests

Bench tests were also undertaken using Superfloc. The results of the bench tests are as follows.

Sample 1, Catchment 1 Initial pH = Initial Turbidity =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
1.6					
3.2					
4.8					
6.4					

Sample 2, Catchment 1 Initial pH = Initial Turbidity =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
1.6					
3.2					
4.8					
6.4					

3 Discussion

Insert discussion and conclusion based on the bench testing results.

Include recommendation / chemical to be used and dose rate.

3.1 Batch Dose Rate

Insert batch dose rate and requirements.

3.2 Rainfall Activated Dosing System Details

Floc Shed Tray Size

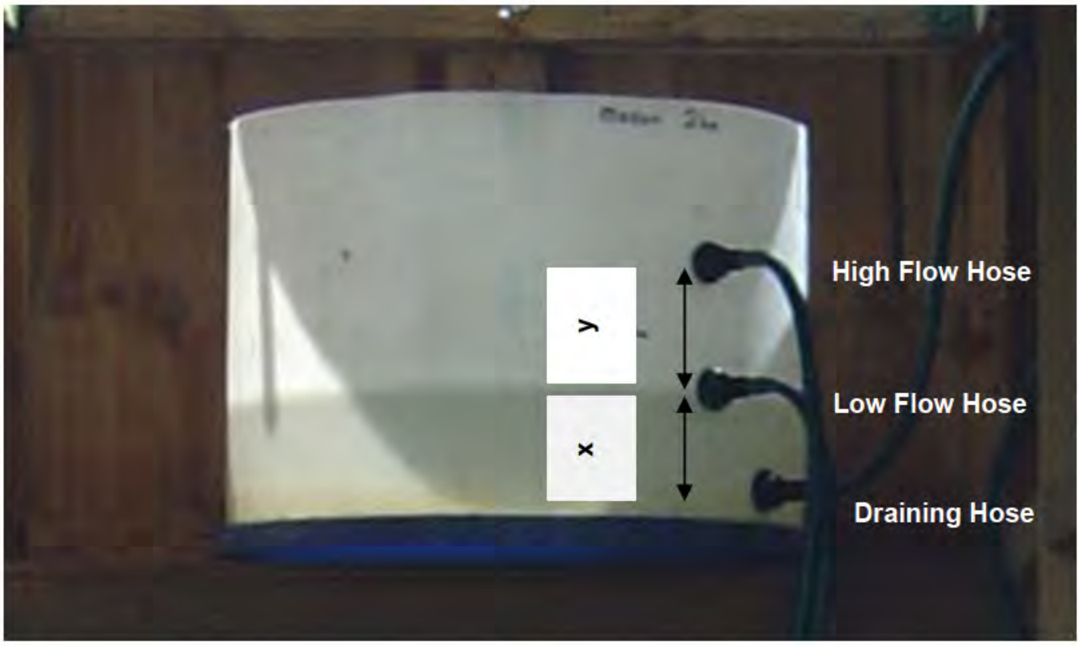
Based on the bench test results displayed in Section 3 undertaken on [insert date of testing] the required tray size is XXX square metres per hectare of exposed land catchment draining to the sediment control device. This is the area inside the upstand around the edge of the tray.

Sediment Retention Device	Catchment area (ha)	Tray Size (m^2)
XX	X	X
XX	X	X

Header Tank Outlet Spacing

The distance between the drain and first dosing outlet, and between the two dosing outlets, for a standard header tank made from a 200-litre drum with an internal diameter of 55 cm would be:

Sediment Retention Device	Catchment Area (ha)	Distance (x) (cm)	Distance (y) (cm)
XX	XX	X	X
XX	XX	X	X



APPENDIX B: EROSION AND SEDIMENT CONTROL MONITORING PLAN

EROSION AND SEDIMENT CONTROL MONITORING PLAN

Maitahi Development

Prepared for CCKV Maitahi Development Co LP

Date:	3 July 2024
Document No:	ESCMP
Revision:	A
Status	Draft

Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
A	03/07/24	Z Woods	C Stewart		Draft

Revision Details

Revision	Details
A	Draft for fast-track application.

Document Details

Document Name:	Erosion and Sediment Control Monitoring Plan
Status:	Draft
Document No:	ESCMP
Author:	Zac Woods

Limitations

This report has been prepared for the particular project described and its extent is limited to the scope of work agreed between the client and SouthernSkies Environmental Limited. No responsibility is accepted by SouthernSkies Environmental Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

Contents

1. INTRODUCTION

The purpose of this Erosion and Sediment Control Monitoring Plan (ESCMP) is to detail the erosion and sediment control (ESC) management and monitoring system that will be implemented for the duration of the site earthworks activities associated with the CCKV Maitahi Development Project (the Project). The ESCMP includes details of processes and procedures that will be followed and confirms how the ESC management and monitoring will be undertaken, and the methods used in the context of the Project to ensure that effects and performances are managed appropriately.

This monitoring plan has been written to detail how CCKV Maitahi Development proposes to manage and monitor ESC measures during construction, to ensure the performance of the Project ESC and to provide rapid and real time information and control to the Project management team.

The ongoing monitoring and reporting that is proposed in this plan creates a continuous feedback loop of the performance of the Project ESC site and device management. This plan provides the approaches to be followed regarding ESC maintenance, monitoring, and reporting.

The ESCMP covers:

- Site management structures, practices, and procedures
- Weather Monitoring
- Erosion and Sediment Control Monitoring
    - Scheduled site visits, pre and post rain event monitoring and water sampling.
    - Rainfall event triggered manual turbidity, clarity, and pH monitoring.
- Reporting
    - Rainfall trigger event reporting following a rainfall trigger event.
    - Recommendations of changes that need to be implemented onsite and modifications to any ESC will also be included.

Chemical treatment will be monitored in accordance with the Project's Chemical Treatment Management Plan (Appendix A to the Project Erosion and Sediment Control Assessment Report (ESCAR)).

2. SITE SPECIFIC EROSION AND SEDIMENT CONTROL IMPLEMENTATION

The construction of all erosion and sediment controls will be managed as follows:

- An ESC Technical Specialist will prepare the Site-Specific Erosion and Sediment Control Plans (SSESCPs) in conjunction with the relevant construction Project Engineer, Project Manager and Earthworks Manager.
- Each SSESCP will be approved by the Project Manager and then submitted to Nelson City Council (NCC) for certification against the Nelson Tasman Erosion and Sediment Control Guidelines (NTESCG).
- Once certified, the Project Manager will issue the certified SSESCP to the Earthworks Manager responsible for the implementation.
- A pre-construction meeting will be held by the Project Manager or Project Engineer where the erosion and sediment controls to be built will be discussed and specific direction given on construction.
- The location of the controls and requirements of the relevant SSESCP will be confirmed on site with the construction team and the Project Manager or Project Engineer.

- The construction of the controls will be overseen by the Project Engineer and / or the ESC Advisor.
- Hold points for construction will be established for each control whereby the Project Engineer (or ESC Advisor) will inspect the work completed, for example the installation of anti-seep collars or the installation of the primary outlet.
- Each control will be ‘as built’ certified by the ESC Advisor to confirm compliance with the certified SSESCP prior to bulk earthworks commencing in the catchment of the device(s).
- Copies of the 'as-built' certifications will be submitted to NCC.

3. WEATHER MONITORING

3.1. Rain Forecast

Rain forecasts relevant to the site will be checked daily using the MetService / MetVuw online / NIWA forecasting systems. Close monitoring of the rain forecast will be necessary to ensure the appropriate site works can be implemented prior to rainfall trigger events.

During working days, daily weather forecast checks will be forwarded to all Site Supervisors and recorded in the daily prestart job sheets.

If the forecasts show more than 25mm of rainfall over a 24-hour period, then this will trigger the pre-rain event inspections (rain event with forecast >25mm over 24 hours), refer to Section 4.1 for further details. The purpose of these inspections is to check that the ESC devices and controls are set-up and ready for the rain event. This is in addition to the routine pre-rain event inspections undertaken by Site Supervisors.

3.2. Rain Gauges

Rainfall will be recorded on site at the existing weather station located near the southern extent of the Kākā Stream. The Project Manager will monitor rainfall recorded at that site. Rainfall trigger responses will be based on recorded events at that location, which is sufficient close to the various earthworks packages to be undertaken during the Project.

4. EROSION AND SEDIMENT CONTROL MONITORING

The Project Manager or nominated staff will conduct routine inspections of the sites. These inspections will take place with adequate time allocated and will be thorough and systematic. Members of the project construction team including the Project Engineer, will accompany the Project Manager or ESC Advisor on these inspections so that the Project Manager or ESC Advisor can better understand the work occurring at that time and that programmed to take place. It is also useful for the Site Supervisors to be reminded of their ESC obligations and for both parties to recognise good performance and outcomes, and where performance has not been to the standard expected or required by consents. This is particularly relevant in identifying how communication between personnel can be improved to avoid a recurrence of an issue.

Communication is critical to the successful implementation of SSESCPs. Internal inspections will cover all areas of the Project, even those that may have been dormant for some time, to ensure that the erosion and sediment controls are still operating properly. These internal inspections will be captured in writing and will include actions and timeframes for close out.

4.1. Site Inspections

4.1.1. Internal Site Inspections

Routine inspections are undertaken during and post instalment of ESC devices. During construction, certain stages are identified for inspection, such as during the installation of anti-seep collars, level spreaders, and T-bars.

Post construction monitoring is undertaken once a sediment retention pond (SRP) or decanting earth bund (DEB) is operational, and the rainfall activated chemical treatment system is operational for the first time. Monitoring will take place as soon as practicable following the first rainfall event that generates runoff to the ESC device. This is to assess the performance of the device and chemical treatment system and the resulting quality of treated water being discharged from the site.

The site will be inspected weekly as a minimum by the Project Manager (or nominated person) and/or ESC Advisor during the course of the works. These inspections will ensure that all ESC devices are installed correctly and then operate effectively throughout the duration of the works. This inspection programme will provide certainty to all parties that appropriate measures are being undertaken to ensure compliance with conditions of consent and the certified SSESCPs. The inspection regime will keep ESC management at the forefront of works on site. Any potential problems will be identified immediately, and remedial works will be promptly carried out.

The inspection programme shall consist of:

- **Weekly** site walkovers involving the environmental team to inspect all ESC measures, identify any maintenance or corrective actions necessary, assign timeframes for completion, and identify any devices that are not performing as anticipated through the certified SSESCP. Any maintenance actions will be undertaken that day where practical. Actions will be recorded and issued to the Earthworks Manager with specific actions required and closeout timeframes. Once completed, the Project Manager (or nominated person) will inspect the works and close-out the item.
- **Pre-rain event:** Prior to all forecast rainfall events, checks will be made of ESC devices, including chemical treatment systems, to ensure that they are fully functioning in preparation for the forecast event. These will be undertaken by the Site Supervisors or Management Team.
- **Pre-rain event with forecast >25mm over 24 hours:** These inspections are additional to the ‘business as usual’ pre-rain inspections. They must be undertaken by the Project Manager and Earthworks Manager or nominated and sufficiently experienced person(s).
- Prior to forecast rainfall “trigger” events, specific site inspections will be undertaken, targeted at any additional ESC measures that are required to be installed to ensure that the sites ESC management system performs effectively during an expected larger event.
- **Rainfall Trigger Inspections**: During or immediately after a rainfall trigger event of >25mm rainfall over any 24-hour period (subject to health and safety restrictions) inspections will be made of all SRPs and the following actions taken:
    - Clarity and pH testing of the inlet and outlet flows undertaken along with a general inspection of the sediment control devices.
    - Clarity of the water within the device adjacent to the decant outlet will be measured using either a clarity tube or black disc indicator.
    - The rainfall trigger alerts will be monitored by the Project Manager.
    - Any issues identified will be remedied as soon as practicable, and remedial measures will be recorded.

The purpose of these inspections is to confirm the performance of devices under the stress of heavy rainfall and obtain a spot check efficiency of the device.

- **Post-rain event**: Following all rainfall events including rainfall trigger events, inspections will be made of all ESC measures to ensure that all controls have performed as expected and to identify any maintenance requirements. Any remedial works will be documented during these monitoring inspections and immediately addressed where practical.

4.1.2. External (NCC) Site Inspections

The Project Manager or Earthworks Manager and or ESC Advisor will accompany the NCC inspector in all programmed NCC audits. All ESC maintenance actions identified by the Council inspector will be recorded and issued to the Project Manager for actioning, based on NCC instruction. The Earthworks Manager will report back the completion of those actions to the Project Manager will inspect the works and confirm that those actions have been completed. Confirmation will be emailed to the NCC inspector.

4.2. Water Quality Monitoring

Water quality monitoring will be undertaken during rainfall trigger event (>25mm of rain within a 24-hour period) site walkovers to provide a snapshot of the ESC performance.

Water quality will be monitored by:

- Clarity (measured at the outlet end of the SRP)
- pH (measured at the inflow and outflow of each chemically treated device)

The following water quality targets apply to the site's ESCs and will be measured during/after each rainfall trigger event (>25mm in a 24-hour period):

- Clarity of 100mm
- pH between 5.5 and 8.5 (for chemically treated devices)

If one or more of the targets identified are breached, then the management actions identified within Section 5.3 will be implemented.

5. MANAGEMENT RESPONSES

5.1. Regular Monitoring Responses

The key to successful implementation of ESC measures and minimising sediment yield will be through the daily and weekly visual monitoring of the site and maintenance of controls. This monitoring will be undertaken by the Site Foreman. The responses to that monitoring will be as follows.

- A checklist record will be made of each device inspected and its conditions, noting any maintenance requirements and timeframes of that to be undertaken. Maintenance will be based on ensuring compliance with NTESCG requirements.
- Ensuring all sediment retention devices are cleaned out before they reach 20% full of sediment.
- Completion of maintenance actions as soon as possible, and typically within 24 hours for standard issues and 8 hours for urgent issues.
- Emphasis on maintenance necessary prior to forecast rain.
- Sign-off of all completed maintenance and reporting to the Project Manager.

5.2. Incident Responses

If one of the following occurs:

i. A failure of an erosion and/or sediment control (e.g. perimeter control, SRP or DEB) that results in visible discharge of sediment to a stream.
ii. Slumping / mass movement or erosion associated with the works, but which is outside the catchment of a sediment control device or has resulted in a device being over-topped by sediment, where that sediment has discharged to a stream.

The responses will be:

- Inform NCC.
- Remedy the failure or event to prevent further uncontrolled discharges.
- Determine if the discharge is an isolated case or is likely to be repeated; and
- Investigate and implement modifications. Modifications could include:
  - Make alterations to erosion and sediment control measures and methodologies;
  - Consider additional ESC;
  - Refinement of chemical treatment systems;
  - Progressive stabilisation in sub catchments;
  - Increase maintenance of controls; and
  - Amendments to methodologies and sequencing of works and refinement of controls necessary.

5.3. Target Exceedance Responses

<u>SRP Water Clarity</u>

If the water clarity target detailed in Section 4.2 is not met the following management responses will occur.

- Within 24hrs of a threshold exceedance, a full audit of the condition of the control device and its contributing catchment will be carried out and recorded in writing.
- Remedy and record any obvious causes on site that may have contributed to a threshold exceedance as soon as practicable.
- Identify any additional reasons for the exceedance and opportunities to modify the management of the site to improve overall efficiency which may include:
  - Consider additional ESC;
  - Refinement of chemical treatment systems; and
  - Increase maintenance of controls.

Generally, any maintenance requirements will have been identified during regular monitoring. Additional considerations will include the measures noted above i.e.:

- The catchment area of the treatment device will be checked against the area assumed when the chemical dosing rate was set. The area and / or dose rate will be adjusted as needed.
- The dose rate will be checked. Additional bench testing and adjustment of the dose rate will be made if required.
- The chemical treatment system will be reviewed and if necessary.

Additional response measures may include:

- Increased frequency of desilting of device(s).
- Reducing the contributing catchment area by temporary stabilisation.
- Installation of additional sediment or erosion controls.
- Increasing forebay ponding areas within the site.

<u>pH exceedance</u>

Typically, chemical treatment of sediment control devices will slightly lower pH. If pH is recorded to be below 5.5, the following actions will occur:

- The catchment area of the treatment device will be checked against the area assumed when the chemical dosing rate was set. The area and / or dose rate will be adjusted as needed.
- The does rate will be checked. Additional bench testing and adjustment of the dose rate will be made if required.
- The chemical treatment system will be reviewed and if necessary.

If a pH exceedance is found where the pH is above 8.5 then the ESC Advisor will be contacted, and a plan and methodology will be developed and provided to NCC for review prior to implementation.

6. REPORTING

6.1. Rainfall Trigger Event Report

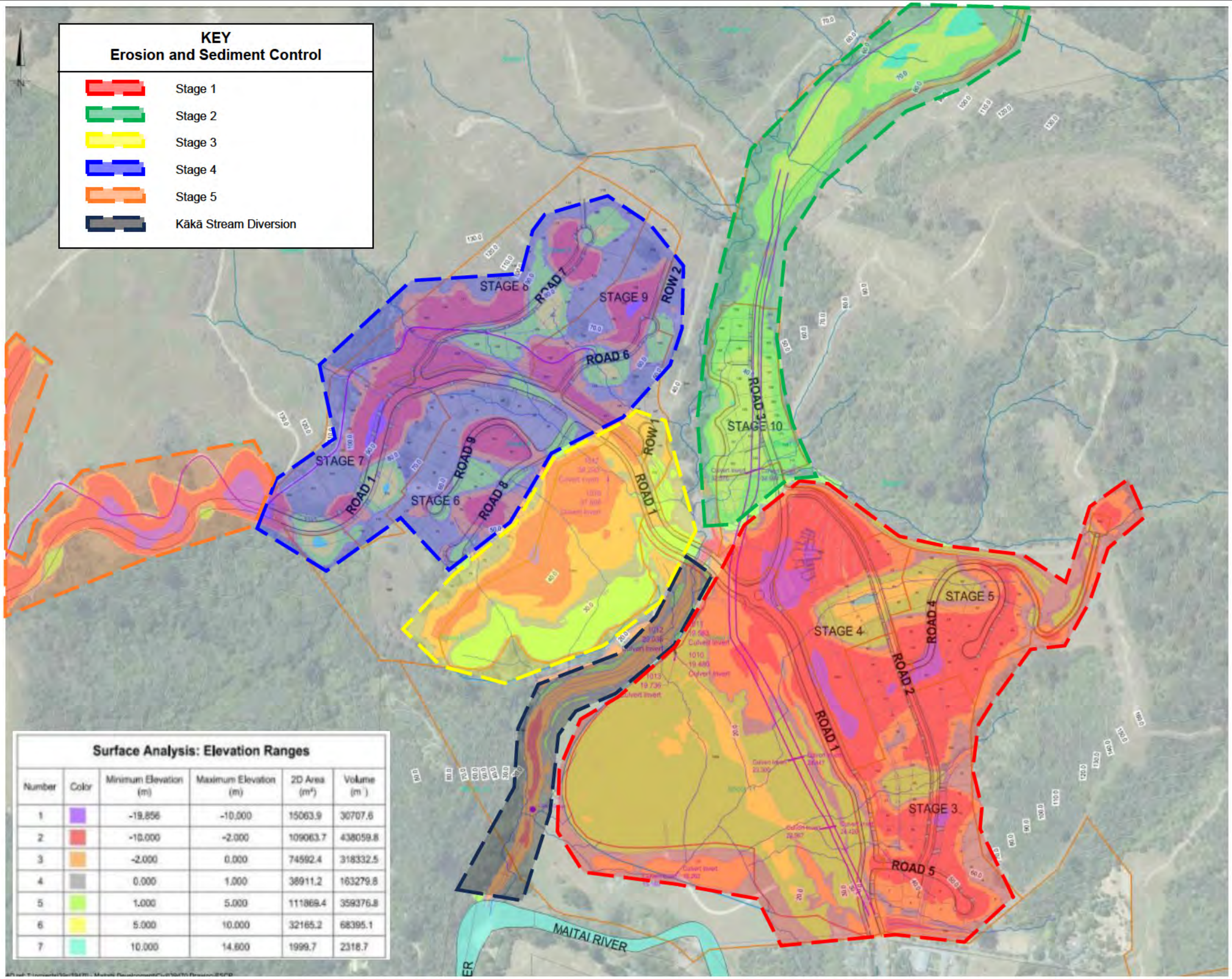
Following a rainfall trigger event (>25mm in a 24hr period), a summary report of the performance of SRPs, DEBs and overall ESC system observed during the rainfall event report will be provided to NCC. The report will include:

- A summary of the rainfall (total and intensity)
- A summary of the manual monitoring undertaken and comparison of manual monitoring results to previously recorded results
- A summary of the site performance against the performance targets.
- A record of any other matters which may have compromised the overall ESC performance during the rain event and the identified mitigation, maintenance, and management response.
- A summary of the water sample analysis.

The Rainfall Trigger Event Report will be provided to NCC within 10 working days of the rainfall trigger event.

APPENDIX C: SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLANS

Reference number	Title	Revision	Date
ESCP-000-00	Erosion and Sediment Control Plan – Staging Index	A	15.06.24
SSESCP-001	Site Specific Erosion and Sediment Control Plan – Stage 1	A	20.05.24
SSESCP-002	Site Specific Erosion and Sediment Control Plan – Stage 2	A	23.05.24
SSESCP-003	Site Specific Erosion and Sediment Control Plan – Stage 3	A	17.06.24
SSESCP-004	Site Specific Erosion and Sediment Control Plan – Stage 4	A	09.07.24
SSESCP-SW-01	Site Specific Erosion and Sediment Control Plan – Kaka Stream Diversion	A	26.05.24



KEY
Erosion and Sediment Control

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5
- Kākā Stream Diversion

Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)	2D Area (m²)	Volume (m³)
1		-19.856	-10.000	15063.9	30707.6
2		-10.000	-2.000	109063.7	438059.8
3		-2.000	0.000	74592.4	318332.5
4		0.000	1.000	38911.2	163279.8
5		1.000	5.000	111869.4	359376.8
6		5.000	10.000	32165.2	68395.1
7		10.000	14.600	1999.7	2318.7

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	15.06.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL
Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Staging Index
Drawn	ZW
Checked	CS
Drawing No.	ESCP-000-00
Sheet No.	00

Maitahi Residential Development

CCKV Maitai Dev Co LP

SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN

STAGE 1

SSESCP-001

Revision A
20 May 2024

SouthernSkies Environmental

1 STAGE 1 SSESCP - CONSTRUCTION NOTES

1.1 Scope

This Site-Specific Erosion and Sediment Control Plan (SSESCP) covers the land disturbing activities associated with Stage 1 of the Maitahi Development.

In brief, the Stage 1 construction sequence will be:

- Enabling works to create clean water diversions and construct Sediment Retention Pond (SRP) 1.
- Cut to fill earthworks over 2.7 hectares for Stage 1A
- Cut to fill earthworks over 2.9ha for Stage 1B.
- Construction of SRP-2.
- Cut to fill earthworks over 9.4ha for Stage 1C.
- Form access road and building platform for cell tower

The proposed erosion and sediment control (ESC) measures and methodology have been designed in accordance with the *Nelson Tasman Erosion and Sediment Control Guidelines, July 2019 (NTESCG).*

The ESC measures are detailed on the erosion and sediment control (ESC) drawings provided in Appendix B.

1.2 Methodology

- Prior to the commencement of any works the Project Manager/ Earthworks Manager will inspect the site to confirm the suitability of the proposed controls and methodology.
- A final version of this SSESCP will be completed and provided to NCC for certification prior to commencement of earthworks within this stage.
- At the approximate location, as detailed in the attached drawings, the erosion and sediment controls will be constructed.

<u>Enabling Works</u>

- The first step will be to install a silt fence below the footprint of SRP-1 and construct the pond. SRP-1 is be built to service a maximum catchment area of 5ha. SRP-1 design details are provided in ESCP-001-SRP-1.
- During this stage SRP-1 will not have much open catchment area as the site remains largely stabilised and clean water flows through the existing flow paths.
- Clean water diversions will need to be construction around the eastern side of Stage 1, and these will be constructed as the earthworks progress north. The first sections of the clean water diversion will have silt fences installed below the required earthwork areas. With these in place, the permanent swale and culvert will be installed along the southern boundary of the site.
- Any cut material generated during the enabling works phase will be stockpiled within the catchment of SRP-1.

As part of the enabling works, the Fill Disposal Sites will be set up. Refer to Stage 2 SSESCP for details. The Fill Disposal Sites will be setup to receive material prior to the commencement of earthworks. The Fill Disposal Sites will be accessed via the existing metalled track that runs north-south through the Site.

<u>Stage 1A</u>

- Once the clean water diversions have been constructed and stabilised, cut to fill earthworks will commence.
- Any unsuitable material will be carted to the north and deposited in the Fill Disposal Sites.
- The total earthworks area during Stage 1A is approximately 2.7ha.
- Dirty water from the cut area will flow downslope (west) towards the existing track. The existing track forms a `~500mm high bund where the water will track along towards an existing 375mm diameter culvert. Runoff will then follow the dirty water diversion around the current fill area to SRP-1.
- Clean water will be diverted to the north and south of the earthworks area.
- Once the earthworks are complete in Stage 1A the area will be topsoiled and stabilised (e.g. seeded and mulched). Once stabilised, the area will be diverted to the south and off site as clean water.

<u>Stage 1B</u>

- Stage 1B is a continuation of Stage 1A as the earthworks progress north.
- The clean water diversion along the eastern site boundary will be extended to the north, capturing the clean water and diverting it to the south, via the permanent swales.
- Stage 1B earthworks area is approximately 2.9ha.
- Stage 1B will be progressively stabilised as the earthworks reach the required design levels.
- At this stage the fill cannot be expanded until the Kākā Stream is diverted. Refer to Kākā Stream Diversion ESCPs for further details.

<u>Stage 1C</u>

- Stage 1C is a continuation of Stage 1B as the earthworks progress north.
- SRP-2 will be constructed on the western edge of the fill. SRP-2 is be built to service a maximum catchment area of 5ha. Refer to ESCP-001-SRP-2 for design details.
- The clean water diversion along the eastern site boundary will be extended to the north, diverting clean water to the north.
- Stage 1C earthworks area is approximately 9.4ha. The runoff from the earthworks area will be split between SRP-1 and SRP-2. Majority of the cut area will be diverted to SRP-1 and the fill area will be serviced by SRP-2.

<u>Cell Tower Access Track and Building Platform</u>

- Minor cut and fill operation to create an access track from the upper extent of Stage 1C to the Cell Tower.
- Clean water diversion bunds to be installed above the access track alignment. Silt fences to be installed immediately below the track alignment.
- The works are expected to be completed in approximately two weeks. The access track will be immediately sheeted with aggregate and exposed batters, topsoiled, seeded and mulched.

As-Builts

- An as-built for each sediment control will be completed following their installation certifying that the controls have been constructed in accordance with this ESCP and the NTESCG.

Dust Management

- The emphasis of the site dust strategy will be one of prevention.
- A water cart will be used, as required, to dampen haul roads and prevent dust.
- Speed restriction will be in place throughout the site to minimise dust generation from vehicles and plant.
- If dust cannot be managed during excessively windy conditions, then the earthworks will cease until the wind speed drops.

Stabilisation

- The works are to be staged in accordance with the staging details above. As areas are completed, they will be progressively stabilised. Stabilisation will include, aggregate, topsoil and grass seeded, including mulching when appropriate, and geotextile in some instances. Note, all sediment control will remain in place until the site is stabilised for the respective catchment area.

Construction Timetable

The stage works are planned to commence in Year 1 of the development (expected to be 2025/26). The Stage 1 earthworks are expected to take approximately eight months to complete.

1.3 Chemical Treatment

- Chemical treatment will be employed on SRP-1 and SRP-2. Refer to the site's Chemical Treatment Management Plan (ChemTMP) for details.

- All chemical treatment will be managed in accordance with the site's Chemical Analysis and Reactivity Test (CART) report and ChemTMP.

1.4 Monitoring and Maintenance

- The ESC measures will be inspected and signed off by the Project Manager or Environmental Advisors prior to commencement of earthworks.
- The monitoring and maintenance requirements for the ESC measures will be in accordance with the Erosion and Sediment Control Monitoring Report, best practice procedures and schedules including extreme weather events, remedial actions, and response.
- The ESC monitoring and maintenance requirements will include, but are not limited to:
  - all ESC measures will be inspected on a weekly basis and within 24 hours of each rainstorm event that is likely to impair the function of performance of the controls.
  - any required maintenance or improvements to control measures will be undertaken immediately.
  - SRPs will be clean out before the volume of accumulated sediment reaches 20% of the total volume of the pond. Forebays will be cleaned out more regularly, as sediment deposition occurs.
  - sediment deposits against the silt fences will be removed as necessary and before sediment accumulation reaches 20% of the fabric height.
  - all erosion and sediment control measures will be maintained in accordance with NTESCG; and
  - weather forecasts will be monitored on a daily basis.
- A record will be maintained of the date and time of inspections undertaken, any maintenance requirements identified, and any maintenance undertaken.
- All ESC measures are to be monitored and maintained throughout the works until the site is stabilised.

The ESCMP includes:

- Pre and post rain event monitoring.
- Rainfall trigger event monitoring when rainfall exceeds 25mm within a 24-hour period.
- During a rainfall trigger event, the site's ESC measures will be checked, and performance of the sediment control measures tested by clarity and pH.
- The discharge targets are:
  - >100mm of clarity measured at the outlet end of the sediment control measure
  - A pH between 5.5 and 8.5 when using chemical treatment.

1.5 Rainfall Response and Contingency Measures

- Best management practices will be used to minimise sediment yields and monitor any potential effects. In addition to the visual inspections and weekly self-auditing refer above, if a severe weather event is forecast, (a severe weather event is defined as greater than a 5% AEP across the project works area) the following actions will be implemented.
- Pre-Weather Event Procedure:
  - Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;
  - Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
  - As far as practicable, stabilise disturbed areas; and
  - Photograph critical ESC measures prior to the weather event to document pre-weather event condition.
- During the severe weather event that results in the discharge of treated discharges from the sediment retention devices water quality inspections will be undertaken where practical at discharge locations where treated discharge could leave the site. The discharges will be checked to document water quality.

1.6 Spill Management and Contingency

- Spill kits will be located at the site sign in station. Fire extinguishers will be located in all site vehicles.
- All refuelling will be undertaken a minimum of 20m away from a water course or overland flow path.
- If there is a chemical spill onsite it shall be immediately contained using earth bunds, or silt socks to prevent it entering water bodies. The spilt chemical shall be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it shall be mixed with a volume of soil to allow the spilt chemical to be collected along with the contaminated soil. The material will then be removed off site to an authorised facility.
- If there is a spill of chemical into ponded water, discharge from the pond to natural water shall be prevented.

If there is a spill of chemical into flowing water:

1) Nelson City Council shall be advised immediately.

2) The volume of the spill shall be recorded.

3) If possible, the water and spilt chemical shall be pumped into a bund or pond until all the spilt chemical has been removed from the watercourse.

4) If the chemical cannot be removed from the watercourse any downstream users shall be identified and advised.

1.7 Staff Contact Details

Position	Name	Ph Number
Construction Manager	Neil Donaldson	[redacted]
Earthworks Manager	Malcolm Edridge	[redacted]
Site Engineer	TBC	TBC
Environmental / ESC Advisor	Campbell Stewart Zac Woods	[redacted]

Appendix A – Erosion and Sediment Control Details

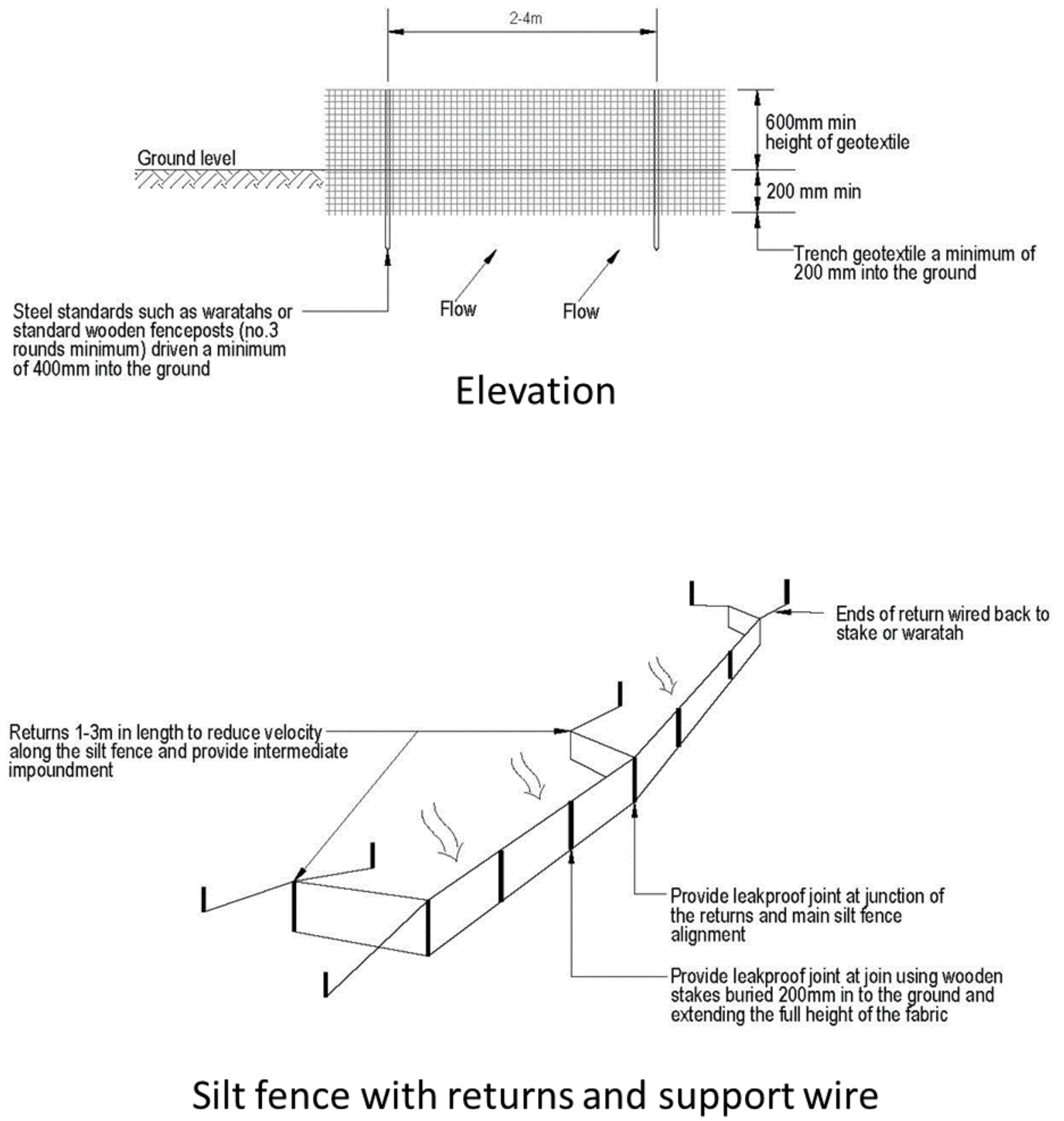


Figure 1: Schematic of a silt fence.

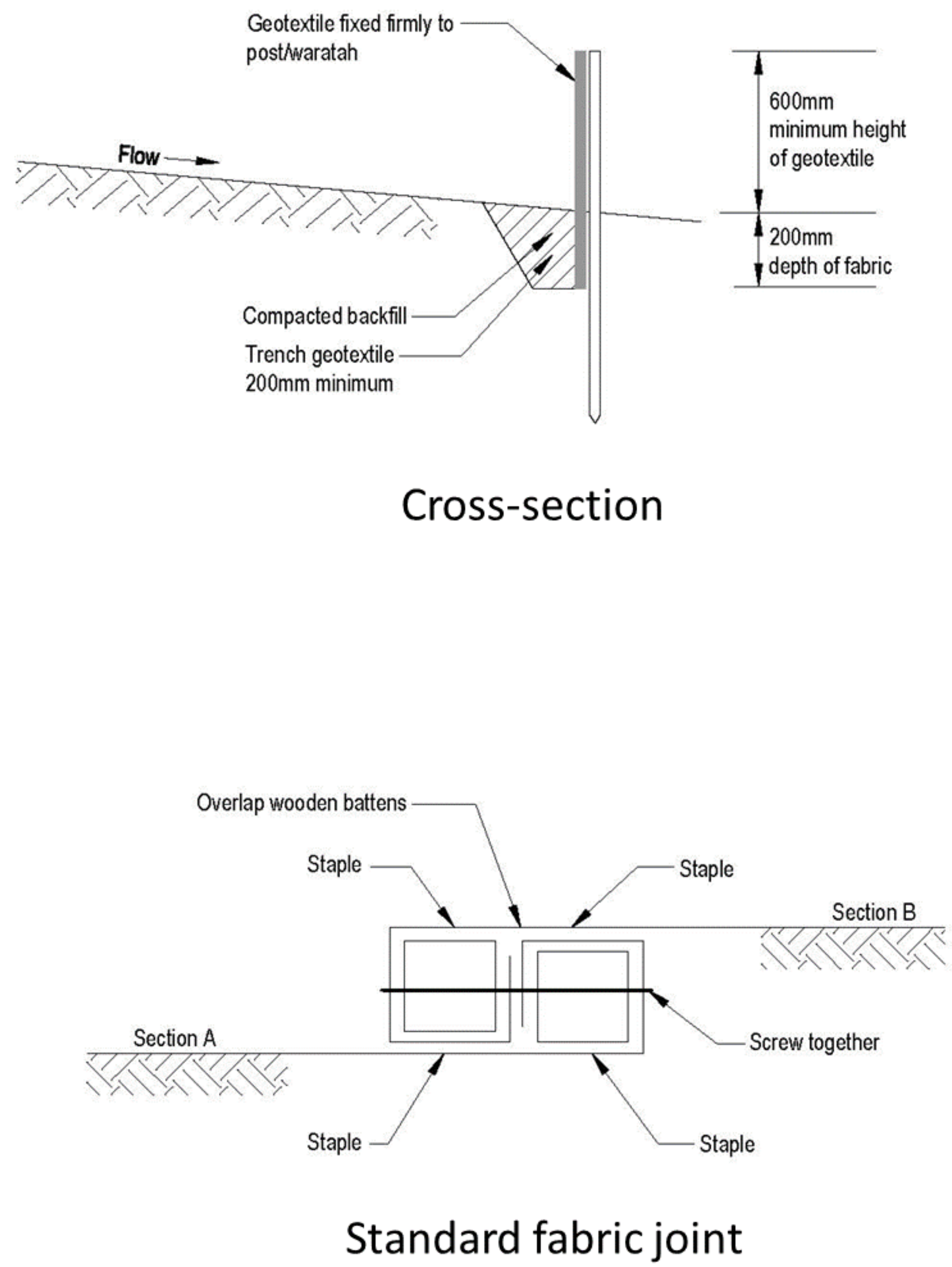


Figure 2: Silt fence cross-section and standard fabric joint.

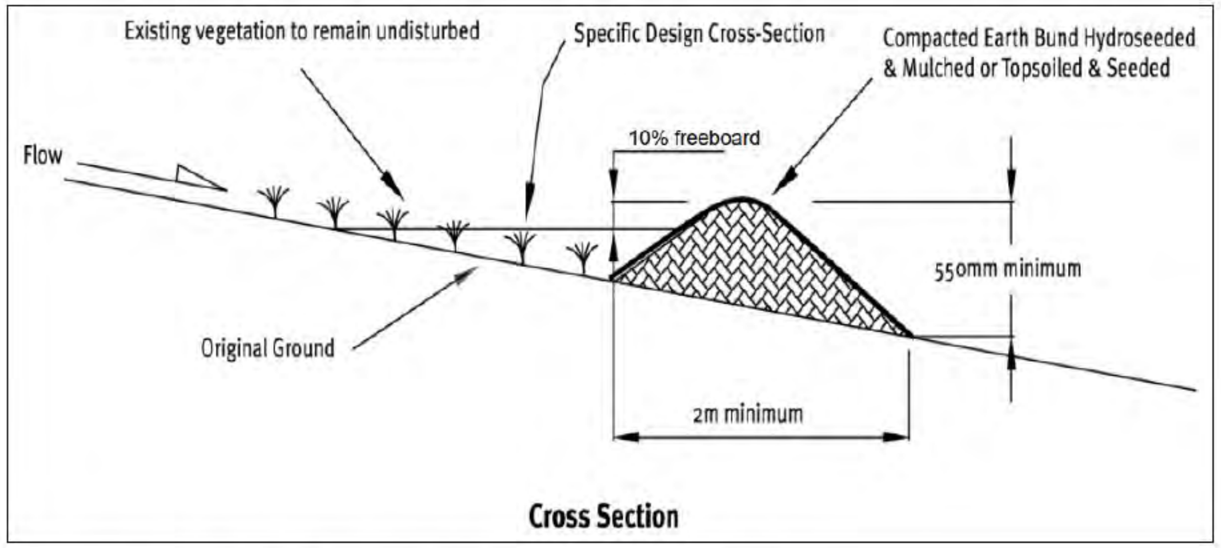


Figure 1: Cross-section of a clean water diversion (permitter bund).

Figure 2: Turfing scraped from within the site to stabilise the perimeter bund. The perimeter bund provides both clean and dirty water control.

Table 1: Clean water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 300mm Freeboard
41mm	5ha	0.17097	0.3m	2%	250	275

A minimum bund height of 500mm will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

All clean water diversions must be stabilised.

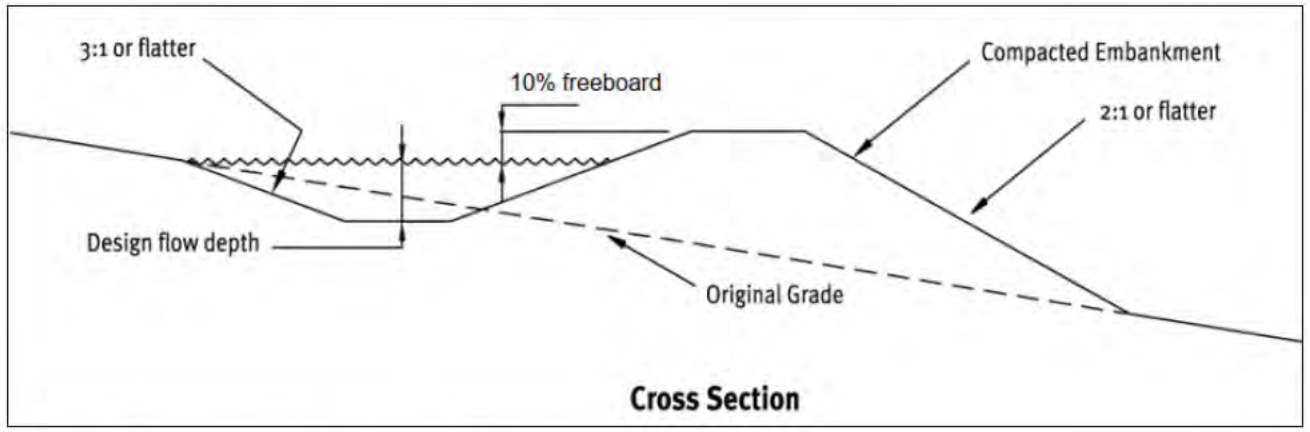


Figure 3: Cross-section of a dirty water diversion.

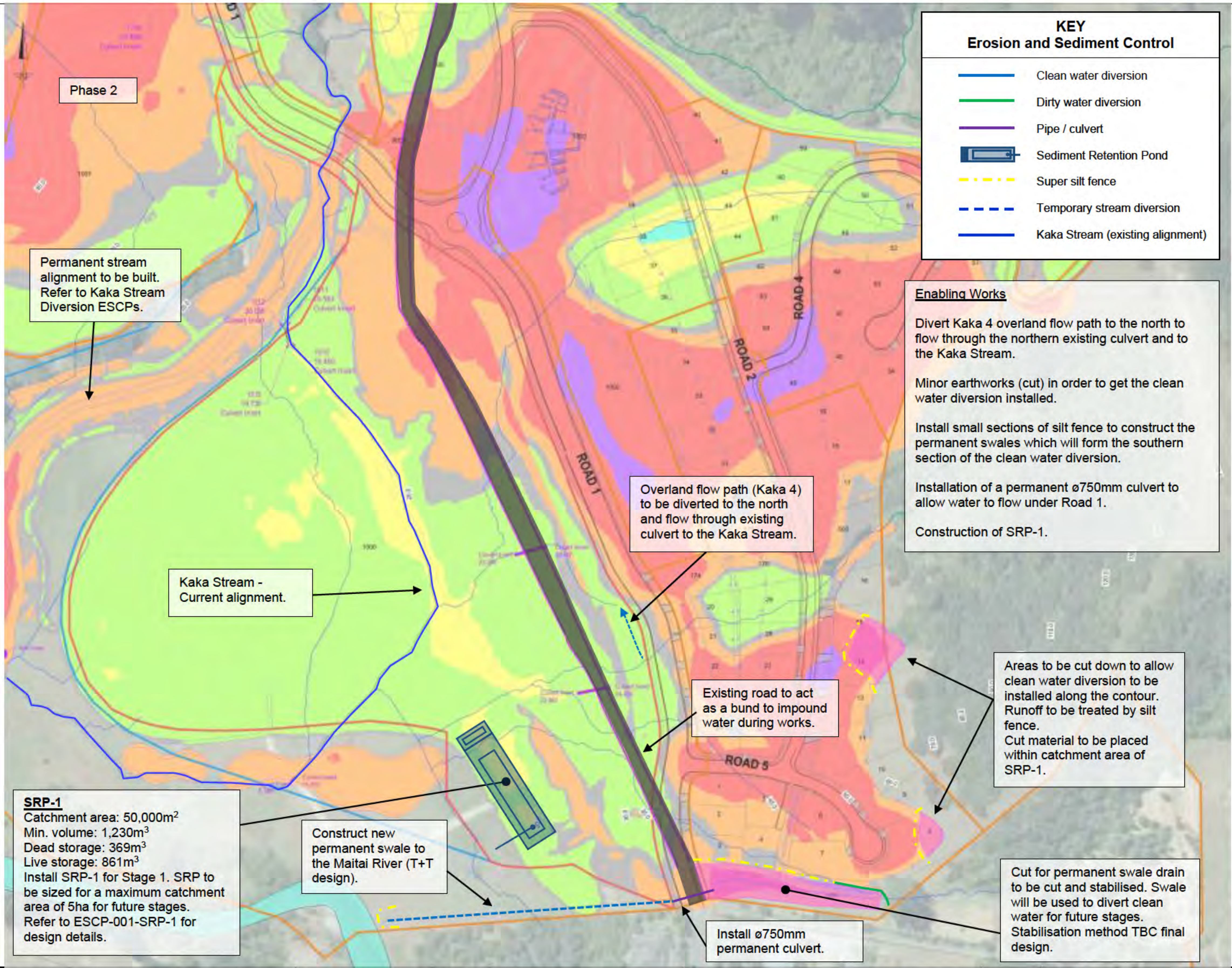
Table 2: Dirty water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 10% Freeboard
41mm	5ha	0.34194	0.5	2%	250	275

A minimum bund height of 500mm will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

Appendix B – Erosion and Sediment Control Plans

Title	Drawing No.	Sheet No.	Revision	Date
Erosion and Sediment Control Plan – Stage 1: Enabling Works	ESCP-001-01	1	A	20.05.24
Erosion and Sediment Control Plan – Stage 1A	ESCP-001-02	2	A	20.05.24
Erosion and Sediment Control Plan – Stage 1B	ESCP-001-03	3	A	20.05.24
Erosion and Sediment Control Plan – Stage 1C	ESCP-001-04	4	A	20.05.24
Erosion and Sediment Control Plan – SRP-1 Design Details	ESCP-001-SRP-1	5	A	20.05.24
Erosion and Sediment Control Plan – SRP-2 Design Details	ESCP-001-SRP-2	6	A	20.05.24



Enabling Works

Divert Kaka 4 overland flow path to the north to flow through the northern existing culvert and to the Kaka Stream.

Minor earthworks (cut) in order to get the clean water diversion installed.

Install small sections of silt fence to construct the permanent swales which will form the southern section of the clean water diversion.

Installation of a permanent ø750mm culvert to allow water to flow under Road 1.

Construction of SRP-1.

SRP-1

Catchment area: 50,000m^2
Min. volume: 1,230m^3
Dead storage: 369m^3
Live storage: 861m^3
Install SRP-1 for Stage 1. SRP to be sized for a maximum catchment area of 5ha for future stages.
Refer to ESCP-001-SRP-1 for design details.

Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)	2D Area (m^2)	Volume (m^3)
1		-19.856	-10.000	[illegible]	[illegible]
2		-10.000	-2.000	[illegible]	438059.8
3		-2.000	0.000	74592.4	318332.6
4		0.000	1.000	38911.2	193279.8
5		1.000	5.000	111869.4	358375.8
6		5.000	10.000	32185.2	68395.1
7		10.000	14.000	9909.7	2316.7

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

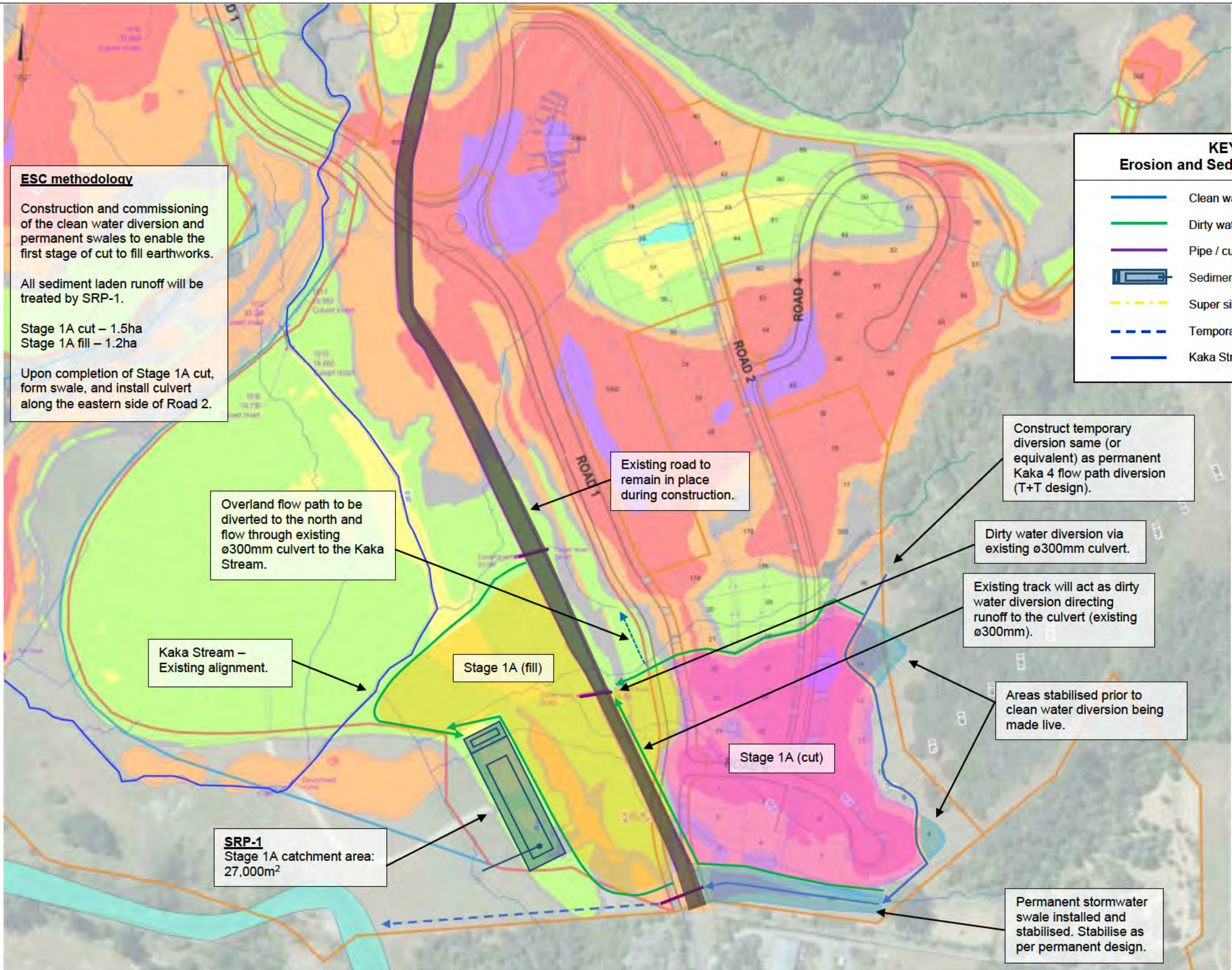
REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 1: Enabling Works

Drawn	Checked	Drawing No.	Sheet No.
MD	CS	ESCP-001-01	1



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
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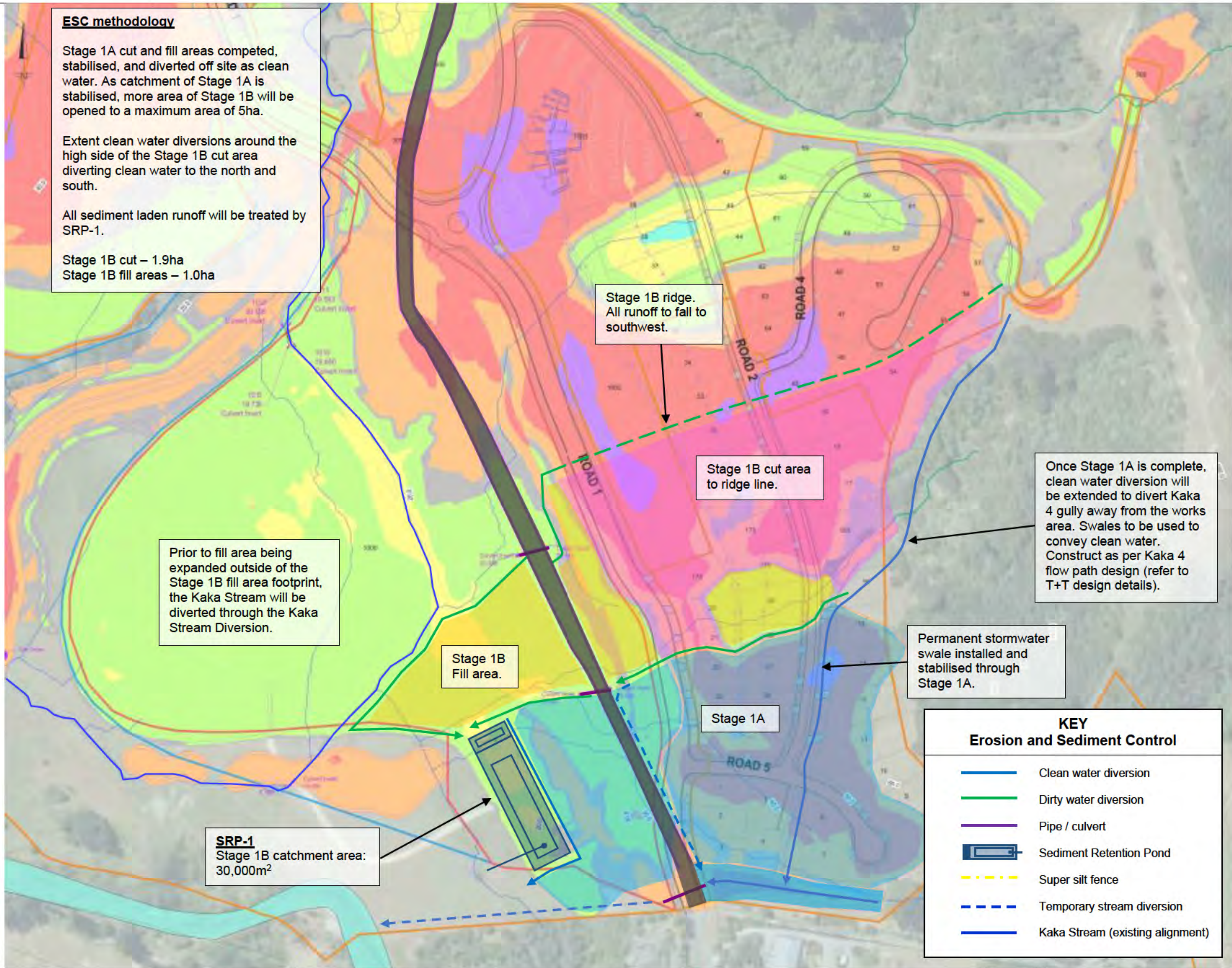
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 1A
Drawn	MD
Checked	CS
Drawing No.	ESCP-001-02
Sheet No.	2



Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)	2D Area (m²)	Volume (m³)
1		-19.858	-10.000	15083.9	30207.8
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3		-2.000	0.000	74592.4	318332.5
4		0.000	1.000	38911.2	163279.8
5		1.000	5.000	111869.4	358376.8
6		5.000	10.000	32185.2	68085.1
7		10.000	14.000	9999.7	2318.7

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
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3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

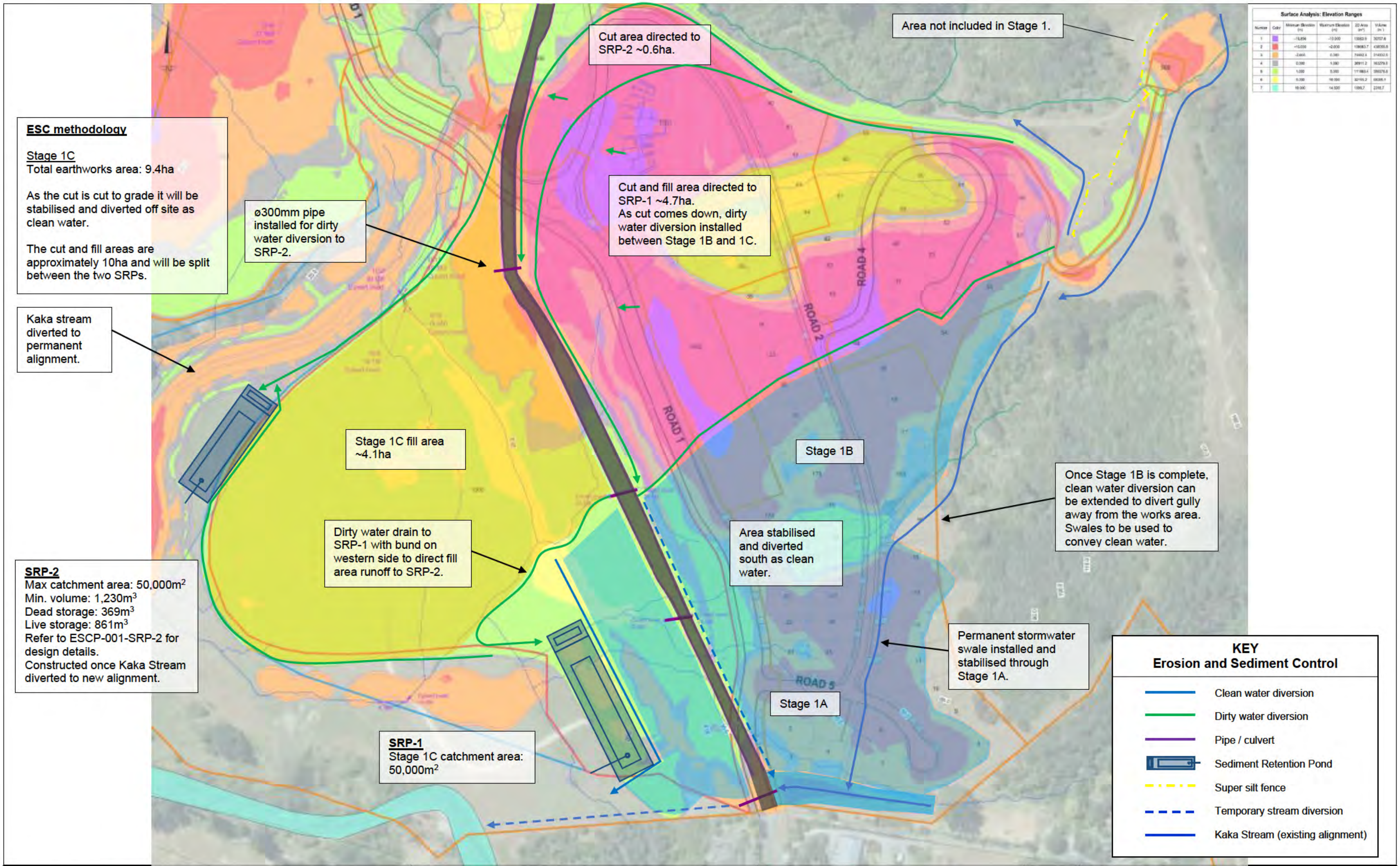
REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 1B

Drawn	Checked	Drawing No.	Sheet No.
MD	CS	ESCP-001-03	3



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	**MAITAHI DEVELOPMENT**
Title	**Erosion & Sediment Control Plan Stage 1C**

Drawn	Checked	Drawing No.	Sheet No.
MD	CS	ESCP-001-04	4

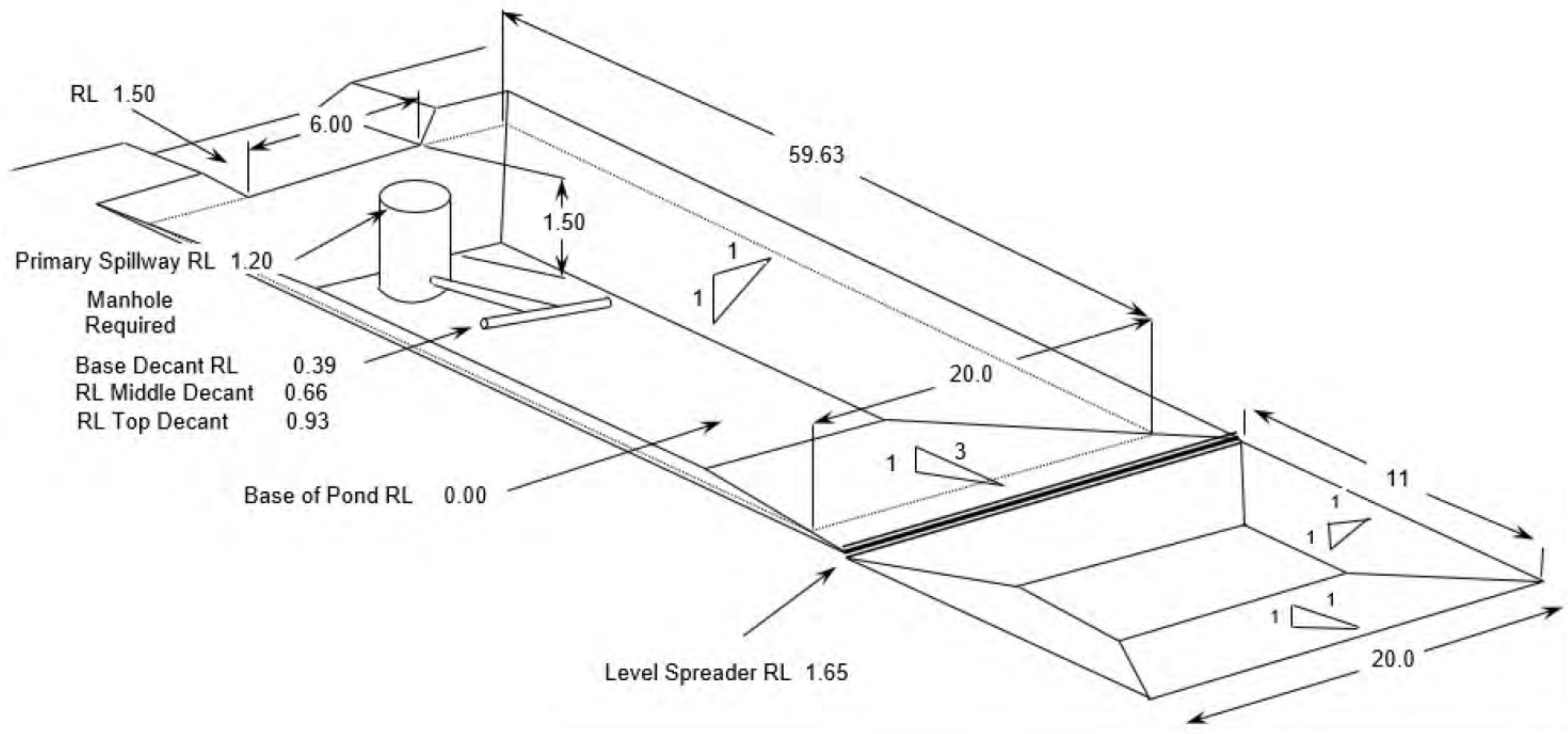
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.50	0.00

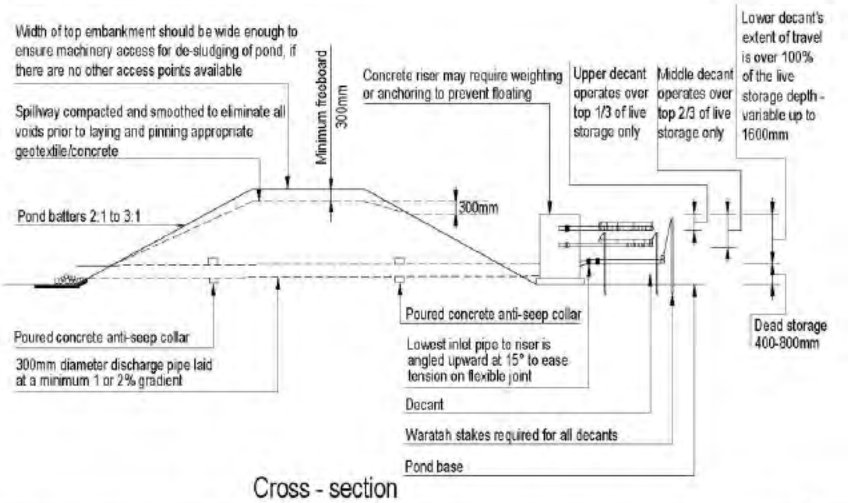
SRP-1

Minimum Storage Volume (m3)	1230
Dead storage (m3)	369
Live storage (m3)	861
Length at Emergency Spillway Level	59.63
Width at Emergency Spillway Level	20.08
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	Manhole Required
Number of decants	3
Number of holes per decant	182
Minimum outlet diameter	300mm
RL Emergency Spillway	1.50
RL Primary Spillway	1.20
RL Level Spreader (min)	1.65
RL Base Decant	0.39
RL Middle Decant	0.66
RL Top Decant	0.93
Length at Base	53.63
Width at Base	17.08

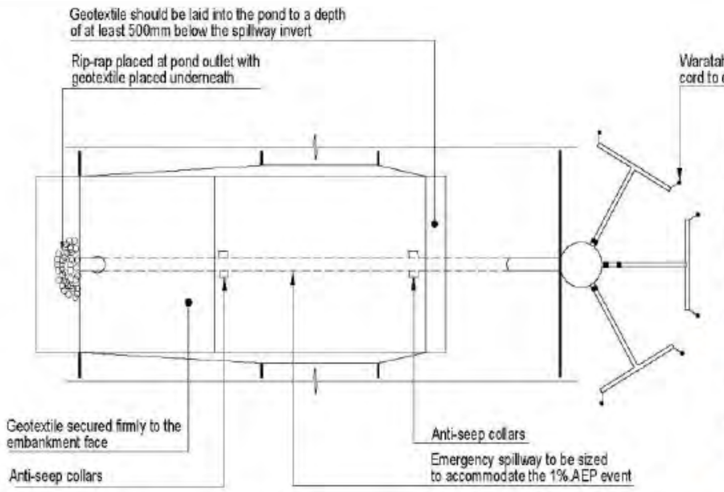
Forebay

Volume	123 m3	
Depth	1 m	min. depth
Width	20.08 m	full width of pond
Length	11 m	min. length





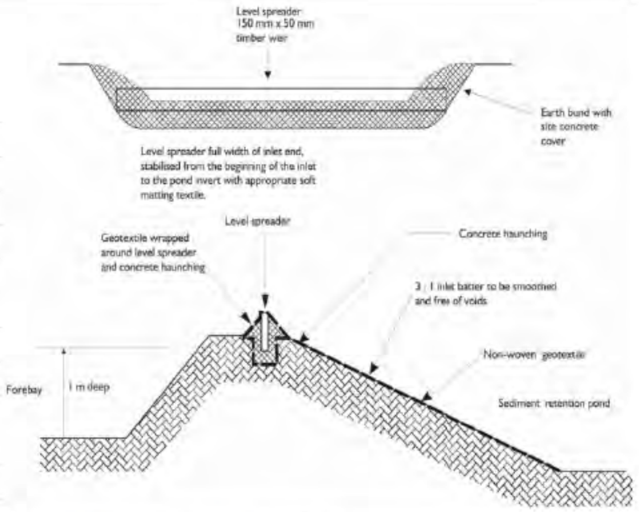
Cross - section



SRP-1 Sizing Calculations

Q =	0.34194	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	5	Max. catchment area.
V =	1230.98	
Q =	0.34194	
D =	3600	

Forebay volume = 123.098



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-1 Design Details

Drawn	Checked	Drawing No.	Sheet No.
MD	CS	ESCP-001-SRP-1	

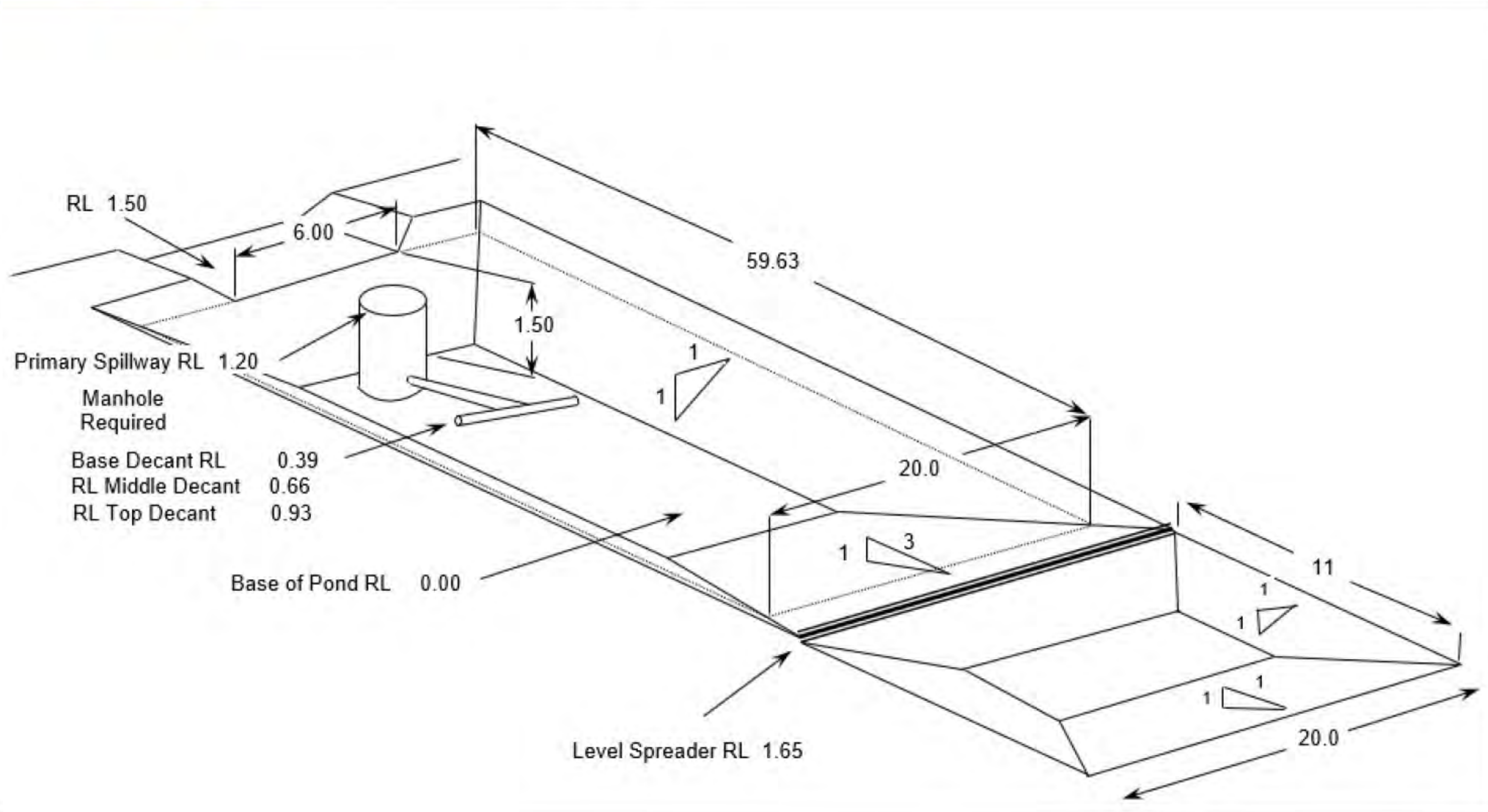
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.50	0.00

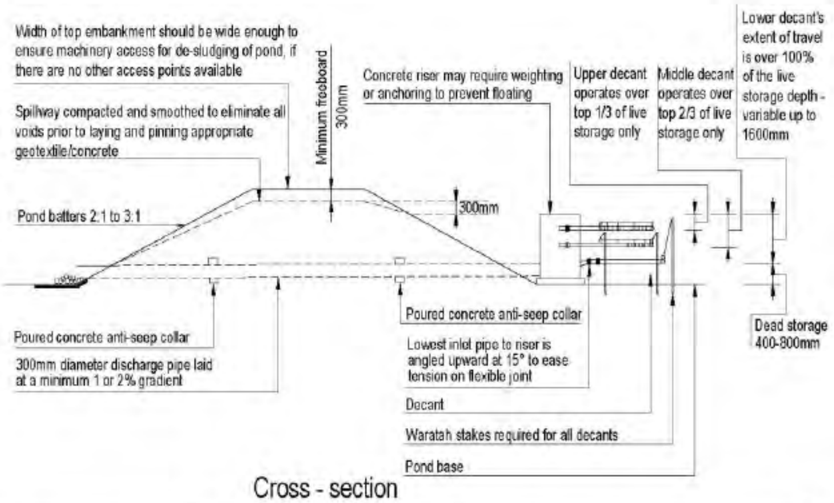
SRP-2

Minimum Storage Volume (m3)	1230
Dead storage (m3)	369
Live storage (m3)	861
Length at Emergency Spillway Level	59.63
Width at Emergency Spillway Level	20.08
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	Manhole Required
Number of decants	3
Number of holes per decant	182
Minimum outlet diameter	300mm
RL Emergency Spillway	1.50
RL Primary Spillway	1.20
RL Level Spreader (min)	1.65
RL Base Decant	0.39
RL Middle Decant	0.66
RL Top Decant	0.93
Length at Base	53.63
Width at Base	17.08

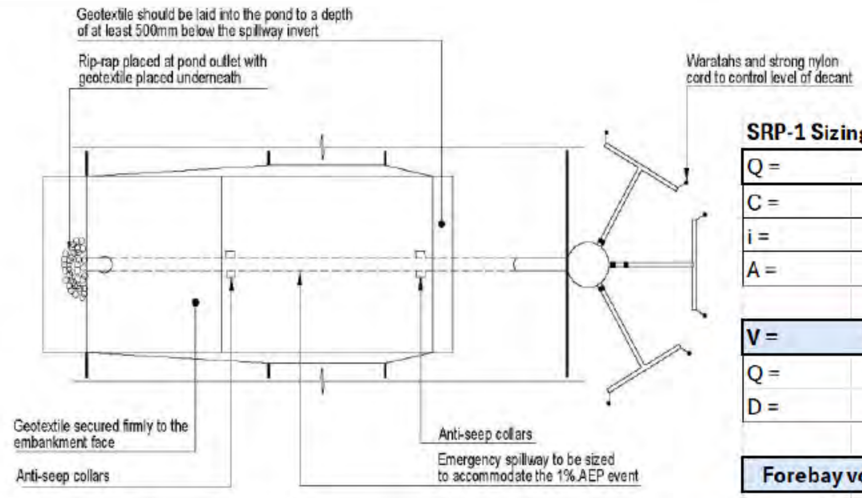
Forebay

Volume	123 m3	
Depth	1 m	min. depth
Width	20.08 m	full width of pond
Length	11 m	min. length





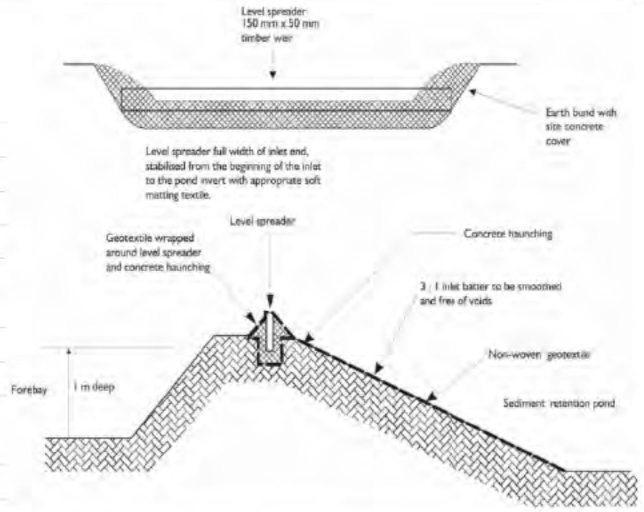
Cross - section



SRP-1 Sizing Calculations

Q =	0.34194	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	5	Max. catchment area.
V =	1230.98	
Q =	0.34194	
D =	3600	

Forebay volume = 123.098



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT		
Title	Erosion & Sediment Control Plan SRP-2 Design Details		
Drawn MD	Checked CS	Drawing No. ESCP-001-SRP-2	Sheet No.

Maitahi Residential Development

CCKV Maitai Dev Co LP

SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN

STAGE 2

SSESCP-002

Revision A
23 May 2024

SouthernSkies Environmental

1 STAGE 2 SSESCP - CONSTRUCTION NOTES

1.1 Scope

This Site-Specific Erosion and Sediment Control Plan (SSESCP) covers the land disturbing activities associated with Stage 2 of the Maitahi Development.

In brief, the Stage 2 construction sequence will be:

- Enabling works to construct the Kākā 2 stream diversion.
- Construct ESC measures DEB-4, SRP-3, SRP-4, DEB-5, and SRP-5.
- Construction of temporary crossing over the Kākā Stream.
- Stage 2 largely consist of fill. Minimal cut is required within Stage 2.

The proposed erosion and sediment control (ESC) measures and methodology have been designed in accordance with the *Nelson Tasman Erosion and Sediment Control Guidelines, July 2019 (NTESCG).*

The ESC measures are detailed on the erosion and sediment control (ESC) drawings provided in Appendix B.

1.2 Methodology

- Prior to the commencement of any works the Project Manager/Earthworks Manager will inspect the site to confirm the suitability of the proposed controls and methodology.
- A final version of this SSESCP will be completed and provided to NCC for certification prior to the commencement of earthworks within this stage.
- At the approximate location, as detailed in the attached drawings, the erosion and sediment controls will be constructed.

Enabling Works

- The first step will be to construct the lower section of the new stream alignment for the Kākā 2 stream. This will be completed offline. A silt fence will be installed below the footprint of this section of work.
- Once live, the Kākā 2 stream will be protected using dirty water diversions.
- Sediment control measures will be constructed progressively as the fill extends to the north. Note, the unsuitable fill area will need to be setup concurrently with the Stage 1 works.

Stage 2

- Once the clean water diversions have been constructed and stabilised, the sediment control measures will be progressively installed as the fill progresses north. The sediment control measures will be installed and certified prior to the commencement of filling activities within the area.
- Any unsuitable material will be carted to the north and deposited in the Unsuitable Fill Area.
- The total fill area available in Stage 2 is approximately 4.8ha. This includes “Phase 4” of the development, the Valley Fill area and the Unsuitable Fill area.

Temporary Crossing

A temporary crossing will be constructed for construction machinery to cross the Kākā Stream. Final detailed is yet to be confirmed, however it is expected to be 3 x 1050mm diameter culverts to form the crossing. The construction methodology will be confirmed as part of the Final SSESCP for Stage 2.

As-Builts

- An as-built for each sediment control will be completed following their installation certifying that the controls have been constructed in accordance with this ESCP and the NTESCG.

Dust Management

- The emphasis of the site dust strategy will be one of prevention.
- A water cart will be used, as required, to dampen haul roads and prevent dust.
- Speed restriction will be in place throughout the site to minimise dust generation from vehicles and plant.
- If dust cannot be managed during excessively windy conditions, then the earthworks will cease until the wind speed drops.

Stabilisation

- The works are to be staged in accordance with the staging details above. As areas are completed, they will be progressively stabilised. Stabilisation will include, aggregate, topsoil and grass seeded, including mulching when appropriate, and geotextile in some instances. Note, all sediment control will remain in place until the site is stabilised for the respective catchment area.

Construction Timetable

The stage works are planned to commence in 2026/2027. The Stage 2 works are expected to take approximately six to seven months to complete.

1.3 Chemical Treatment

- Chemical treatment will be employed on each sediment control measures. Refer to the site’s Chemical Treatment Management Plan (ChemTMP) for details.
- All chemical treatment will be managed in accordance with the site’s Chemical Analysis and Reactivity Test (CART) report and ChemTMP.

1.4 Monitoring and Maintenance

- The ESC measures will be inspected and signed off by the Project Manager or Environmental Advisors prior to commencement of earthworks.
- The monitoring and maintenance requirements for the ESC measures will be in accordance with the Erosion and Sediment Control Monitoring Report, best practice procedures and schedules including extreme weather events, remedial actions, and response.
- The ESC monitoring and maintenance requirements will include, but are not limited to:
  - all ESC measures will be inspected on a weekly basis and within 24 hours of each rainstorm event that is likely to impair the function of performance of the controls.
  - any required maintenance or improvements to control measures will be undertaken immediately.
  - SRPs will be clean out before the volume of accumulated sediment reaches 20% of the total volume of the pond. Forebays will be cleaned out more regularly, as sediment deposition occurs.
  - sediment deposits against the silt fences will be removed as necessary and before sediment accumulation reaches 20% of the fabric height.
  - all erosion and sediment control measures will be maintained in accordance with NTESCG; and
  - weather forecasts will be monitored on a daily basis.
- A record will be maintained of the date and time of inspections undertaken, any maintenance requirements identified, and any maintenance undertaken.
- All ESC measures are to be monitored and maintained throughout the works until the site is stabilised.

The ESCMP includes:

- Pre and post rain event monitoring.
- Rainfall trigger event monitoring when rainfall exceeds 25mm within a 24-hour period.
- During a rainfall trigger event, the site’s ESC measures will be checked, and performance of the sediment control measures tested by clarity and pH.
- The discharge targets are:
  - >100mm of clarity measured at the outlet end of the sediment control measure
  - A pH between 5.5 and 8.5 when using chemical treatment.

1.5 Rainfall Response and Contingency Measures

- Best management practices will be used to minimise sediment yields and monitor any potential effects. In addition to the visual inspections and weekly self-auditing refer above, if a severe weather event is forecast, (a severe weather event is defined as greater than a 5% AEP across the project works area) the following actions will be implemented.
- Pre-Weather Event Procedure:
  - Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;
  - Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
  - As far as practicable, stabilise disturbed areas; and
  - Photograph critical ESC measures prior to the weather event to document pre-weather event condition.
- During the severe weather event that results in the discharge of treated discharges from the sediment retention devices water quality inspections will be undertaken where practical at discharge locations where treated discharge could leave the site. The discharges will be checked to document water quality.

1.6 Spill Management and Contingency

- Spill kits will be located at the site sign in station. Fire extinguishers will be located in all site vehicles.
- All refuelling will be undertaken a minimum of 20m away from a water course or overland flow path.
- If there is a chemical spill onsite it shall be immediately contained using earth bunds, or silt socks to prevent it entering water bodies. The spilt chemical shall be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it shall be mixed with a volume of soil to allow the spilt chemical to be collected along with the contaminated soil. The material will then be removed off site to an authorised facility.
- If there is a spill of chemical into ponded water, discharge from the pond to natural water shall be prevented.

If there is a spill of chemical into flowing water:

1) Nelson City Council shall be advised immediately.

2) The volume of the spill shall be recorded.

3) If possible, the water and spilt chemical shall be pumped into a bund or pond until all the spilt chemical has been removed from the watercourse.

4) If the chemical cannot be removed from the watercourse any downstream users shall be identified and advised.

1.7 Staff Contact Details

Position	Name	Ph Number
Construction Manager	Neil Donaldson	[redacted]
Earthworks Manager	Malcolm Edridge	[redacted]
Site Engineer	TBC	TBC
Environmental / ESC Advisor	Campbell Stewart Zac Woods	[redacted]

Appendix A – Erosion and Sediment Control Details

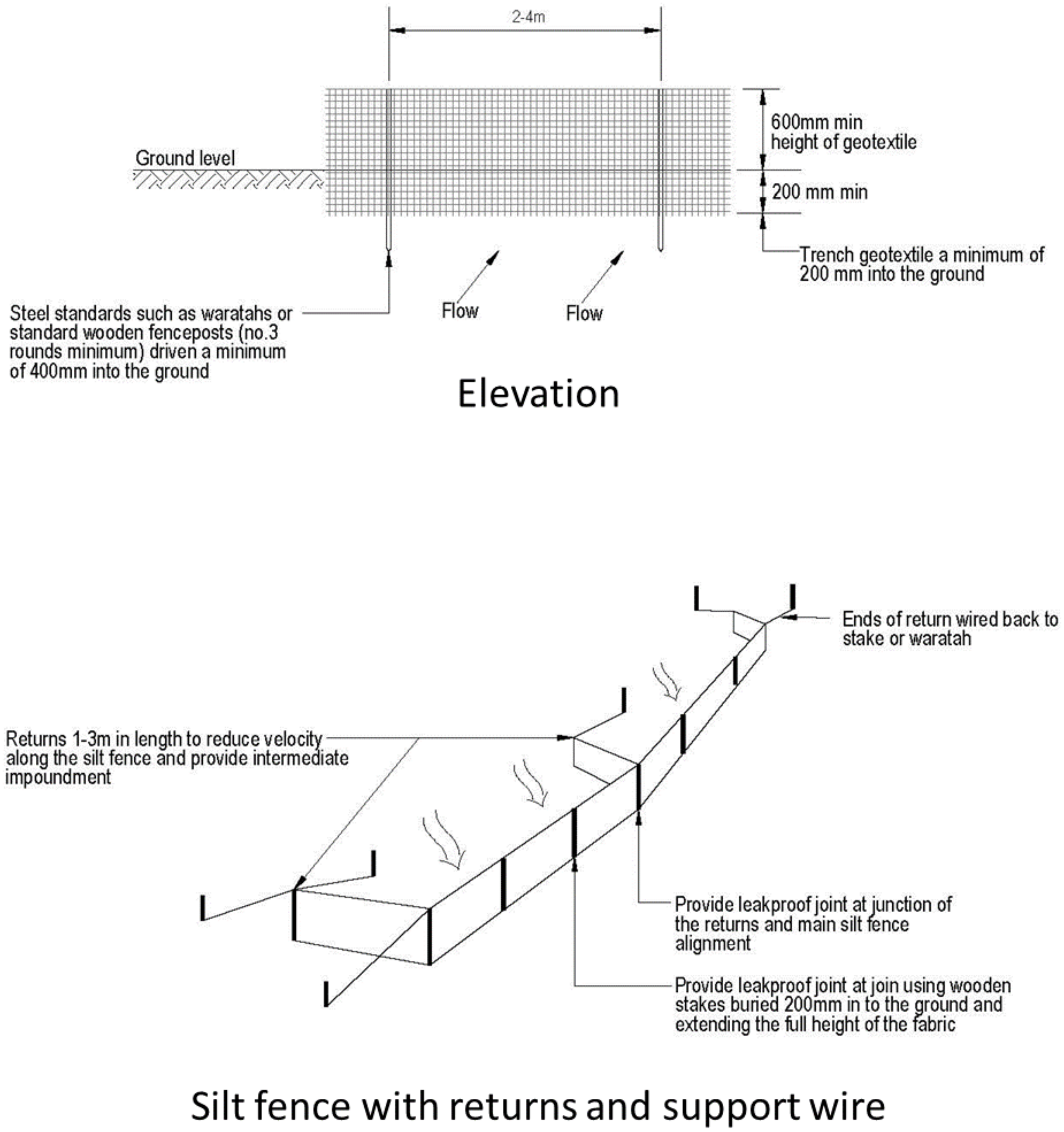


Figure 1: Schematic of a silt fence.

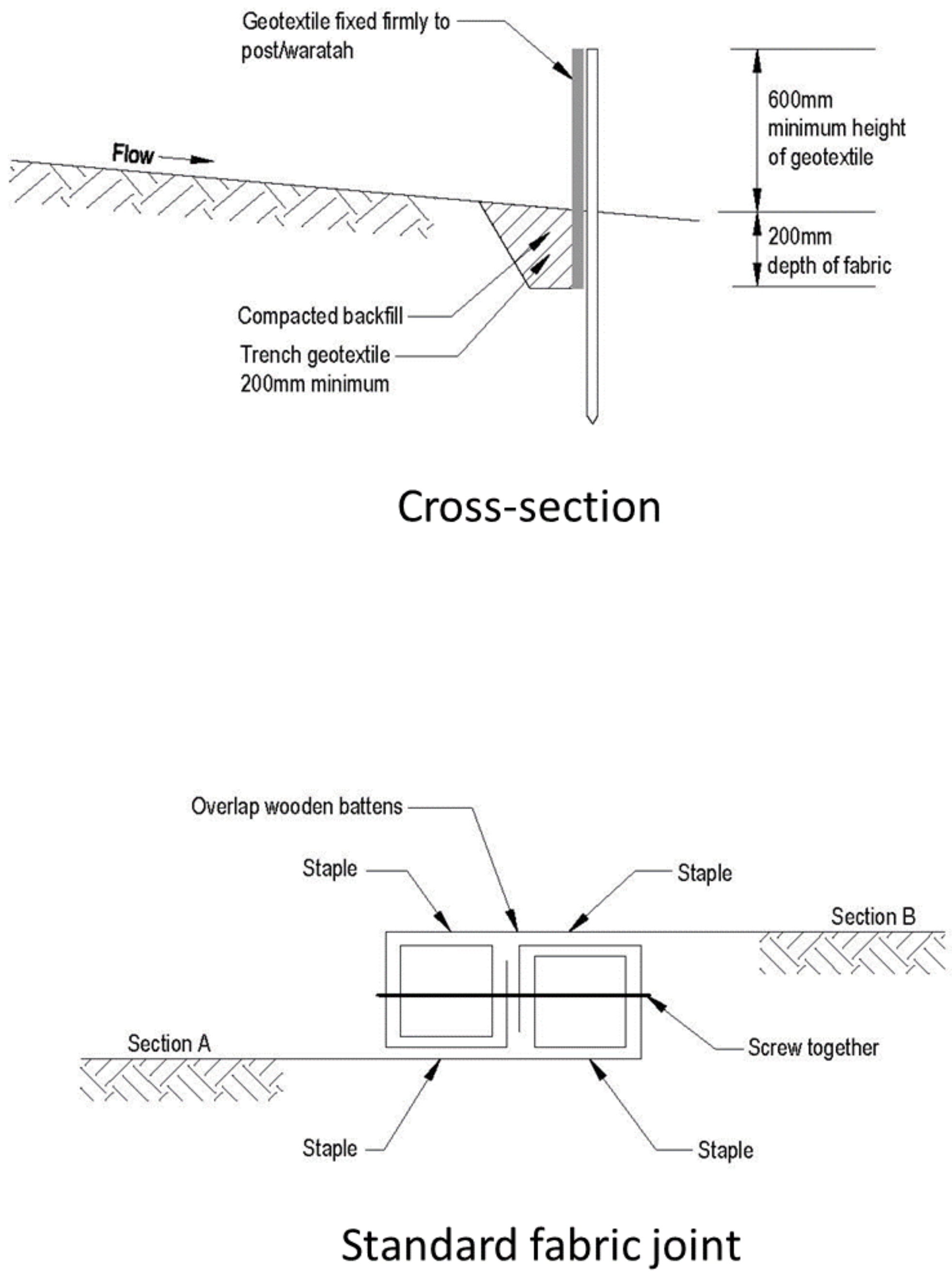


Figure 2: Silt fence cross-section and standard fabric joint.

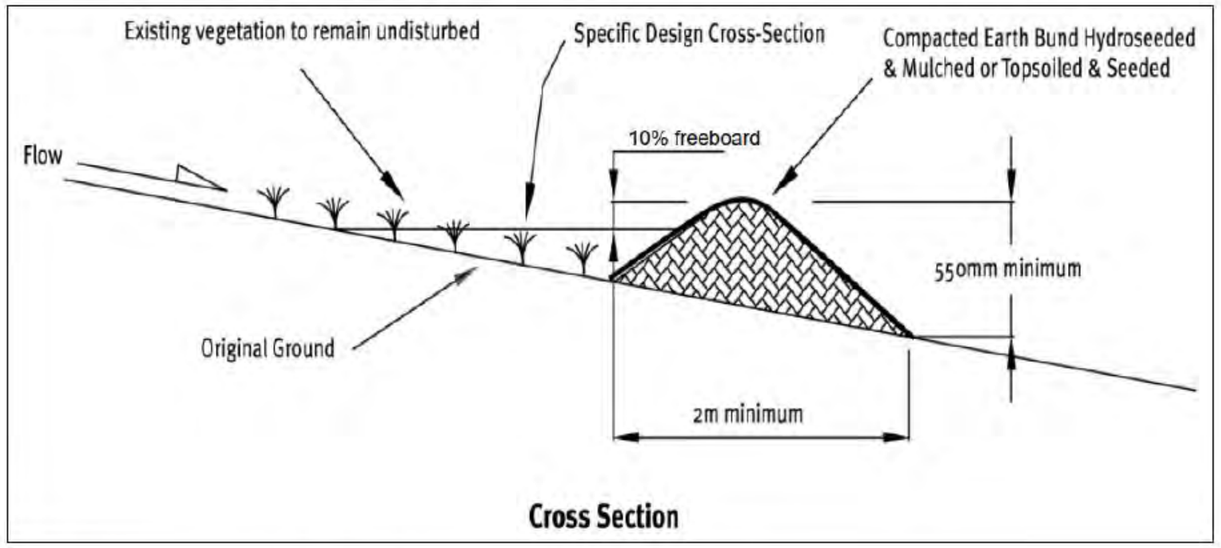


Figure 1: Cross-section of a clean water diversion (permitter bund).

Figure 2: Turfing scraped from within the site to stabilise the perimeter bund. The perimeter bund provides both clean and dirty water control.

Table 1: Clean water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 300mm Freeboard
41mm	5ha	0.17097	0.3m	2%	250	275

<u>A minimum bund height of 500mm</u> will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

All clean water diversions must be stabilised.

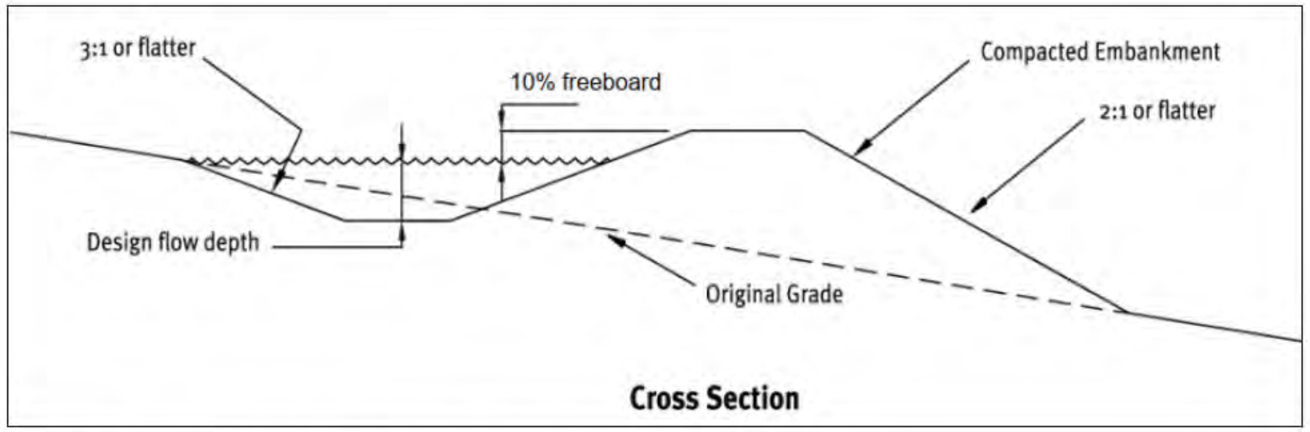


Figure 3: Cross-section of a dirty water diversion.

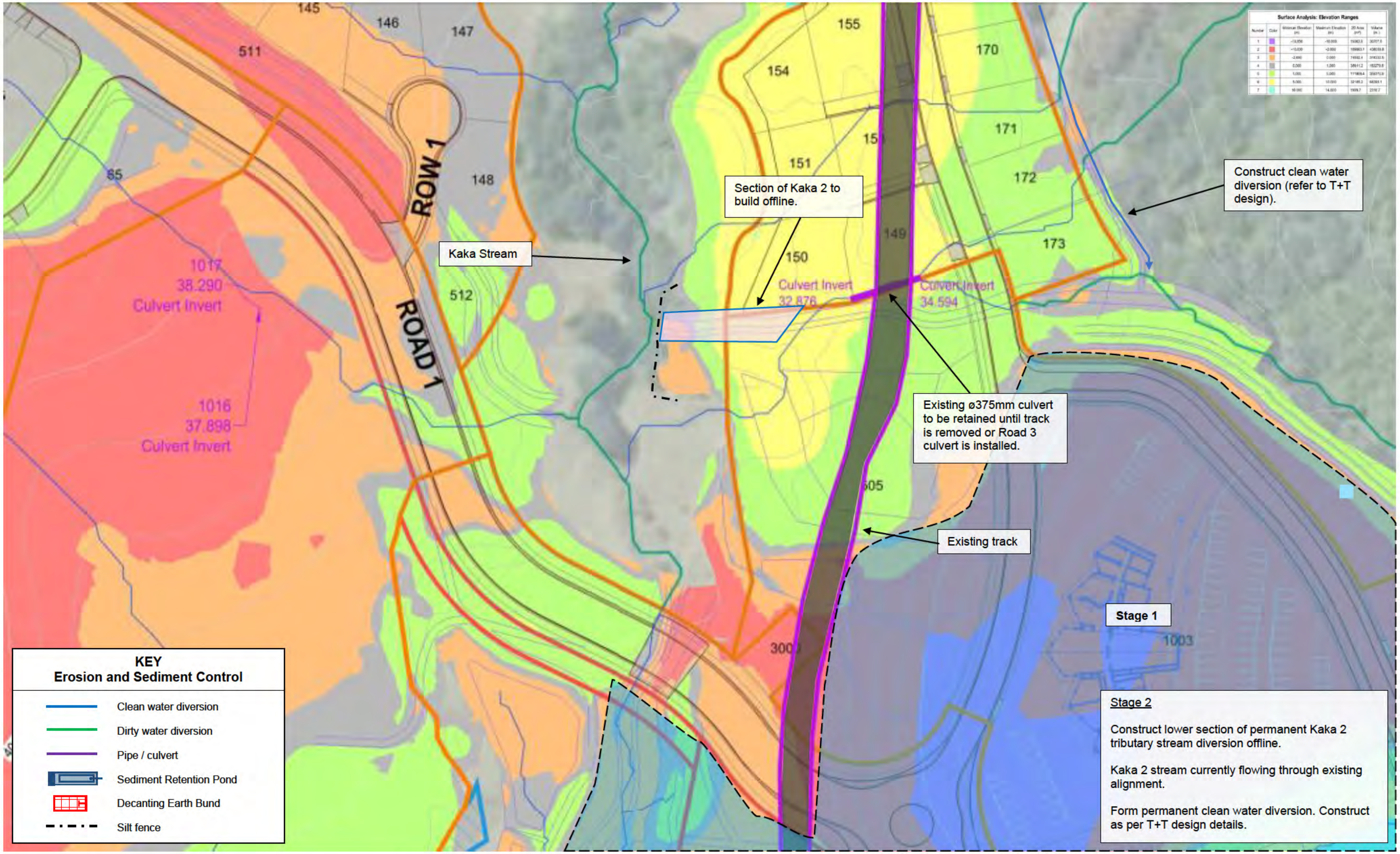
Table 2: Dirty water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 10% Freeboard
41mm	5ha	0.34194	0.5	2%	250	275

<u>A minimum bund height of 500mm</u> will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

Appendix B – Erosion and Sediment Control Plans

Title	Drawing No.	Sheet No.	Revision	Date
Erosion and Sediment Control Plan – Stage 2: Enabling Works	ESCP-002-01	1	A	23.05.24
Erosion and Sediment Control Plan – Stage 2	ESCP-002-02	2	A	23.05.24
Erosion and Sediment Control Plan – Stage 2	ESCP-002-03	3	A	23.05.24
Erosion and Sediment Control Plan – Stage 2	ESCP-002-04	4	A	27.05.24
Erosion and Sediment Control Plan – Stage 2	ESCP-002-05	5	A	27.05.24
Erosion and Sediment Control Plan – DEB-4 Design Details	ESCP-002-DEB-4	6	A	25.05.24
Erosion and Sediment Control Plan – DEB-5 Design Details	ESCP-002-DEB-5	7	A	25.05.24
Erosion and Sediment Control Plan – SRP-3 Design Details	ESCP-002-SRP-3	8	A	27.05.24
Erosion and Sediment Control Plan – SRP-4 Design Details	ESCP-002-SRP-4	9	A	27.05.24
Erosion and Sediment Control Plan – SRP-5 Design Details	ESCP-002-SRP-5	10	A	27.05.24



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019.*
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

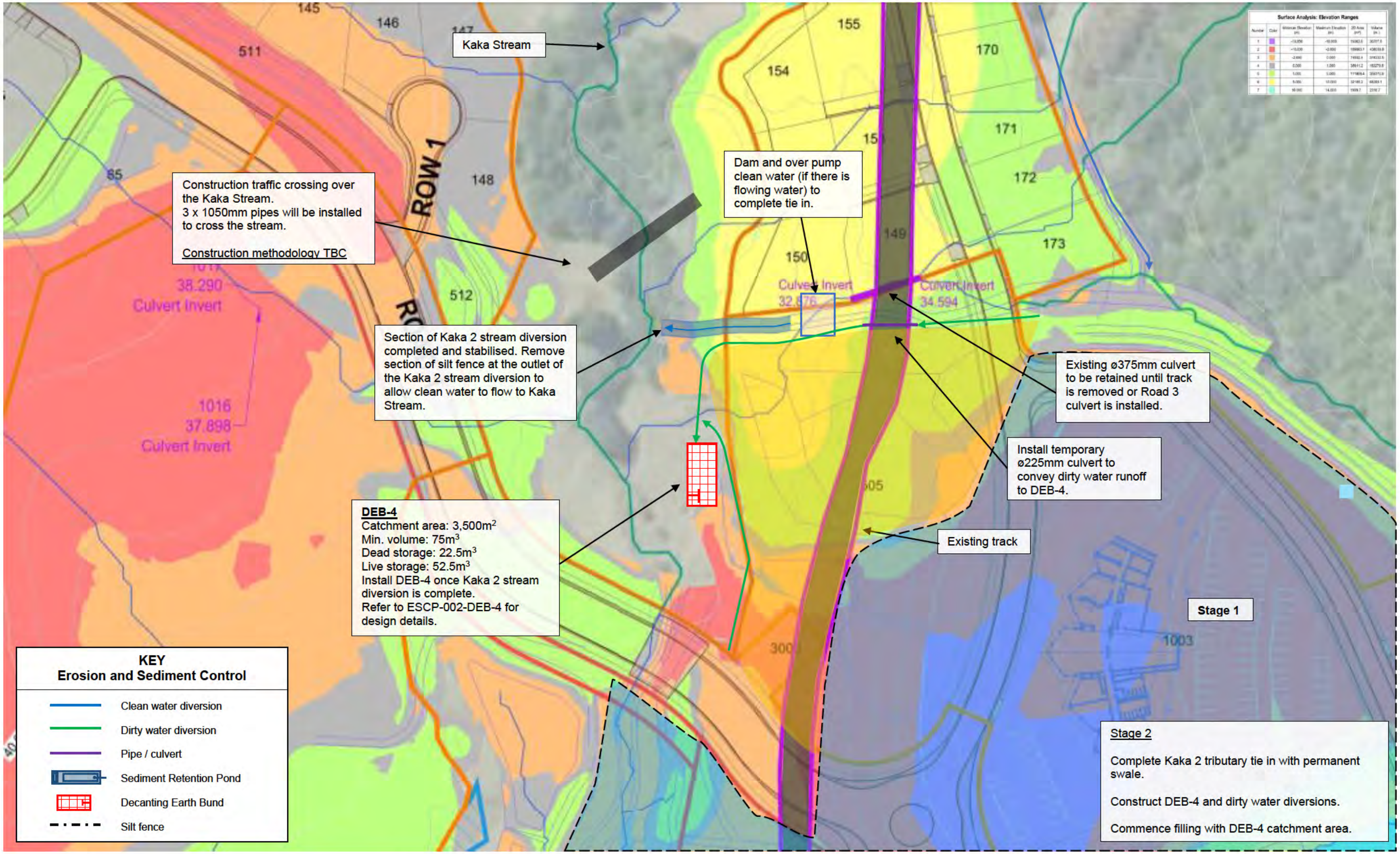
REV	DATE	REVISION DETAILS	APPROVED
A	23.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 2: Enabling Works

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-002-01	1



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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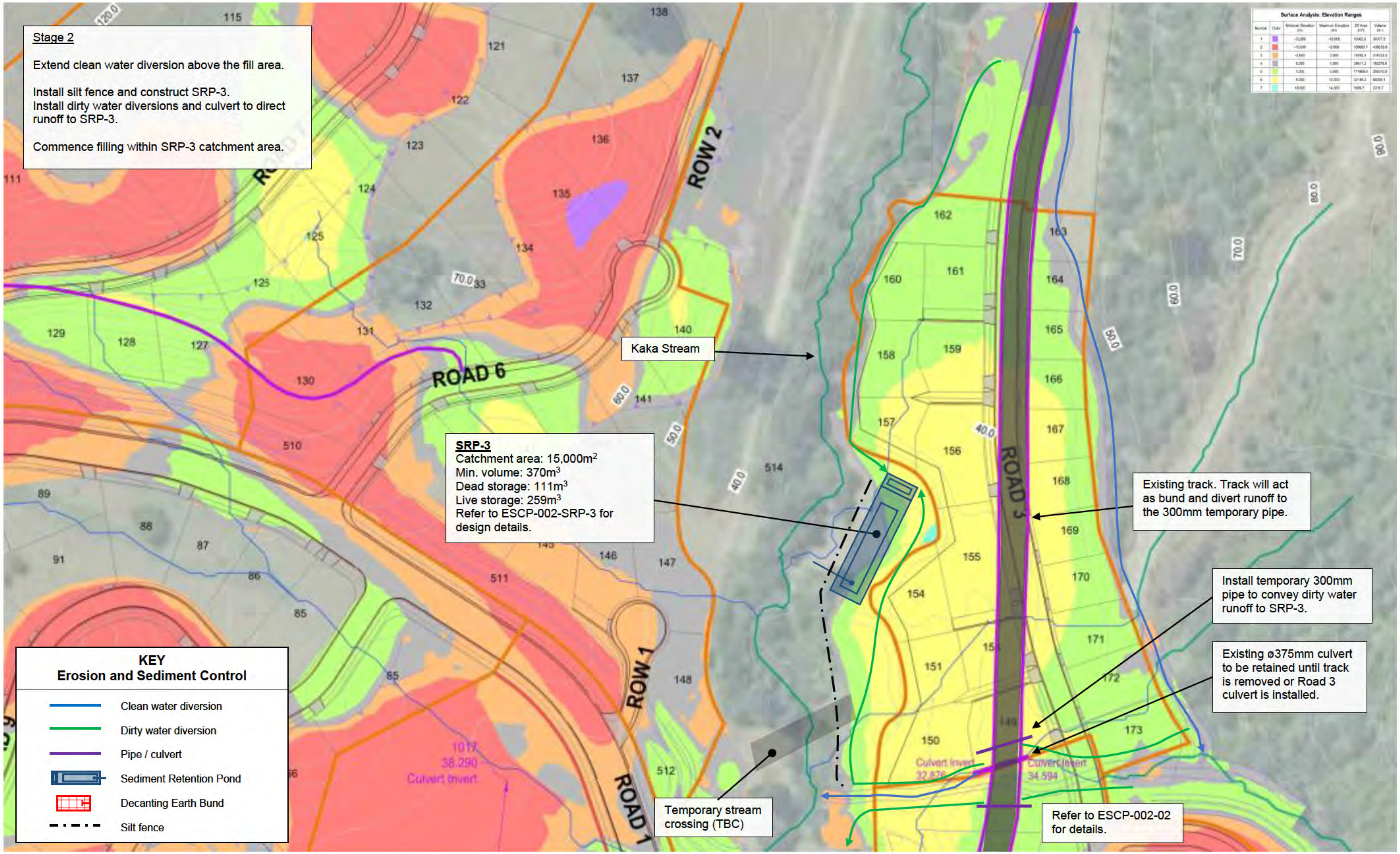
REV	DATE	REVISION DETAILS	APPROVED
A	23.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 2
Drawn	ZW
Checked	CS
Drawing No.	ESCP-002-02
Sheet No.	2



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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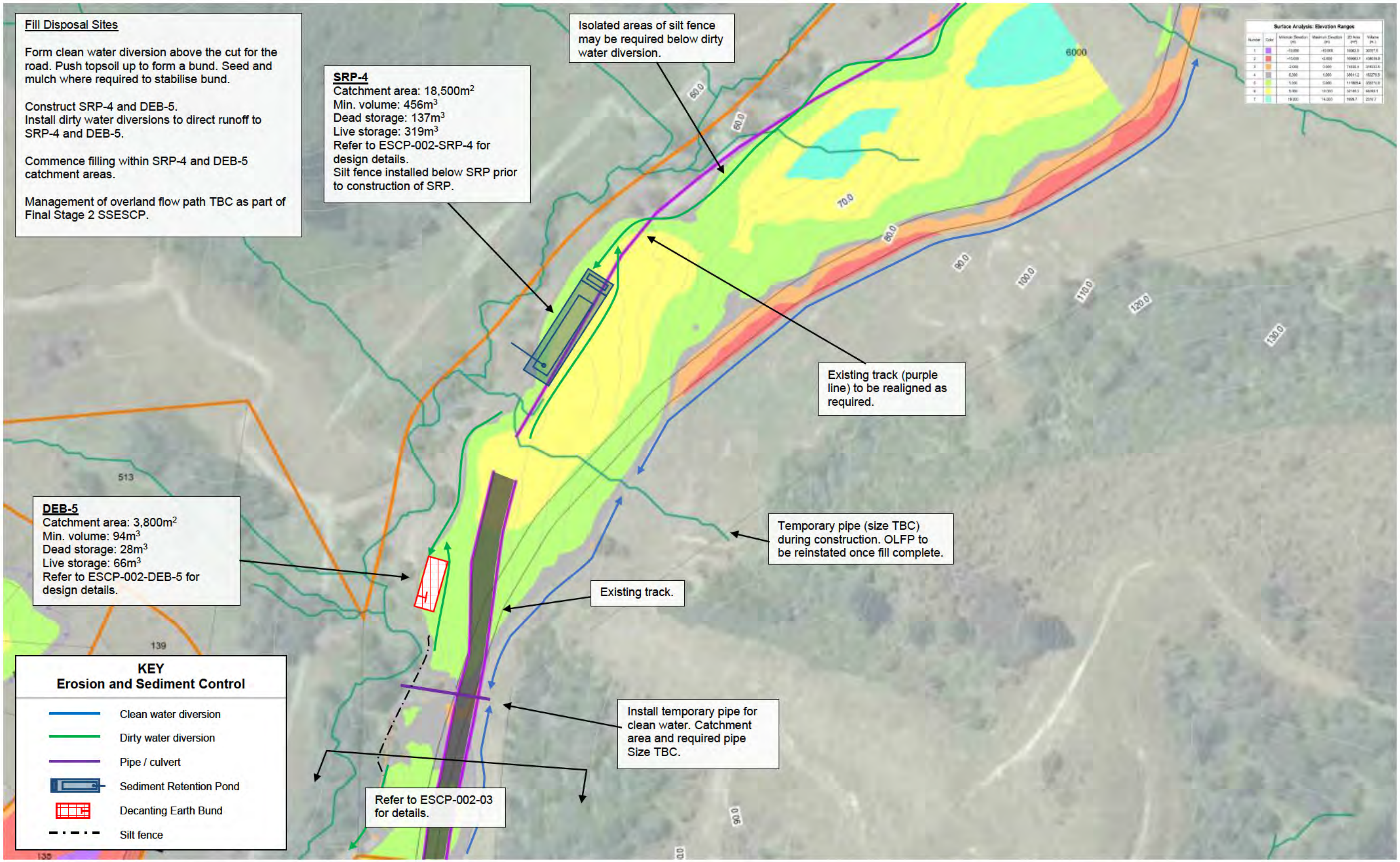
REV	DATE	REVISION DETAILS	APPROVED
A	23.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL | Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 2
Drawn	ZW
Checked	CS
Drawing No.	ESCP-002-03
Sheet No.	3



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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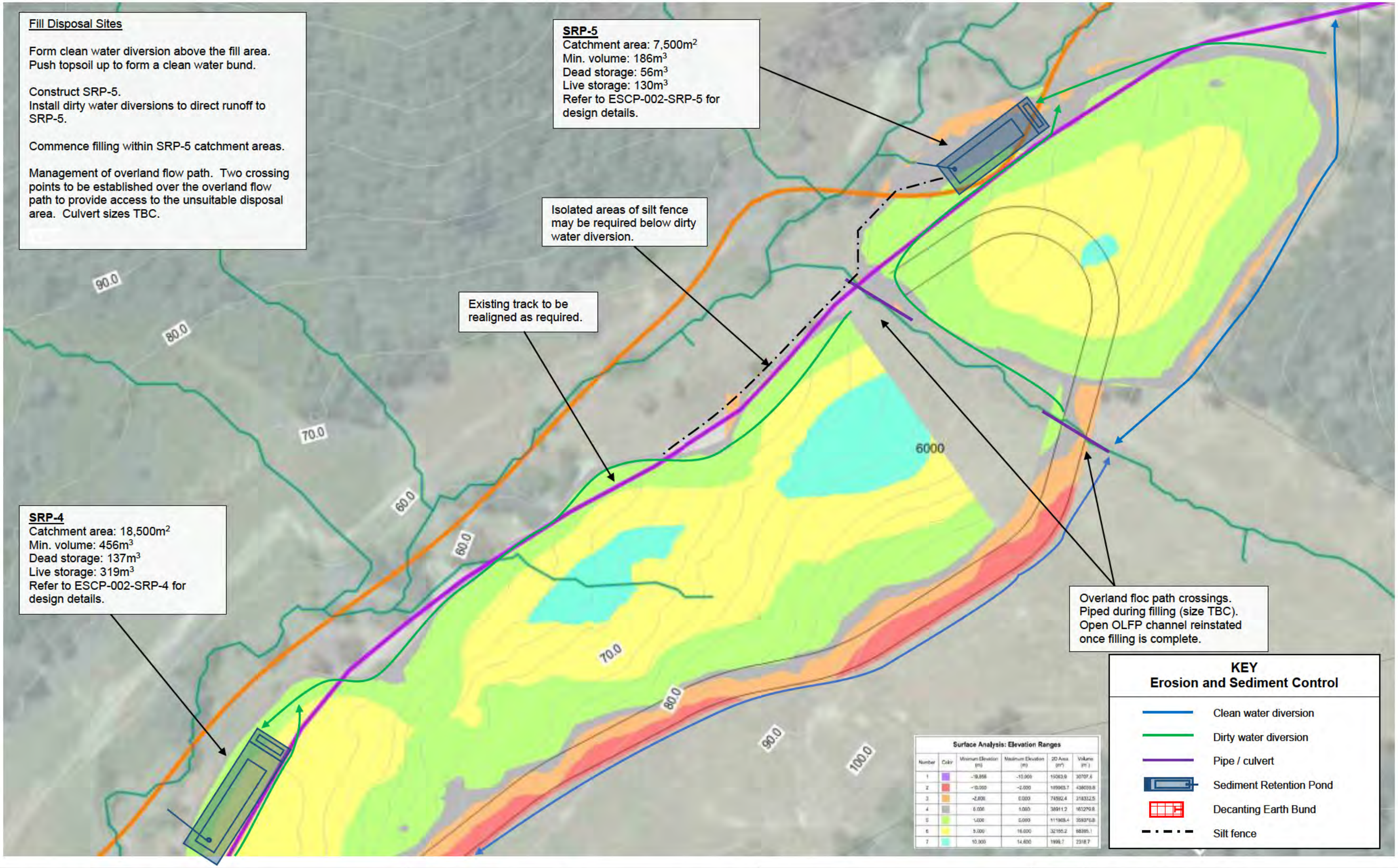
REV	DATE	REVISION DETAILS	APPROVED
A	27.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 2

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-002-04	4



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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REV	DATE	REVISION DETAILS	APPROVED
A	27.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

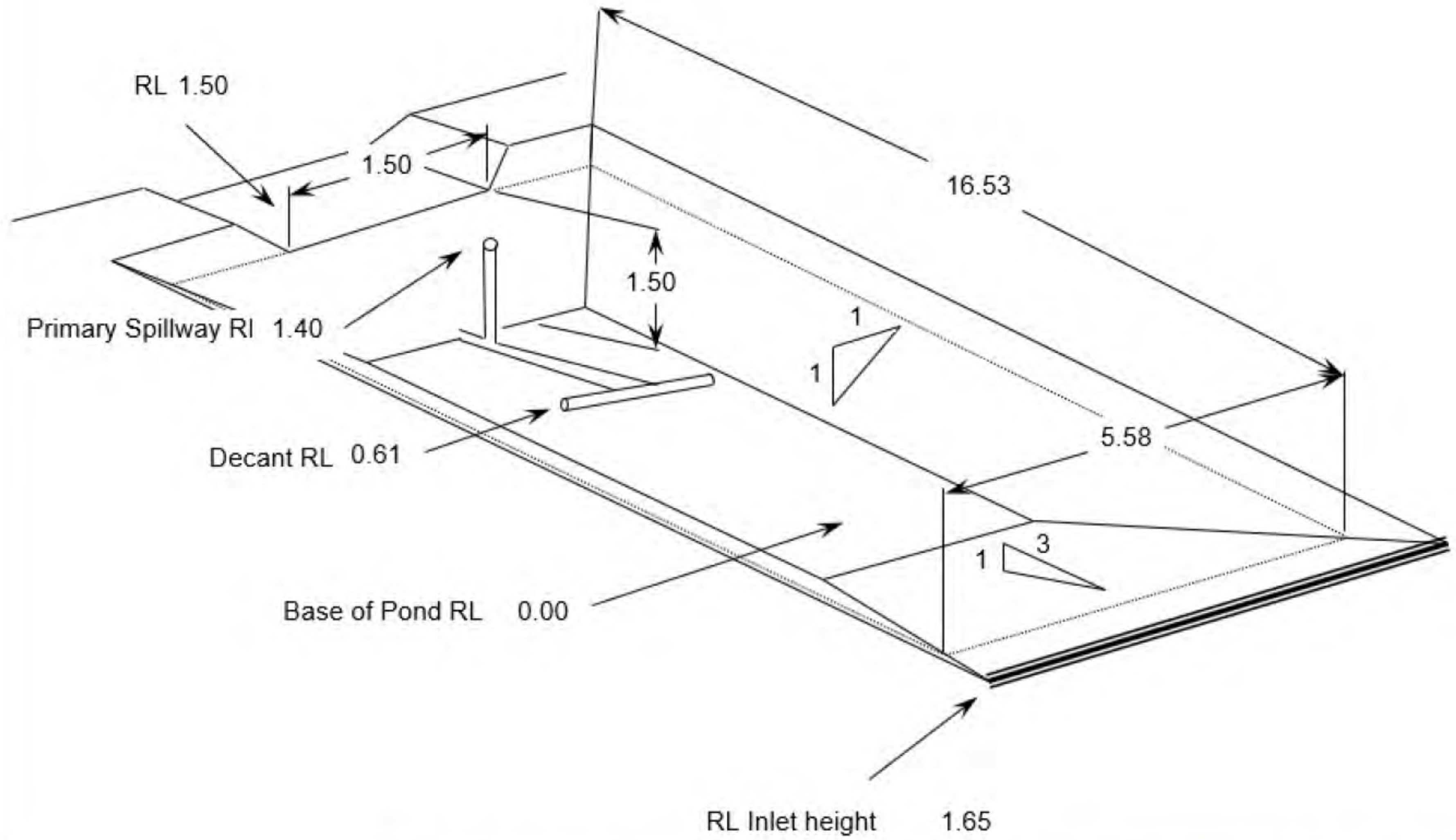
Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 2

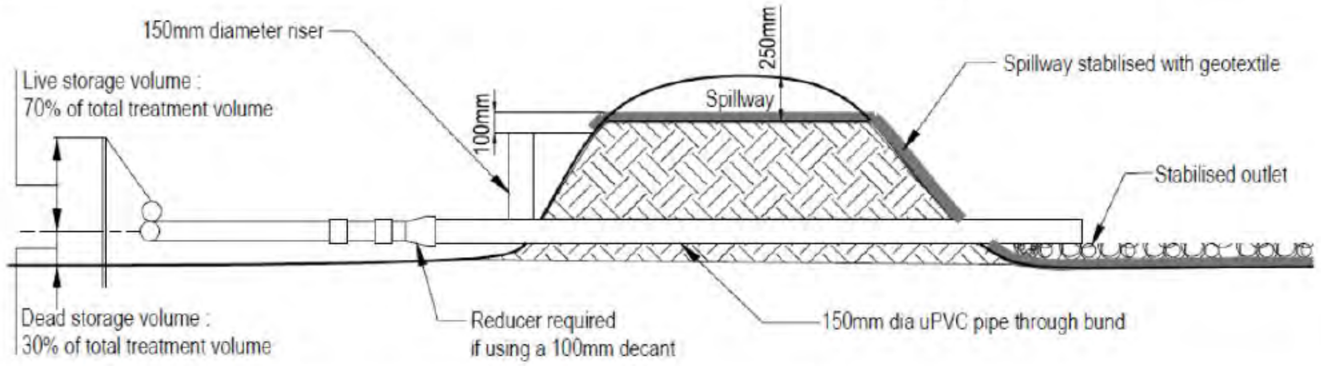
Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-002-05	5

Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
3:1	1:1	1.50	0.00

DEB-4

Minimum Storage Volume (m3)	76
Dead storage (m3)	22.8
Live storage (m3)	53.2
Length at Spillway Level	16.53
Width at Spillway Level	5.58
Spillway base width (250mm deep)	1.50
Primary Spillway diameter (min)	150mm
Number of decants	1
Number of holes per decant	51
Minimum outlet diameter	150mm
RL Emergency Spillway	1.50
RL Primary Spillway	1.40
RL Inlet height (min)	1.65
RL Decant	0.61
Length at Base	10.53
Width at Base	2.58





DEB-4 Sizing Calculations		
Q =	0.02072	
C =	0.6	Med. Soakage bare soil
i =	35.5	1hr 10yr rainfall intensity
A =	0.35	Max. catchment area.
V =	74.6096	
Q =	0.02072	
D =	3600	

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019.*
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
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REV	DATE	REVISION DETAILS	APPROVED
A	25.05.24	Draft for review.	

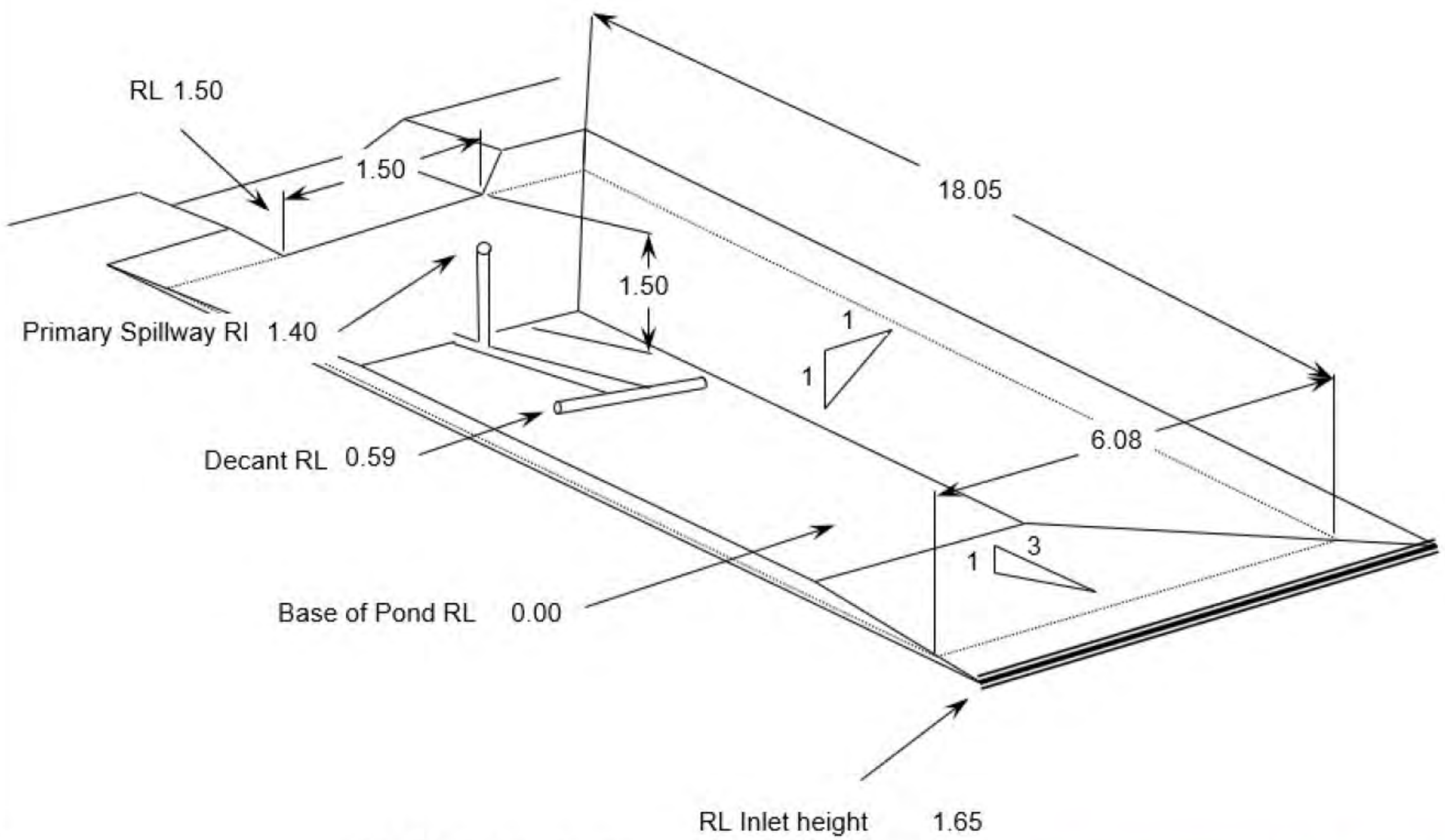
SOUTHERNSKIES ENVIRONMENTAL
Maitahi

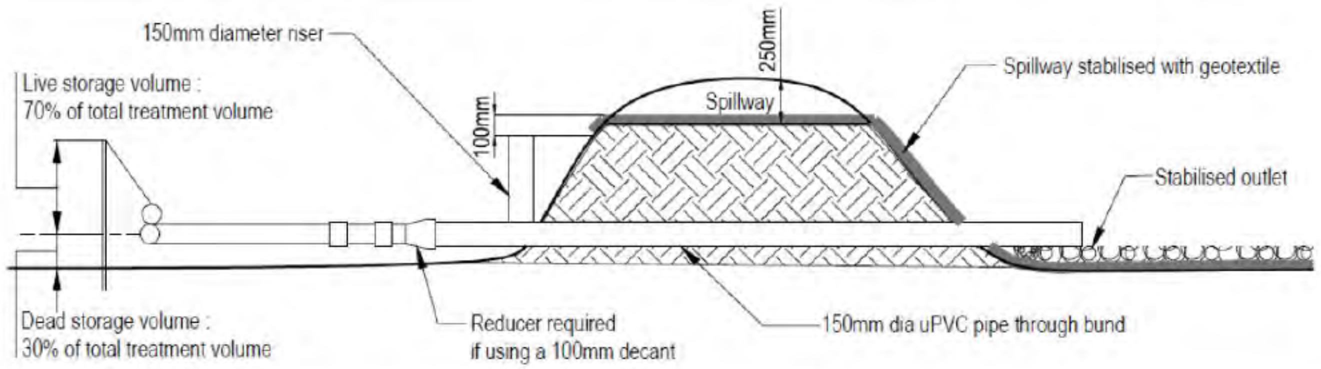
Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan DEB-4 Design Details
Drawn	ZW
Checked	CS
Drawing No.	ESCP-002-DEB-4
Sheet No.	

DEB-5

Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
3:1	1:1	1.50	0.00

Minimum Storage Volume (m3)	95
Dead storage (m3)	28.5
Live storage (m3)	66.5
Length at Spillway Level	18.05
Width at Spillway Level	6.08
Spillway base width (250mm deep)	1.50
Primary Spillway diameter (min)	150mm
Number of decants	1
Number of holes per decant	63
Minimum outlet diameter	150mm
RL Emergency Spillway	1.50
RL Primary Spillway	1.40
RL Inlet height (min)	1.65
RL Decant	0.59
Length at Base	12.05
Width at Base	3.08





DEB-5 Sizing Calculations

Q =	0.02599	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	0.38	Max. catchment area.
V =	**93.6**	
Q =	0.02599	
D =	3600	

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	25.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT		
Title	Erosion & Sediment Control Plan DEB-5 Design Details		
Drawn ZW	Checked CS	Drawing No. ESCP-002-DEB-5	Sheet No.

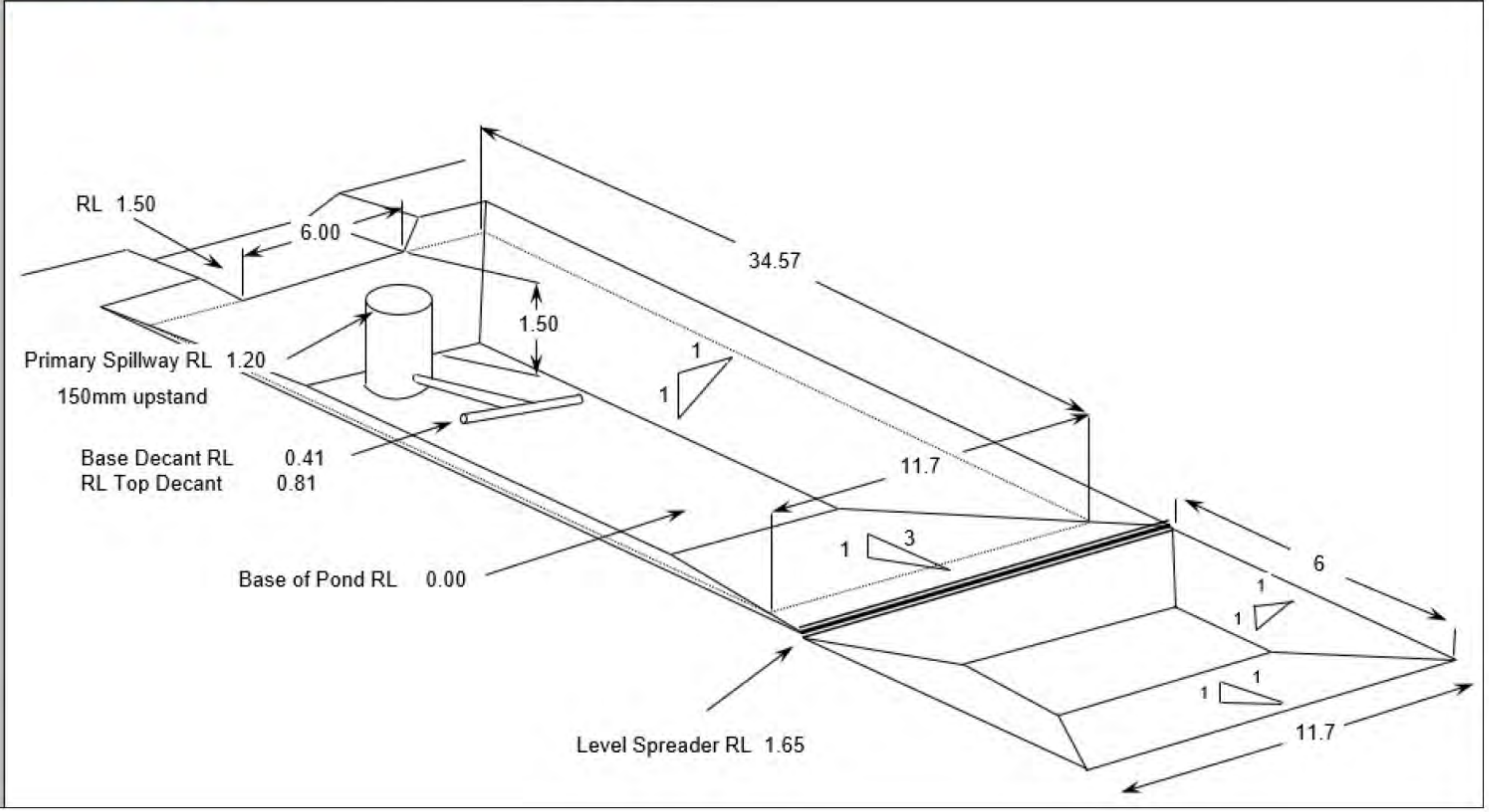
SRP-3

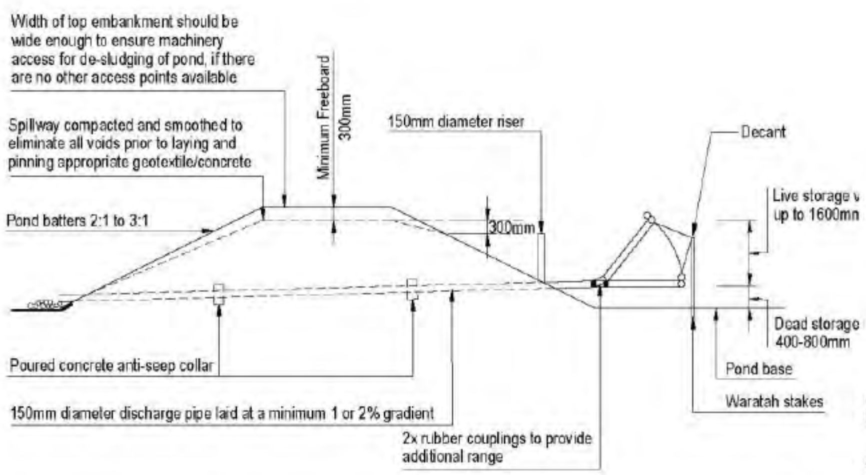
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.50	0.00

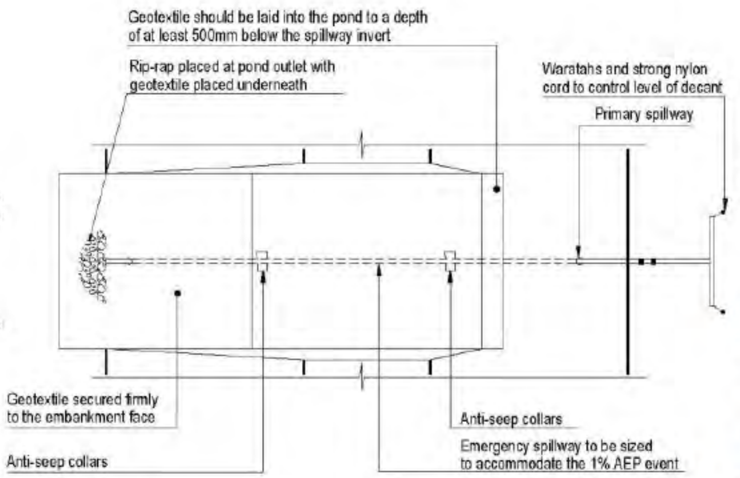
Minimum Storage Volume (m3)	370
Dead storage (m3)	111
Live storage (m3)	259
Length at Emergency Spillway Level	34.57
Width at Emergency Spillway Level	11.72
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	150mm
Number of decants	2
Number of holes per decant	123
Minimum outlet diameter	150mm
RL Emergency Spillway	1.50
RL Primary Spillway	1.20
RL Level Spreader (min)	1.65
RL Base Decant	0.41
RL Top Decant	0.81
Length at Base	28.57
Width at Base	8.72

Forebay

Depth	1 m	min. depth
Width	11.72 m	full width of pond
Length	6 m	min. length
Volume	37 m3	min. volume

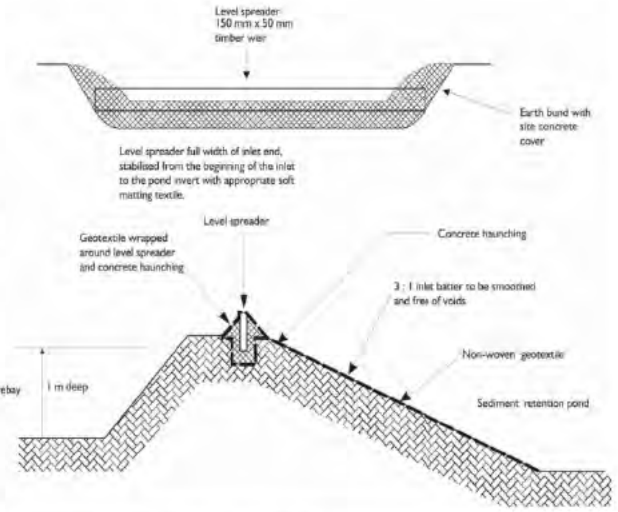






SRP-3 Sizing Calculations

Q =	0.10258	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	1.5	Max. catchment area.
V =	369.3	
Q =	0.10258	
D =	3600	
Forebay volume =	36.9	



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	27.05.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-3 Design Details
Drawn	ZW
Checked	CS
Drawing No.	ESCP-002-SRP-3
Sheet No.	

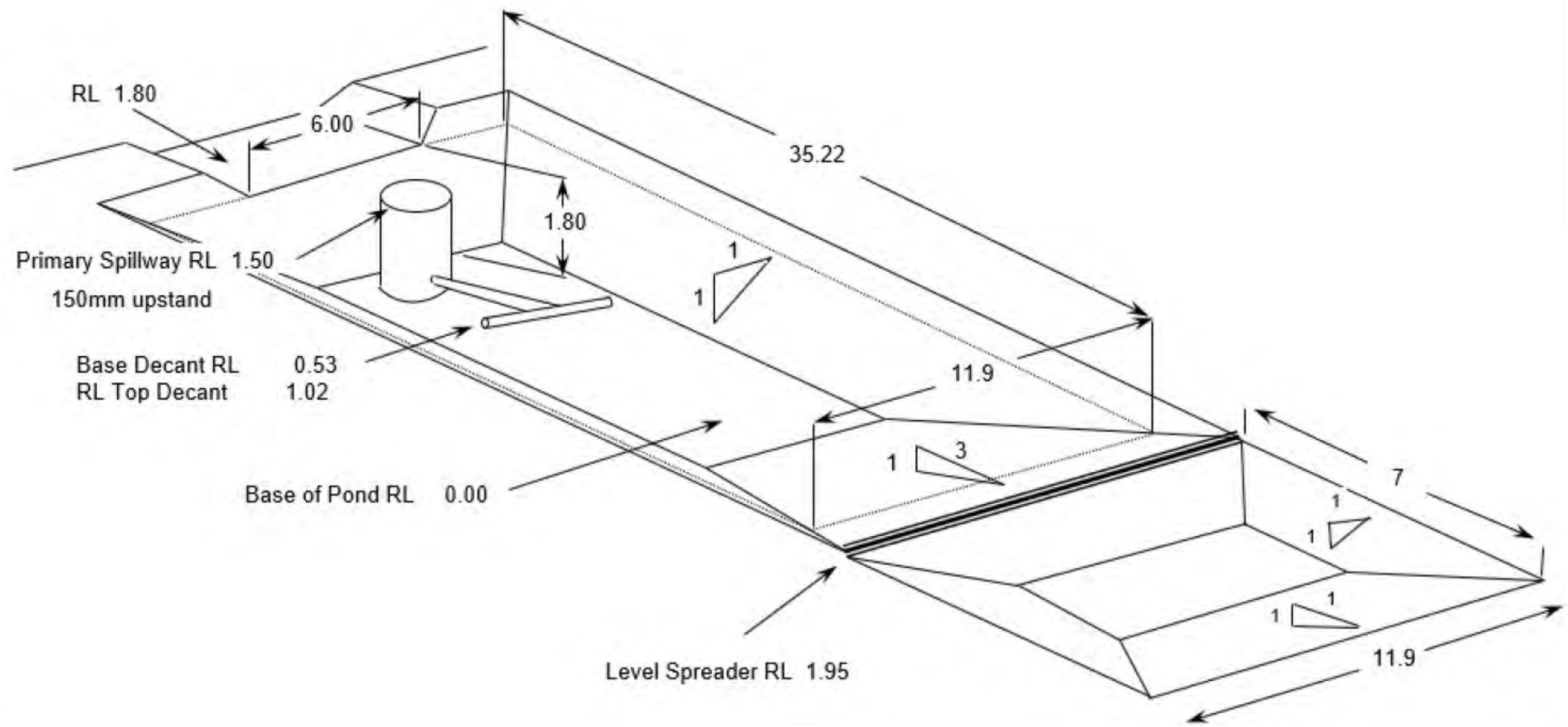
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.80	0.00

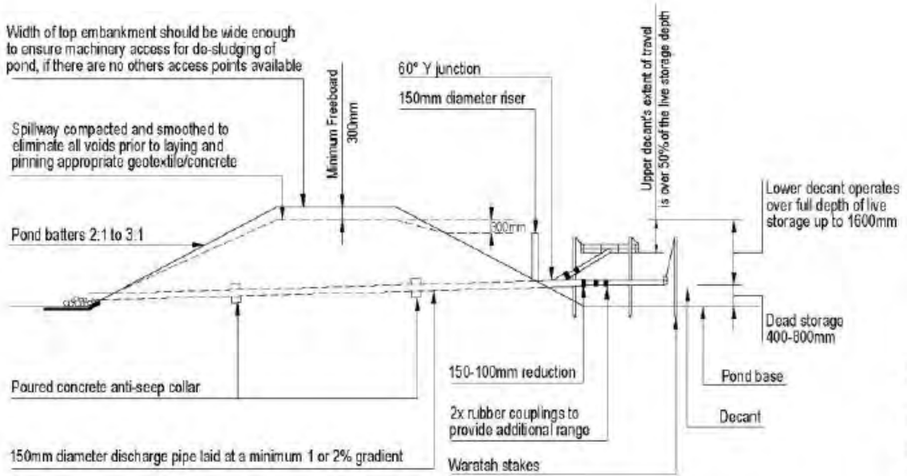
SRP-4

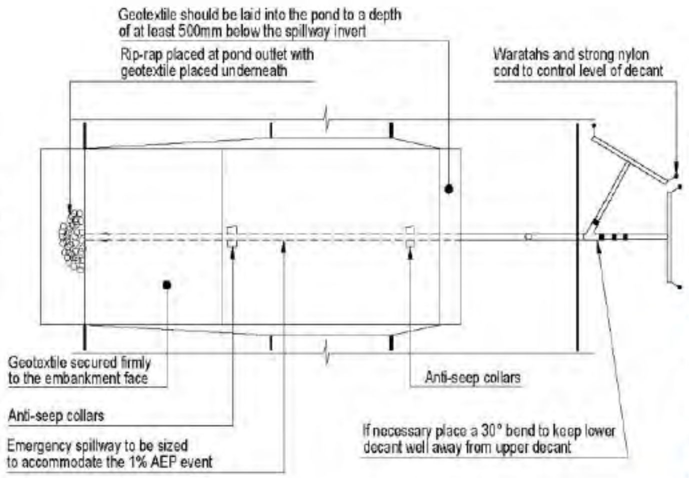
Minimum Storage Volume (m3)	460
Dead storage (m3)	138
Live storage (m3)	322
Length at Emergency Spillway Level	35.22
Width at Emergency Spillway Level	11.94
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	150mm
Number of decants	2
Number of holes per decant	153
Minimum outlet diameter	150mm
RL Emergency Spillway	1.80
RL Primary Spillway	1.50
RL Level Spreader (min)	1.95
RL Base Decant	0.53
RL Top Decant	1.02
Length at Base	28.02
Width at Base	8.34

Forebay

Depth	1 m	min. depth
Width	11.94 m	full width of pond
Length	7 m	min. length
Volume	46 m3	min. volume

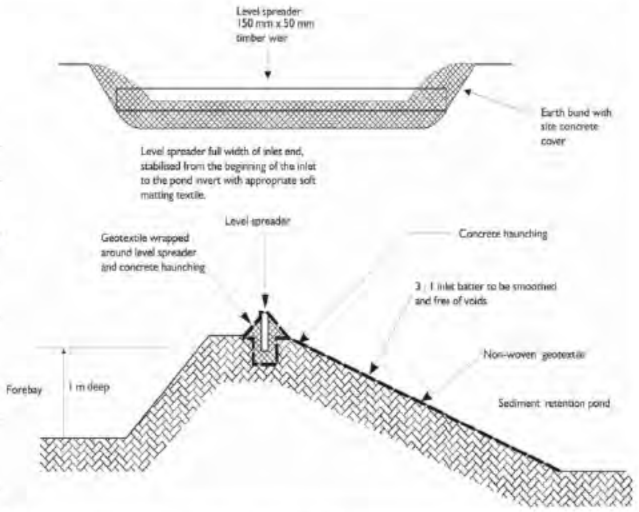






SRP-4 Sizing Calculations

Q =	0.12652	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	1.85	Max. catchment area.
V =	**455.5**	
Q =	0.12652	
D =	3600	
Forebay volume =	**45.5**	



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	27.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-4 Design Details

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-002-SRP-4	

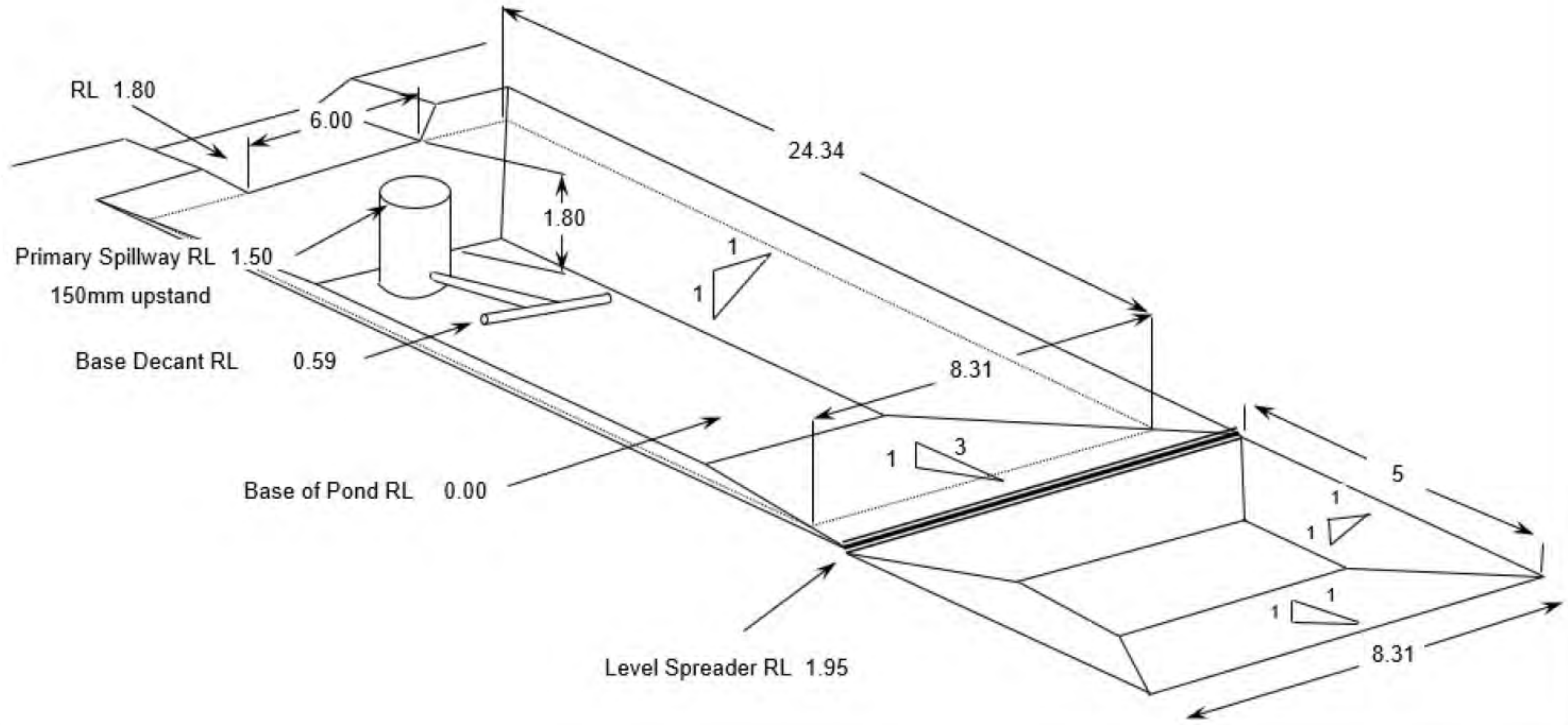
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.80	0.00

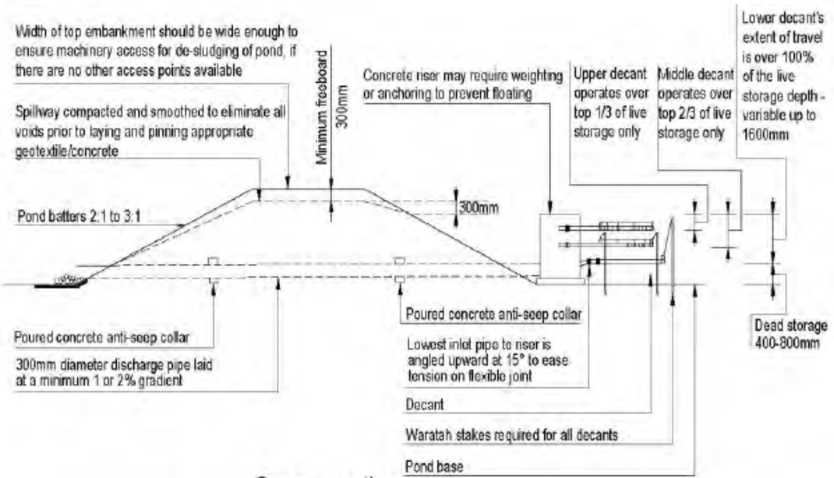
SRP-5

Minimum Storage Volume (m3)	190
Dead storage (m3)	57
Live storage (m3)	133
Length at Emergency Spillway Level	24.34
Width at Emergency Spillway Level	8.31
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	150mm
Number of decants	1
Number of holes per decant	126
Minimum outlet diameter	150mm
RL Emergency Spillway	1.80
RL Primary Spillway	1.50
RL Level Spreader (min)	1.95
RL Base Decant	0.59
Length at Base	17.14
Width at Base	4.71

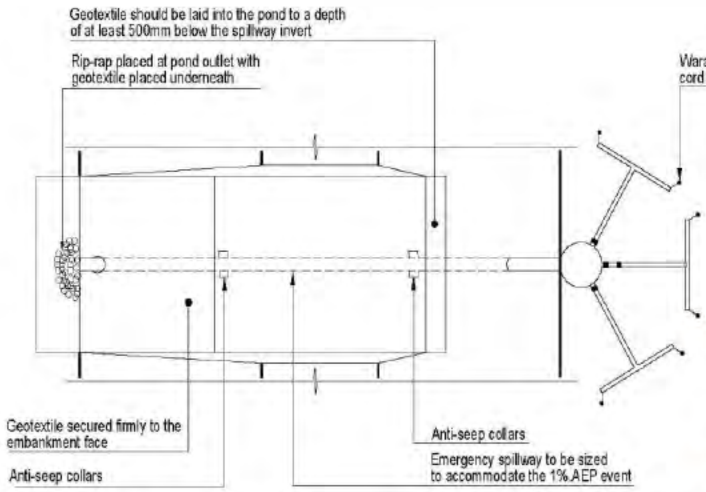
Forebay

Depth	1 m	min. depth
Width	8.31 m	full width of pond
Length	5 m	min. length
Volume	19 m3	min. volume



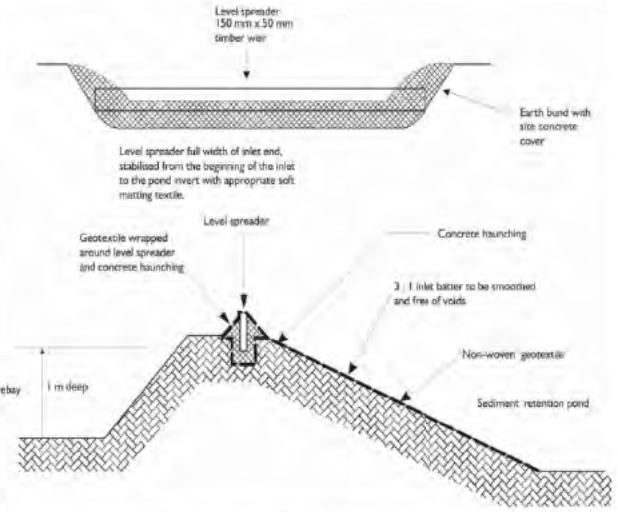


Cross - section



SRP-5 Sizing Calculations

Q =	0.05129	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	0.75	Max. catchment area.
V =	184.6	
Q =	0.05129	
D =	3600	
Forebay volume =	18.5	



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	27.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-5 Design Details

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-002-SRP-5	

Maitahi Residential Development

CCKV Maitai Dev Co LP

SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN

Stage 3

SSESCP-003

Revision A
17 June 2024

SouthernSkies Environmental

1 STAGE 3 SSESCP - CONSTRUCTION NOTES

1.1 Scope

This Site-Specific Erosion and Sediment Control Plan (SSESCP) covers the land disturbing activities associated with Stage 3 of the Maitahi Development.

In brief, the Stage 3 construction sequence will be:

- Construct SRP-6 and clean and dirty water diversions.
- Commence cut and fill within Stage 3.
- Construct lower section of the Kaka 5A and 5B Stream permanent alignment.

The proposed erosion and sediment control (ESC) measures and methodology have been designed in accordance with the *Nelson Tasman Erosion and Sediment Control Guidelines, July 2019 (NTESCG).*

The ESC measures are detailed on the erosion and sediment control (ESC) drawings provided in Appendix B.

1.2 Methodology

Prior to the commencement of any works the Project Manager/Earthworks Manager will inspect the site to confirm the suitability of the proposed controls and methodology.

A final version of this SSESCP will be completed and provided to NCC for certification prior to the commencement of earthworks within this stage.

At the approximate location, as detailed in the attached drawings, the erosion and sediment controls will be constructed.

- The first step will be to construct SRP-6. This pond will be located in a future stormwater pond / wetland. A silt fence will be installed below the footprint of this pond prior to construction to protect the Kaka Stream from sediment laden runoff.
- Construct clean water diversions, followed by the dirty water diversions once SRP-6 is commissioned.
- Commence cut to fill earthworks over approximately 4.5ha.
- Once earthworks are nearing completion, the lower section of the Kaka 5A and 5B permanent alignment will be formed and stabilised in accordance with the permanent design details.

Stage 3 includes approximately 148,000m^3 of cut and 68,000m^3 of fill. Excess cut is to be taken to the Valley Fill Area, refer to Stage 2 SSESCP.

As-Builts

- An as-built for each sediment control will be completed following their installation certifying that the controls have been constructed in accordance with this ESCP and the NTESCG.

Dust Management

- The emphasis of the site dust strategy will be one of prevention.
- A water cart will be used, as required, to dampen haul roads and prevent dust.
- Speed restrictions will be in place throughout the site to minimise dust generation from vehicles and plant when and where required.
- If dust cannot be managed during excessively windy conditions, then the earthworks will cease until the wind speed drops.

Stabilisation

- The works are to be staged in accordance with the staging details above. As areas are completed, they will be progressively stabilised. Stabilisation will include, aggregate, topsoil and grass seeded, including mulching when appropriate, and geotextile in some instances. Note, all sediment control will remain in place until the site is stabilised for the respective catchment area.

Construction Timetable

The stage works are planned to commence in Year 2 of the development (estimated 2025/26). The Stage 3 earthworks are expected to take approximately six months to complete.

1.3 Chemical Treatment

- Chemical treatment will be employed on each sediment control measure. Refer to the site's Chemical Treatment Management Plan (ChemTMP) for details.
- All chemical treatment will be managed in accordance with the site's Chemical Analysis and Reactivity Test (CART) report and ChemTMP.

1.4 Monitoring and Maintenance

- The ESC measures will be inspected and signed off by the Construction Manager or Environmental Advisors prior to commencement of earthworks.
- The monitoring and maintenance requirements for the ESC measures will be in accordance with the Erosion and Sediment Control Monitoring Report, best practice procedures and schedules including extreme weather events, remedial actions, and response.
- The ESC monitoring and maintenance requirements will include, but are not limited to:
  - all ESC measures will be inspected on a weekly basis and within 24 hours of each rainstorm event that is likely to impair the function of performance of the controls.
  - any required maintenance or improvements to control measures will be undertaken immediately.
  - SRPs will be clean out before the volume of accumulated sediment reaches 20% of the total volume of the pond. Forebays will be cleaned out more regularly, as sediment deposition occurs.
  - sediment deposits against the silt fences will be removed as necessary and before sediment accumulation reaches 20% of the fabric height.
  - all erosion and sediment control measures will be maintained in accordance with NTESCG; and
  - weather forecasts will be monitored on a daily basis.
- A record will be maintained of the date and time of inspections undertaken, any maintenance requirements identified, and any maintenance undertaken.
- All ESC measures are to be monitored and maintained throughout the works until the site is stabilised.

The ESCMP includes:

- Pre and post rain event monitoring.
- Rainfall trigger event monitoring when rainfall exceeds 25mm within a 24-hour period.
- During a rainfall trigger event, the site's ESC measures will be checked, and performance of the sediment control measures tested by clarity and pH.
- The discharge targets are:
  - >100mm of clarity measured at the outlet end of the sediment control measure
  - A pH between 5.5 and 8.5 when using chemical treatment.

1.5 Rainfall Response and Contingency Measures

- Best management practices will be used to minimise sediment yields and monitor any potential effects. In addition to the visual inspections and weekly self-auditing refer above, if a severe weather event is forecast, (a severe weather event is defined as greater than a 5% AEP across the project works area) the following actions will be implemented.
- Pre-Weather Event Procedure:
  - Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;

- Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
- As far as practicable, stabilise disturbed areas; and
- Photograph critical ESC measures prior to the weather event to document pre-weather event condition.

- During the severe weather event that results in the discharge of treated discharges from the sediment retention devices water quality inspections will be undertaken where practical at discharge locations where treated discharge could leave the site. The discharges will be checked to document water quality.

1.6 Spill Management and Contingency

- Spill kits will be located at the site sign in station. Fire extinguishers will be located in all site vehicles.
- All refuelling will be undertaken a minimum of 20m away from a water course or overland flow path.
- If there is a chemical spill onsite it shall be immediately contained using earth bunds, or silt socks to prevent it entering water bodies. The spilt chemical shall be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it shall be mixed with a volume of soil to allow the spilt chemical to be collected along with the contaminated soil. The material will then be removed off site to an authorised facility.
- If there is a spill of chemical into ponded water, discharge from the pond to natural water shall be prevented.

If there is a spill of chemical into flowing water:

1) Nelson City Council shall be advised immediately.

2) The volume of the spill shall be recorded.

3) If possible, the water and spilt chemical shall be pumped into a bund or pond until all the spilt chemical has been removed from the watercourse.

4) If the chemical cannot be removed from the watercourse any downstream users shall be identified and advised.

1.7 Staff Contact Details

Position	Name	Ph Number
Construction Manager	Neil Donaldson	[redacted]
Earthworks Manager	Malcolm Edridge	[redacted]
Site Engineer	TBC	TBC
Environmental / ESC Advisor	Campbell Stewart Zac Woods	[redacted]

Appendix A – Erosion and Sediment Control Details

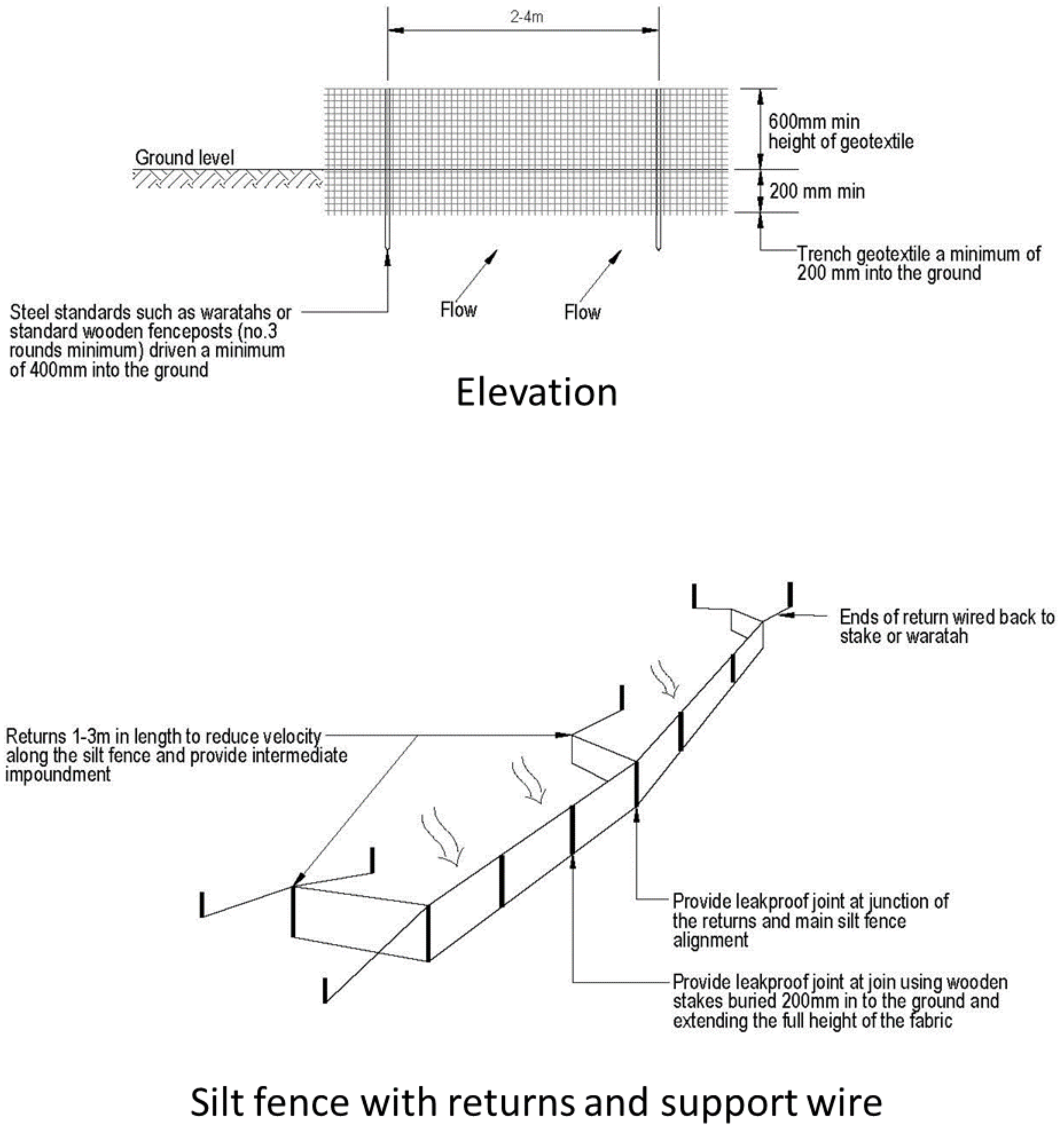


Figure 1: Schematic of a silt fence.

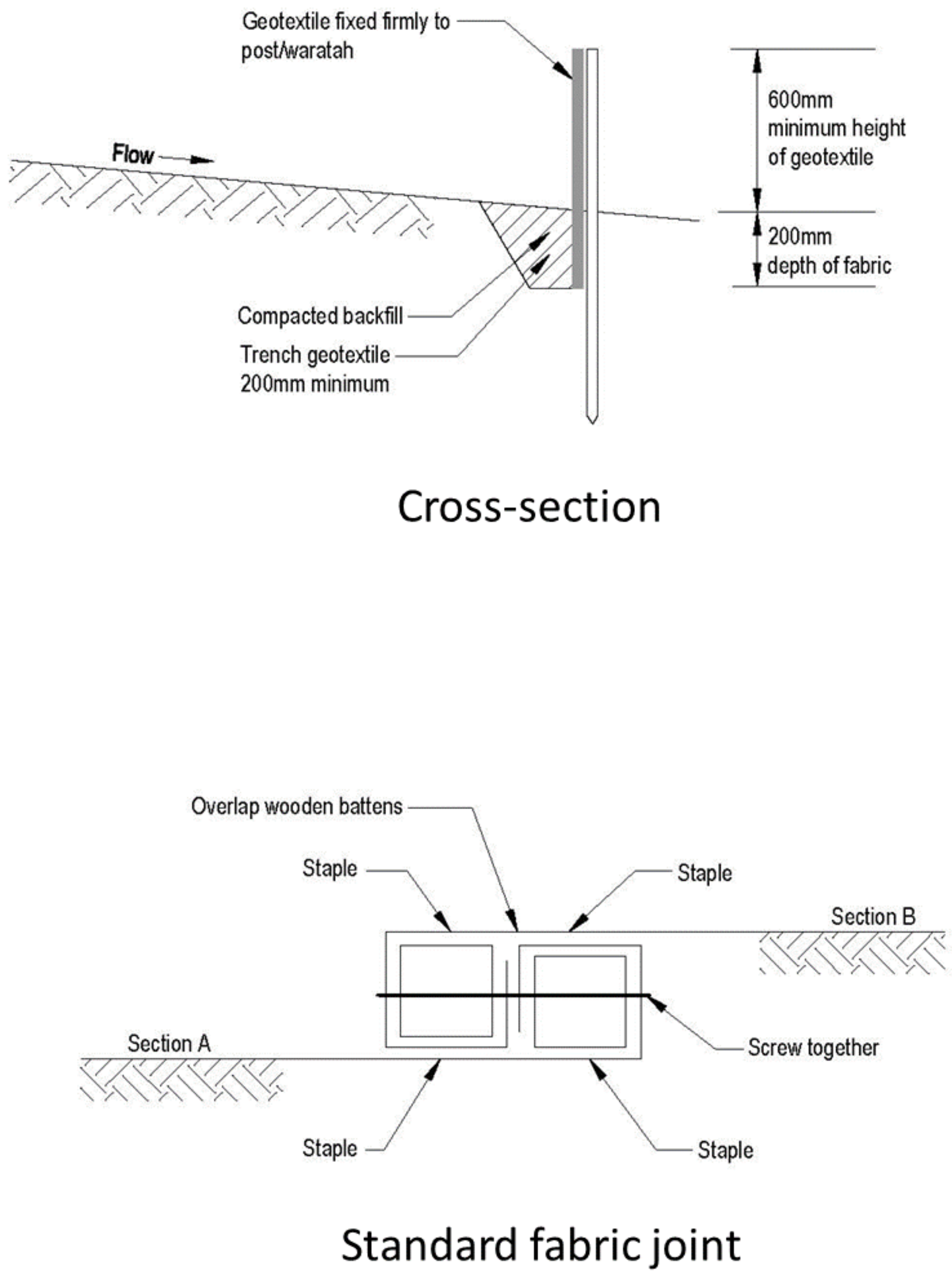


Figure 2: Silt fence cross-section and standard fabric joint.

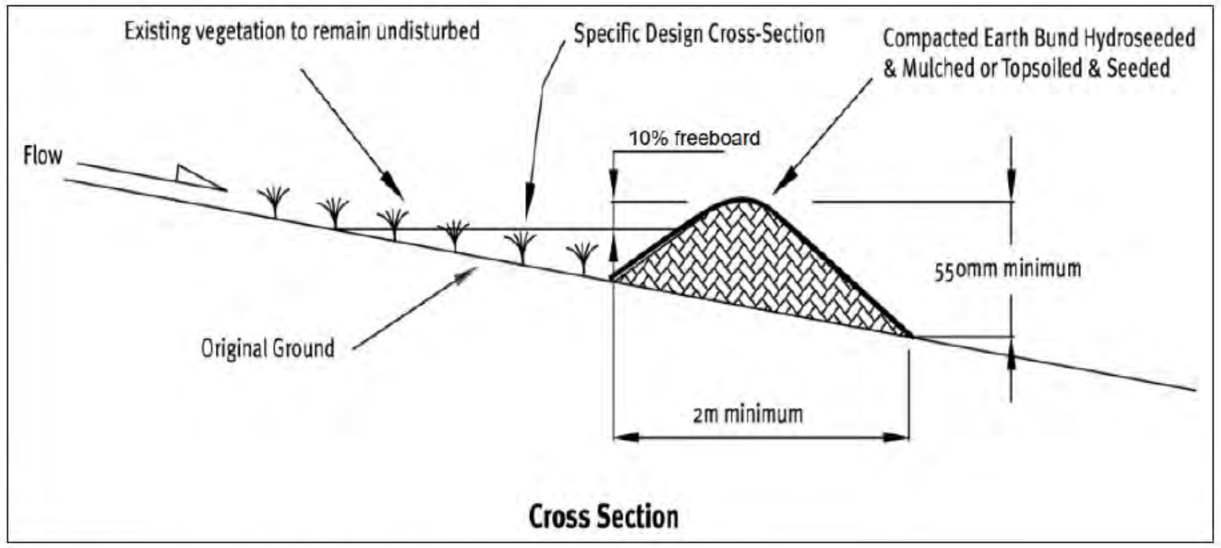


Figure 1: Cross-section of a clean water diversion (permitter bund).

Figure 2: Turfing scraped from within the site to stabilise the perimeter bund. The perimeter bund provides both clean and dirty water control.

Table 1: Clean water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 300mm Freeboard
41mm	5ha	0.17097	0.3m	2%	250	275

<u>A minimum bund height of 500mm</u> will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

All clean water diversions must be stabilised.

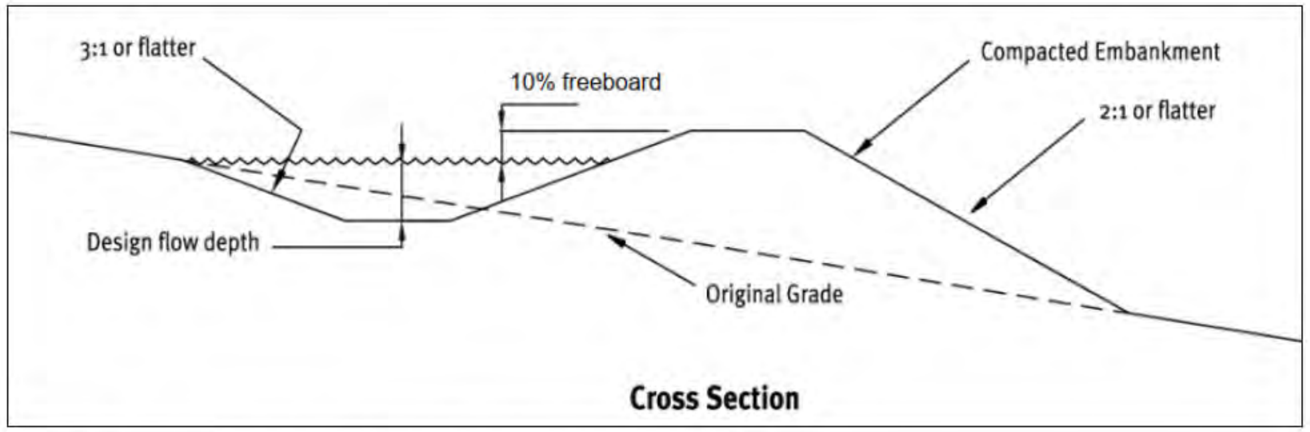


Figure 3: Cross-section of a dirty water diversion.

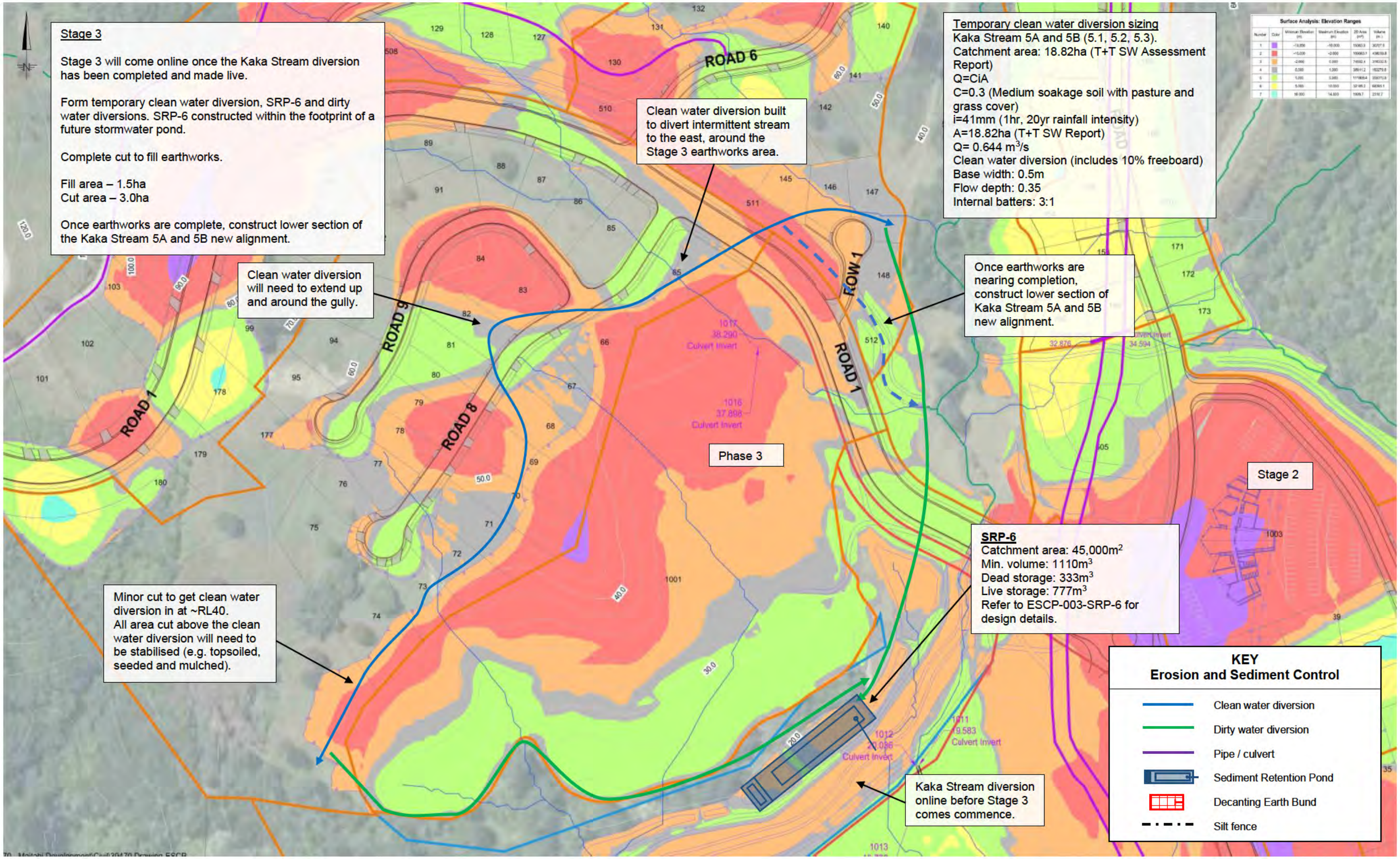
Table 2: Dirty water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 10% Freeboard
41mm	5ha	0.34194	0.5	2%	250	275

<u>A minimum bund height of 500mm</u> will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

Appendix B – Erosion and Sediment Control Plans

Title	Drawing No.	Sheet No.	Revision	Date
Erosion and Sediment Control Plan – Stage 3	ESCP-003-01	1	A	17.06.24
Erosion and Sediment Control Plan – SRP-6 Design Details	ESCP-003-SRP-6	2	A	17.06.24



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	17.06.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL
Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 3

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-003-01	1

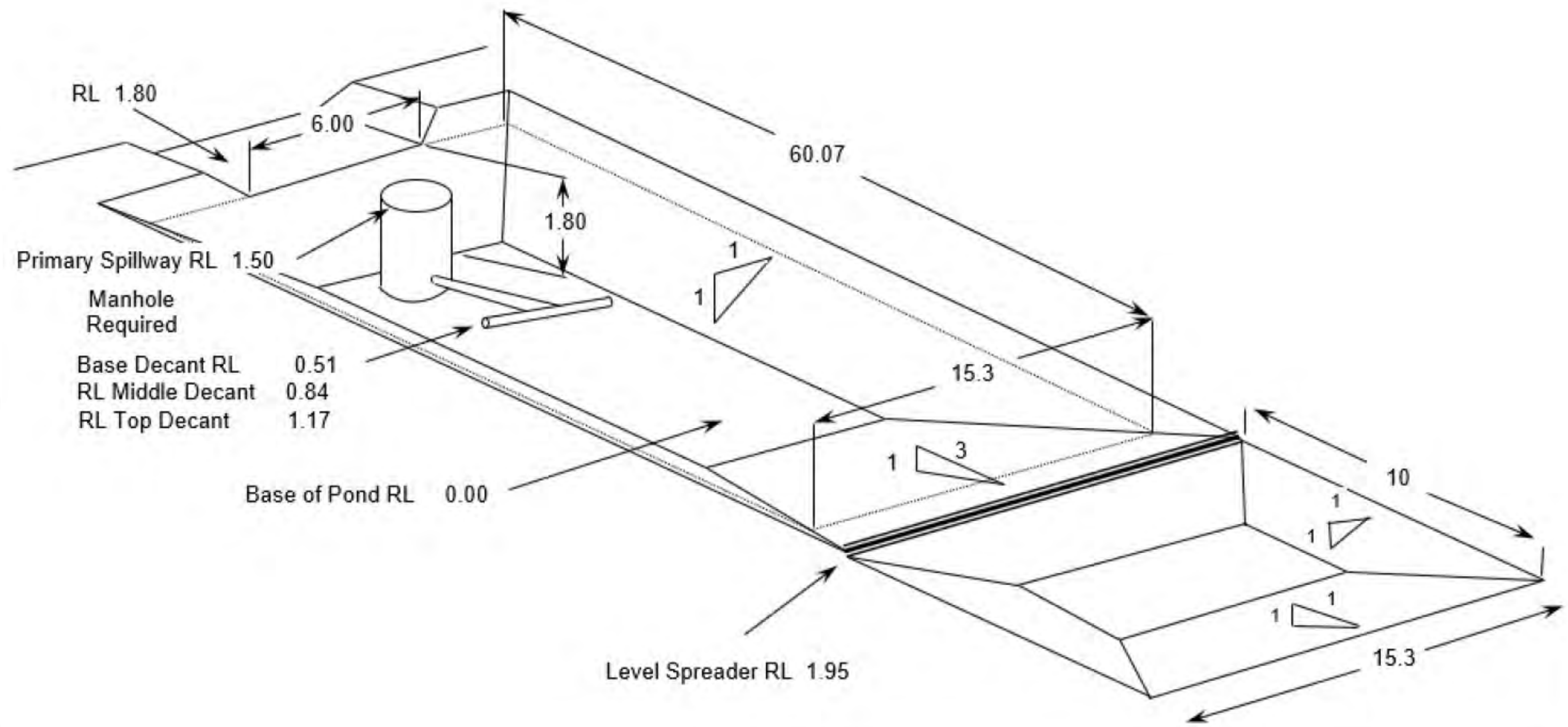
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	4:1	1:1	1.80	0.00

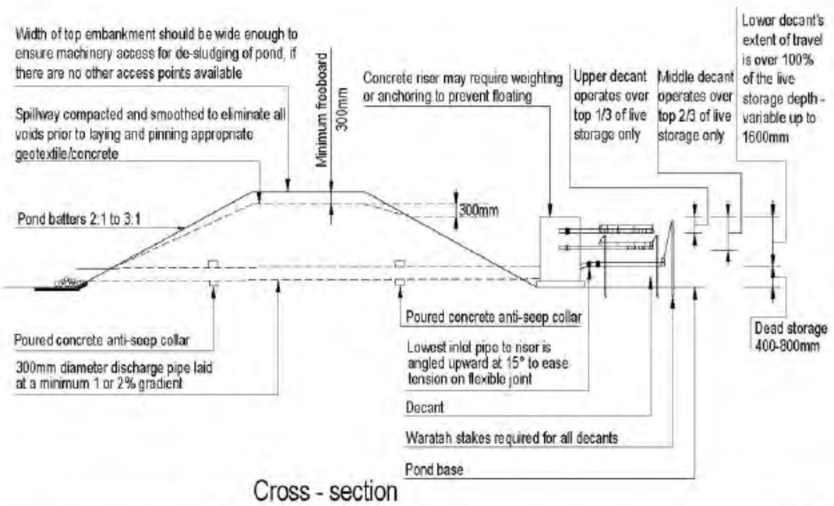
SRP-6

Minimum Storage Volume (m3)	1110
Dead storage (m3)	333
Live storage (m3)	777
Length at Emergency Spillway Level	60.07
Width at Emergency Spillway Level	15.32
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	Manhole Required
Number of decants	3
Number of holes per decant	164
Minimum outlet diameter	300mm
RL Emergency Spillway	1.80
RL Primary Spillway	1.50
RL Level Spreader (min)	1.95
RL Base Decant	0.51
RL Middle Decant	0.84
RL Top Decant	1.17
Length at Base	52.87
Width at Base	11.72

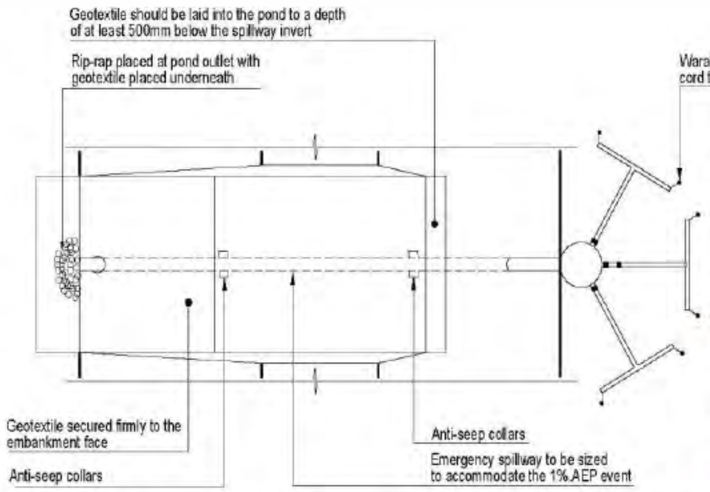
Forebay

Depth	1 m	min. depth
Width	15.32 m	full width of pond
Length	10 m	min. length
Volume	111 m3	min. volume



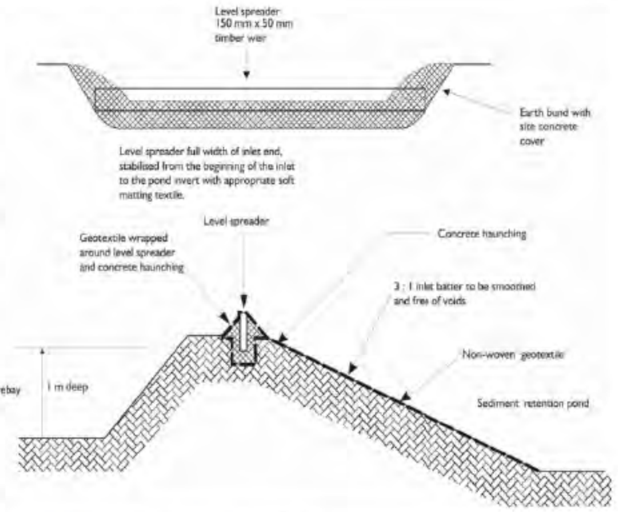


Cross - section



SRP-6 Sizing Calculations

Q =	0.307746	
C =	0.6	Med. Soakage bare soil
i =	41	1hr 20yr rainfall intensity
A =	4.5	Max. catchment area.
V =	1107.9 m^3	
Q =	0.307746	
D =	3600	
Forebay volume =	110.8 m^3	



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019.*
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	17.06.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL — Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-6 Design Details
Drawn	ZW
Checked	CS
Drawing No.	ESCP-003-SRP-6
Sheet No.	2

Maitahi Residential Development

CCKV Maitai Dev Co LP

SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN

STAGE 4

SSESCP-004

Revision A
9 July 2024

SouthernSkies Environmental

1 STAGE 4 SSESCP - CONSTRUCTION NOTES

1.1 Scope

This Site-Specific Erosion and Sediment Control Plan (SSESCP) covers the land disturbing activities associated with Stage 4 of the Maitahi Development.

In brief, the Stage 4 ESCP construction sequence will be:

- Construct SRP-7 and SRP-8 and clean and dirty water diversions.
- Construct upper section of the Kaka 5A and 5B Stream permanent alignment.
- Commence restricted cut and fill within Stage 4. The area of earthworks is limited by the clean water diversion construction and existing Kaka 5A and 5B stream alignment.
- Once the Kaka 5A and 5B stream permanent alignment is completed and commissioned this will enable earthworks across the remained of the stage (DO Earthworks Plan Phase 3A and Phase 3B).

The proposed erosion and sediment control (ESC) measures and methodology have been designed in accordance with the *Nelson Tasman Erosion and Sediment Control Guidelines, July 2019 (NTESCG).*

The ESC measures are detailed on the erosion and sediment control (ESC) drawings provided in Appendix B.

1.2 Methodology

Prior to the commencement of any works the Project Manager/ Earthworks Manager will inspect the site to confirm the suitability of the proposed controls and methodology.

A final version of this SSESCP will be completed and provided to NCC for certification prior to the commencement of earthworks within this stage.

At the approximate location, as detailed in the attached drawings, the erosion and sediment controls will be constructed.

<u>ESCP-004-01</u>

- The first step will be to construct the clean water diversions and SRP-7 and SRP-8. SRP-7 is located within the Stage 3 fill area. Due to topography within Stage 4 (Phase 3A), this is the most suitable location of this pond. SRP-8 will be constructed below Phase 3B area. This pond will need to have a length to width ratio of 5:1 due to the topography to minimise the amount of cut required to install the pond. Final locations to be confirmed on site. SRP-8 may need to be divided into two smaller ponds. A second smaller pond would sit further to the northeast, beyond ROW2.
- The first step of the Stage 4 earthworks will be to construct the upper section of the Kaka 5A and 5B permanent stream alignment. A temporary clean water diversion will be constructed at the top (northern extent) of the earthworks area to divert clean water to the southern tributary. This will enable the full alignment of the permanent stream diversion to be undertaken offline. Clean water is diverted into the lower section of the permanent Kaka 5A and 5B alignment constructed as part of Stage 3 ESC.
- During this stage of works SRP-8 will collect any dirty water runoff generated during the permanent stream construction.
- Bulk earthworks can commence within the eastern section of SRP-7 catchment.

<u>ESCP-004-02</u>

- Once the Kaka 5A and 5B permanent stream alignment has been constructed and commissioned, bunds will be installed either side of the permanent stream to protect it from any dirty water runoff. Dirty water will be diverted to SRP-7 and SRP-8.
- Commence cut to fill earthworks. Phase 3A and 3B are characterized by steeper topography. The earthworks involve cut to fill to construct Road 1, Road 6, Road 7, Road 8, Road 9 and ROW2. SRP-7 and SRP-8 will treat catchments of 5ha and 4.5ha respectively. However, the actual area of earthworks will be less than the totals 9.5ha. Areas with the SRP catchments will be retained in pasture and not earth worked (refer to ESCP-004-02).
- Additional erosion protection and contour drains will be required to minimise erosion. Rock riprap will also be used where required to reduce flow velocities, especially before runoff enters the SRPs.

Stage 4 includes generally a cut operation of approximately 18,000 m^3 of cut to waste. The cut material is to be taken to the Valley Fill Area, refer to Stage 2 SSESCP.

As-Builts

- An as-built for each sediment control will be completed following their installation certifying that the controls have been constructed in accordance with this ESCP and the NTESCG.

Dust Management

- The emphasis of the site dust strategy will be one of prevention.
- A water cart will be used, as required, to dampen haul roads and prevent dust.
- Speed restriction will be in place throughout the site to minimise dust generation from vehicles and plant where and when required.
- If dust cannot be managed during excessively windy conditions, then the earthworks will cease until the wind speed drops.

Stabilisation

- The works are to be staged in accordance with the staging details above. As areas are completed, they will be progressively stabilised. Stabilisation will include, aggregate, topsoil and grass seeded, including mulching when appropriate, and geotextile in some instances. Note, all sediment control will remain in place until the site is stabilised for the respective catchment area.

Construction Timetable

The stage works are planned to commence in Year 3 of the development (expected to be 20276/28). The Stage 4 works are expected to take approximately six to seven months to complete.

1.3 Chemical Treatment

- Chemical treatment will be employed on each sediment control measure. Refer to the site's Chemical Treatment Management Plan (ChemTMP) for details.
- All chemical treatment will be managed in accordance with the site's Chemical Analysis and Reactivity Test (CART) report and ChemTMP.

1.4 Monitoring and Maintenance

- The ESC measures will be inspected and signed off by the Construction Manager or Environmental Advisors prior to commencement of earthworks.
- The monitoring and maintenance requirements for the ESC measures will be in accordance with the Erosion and Sediment Control Monitoring Report, best practice procedures and schedules including extreme weather events, remedial actions, and response.
- The ESC monitoring and maintenance requirements will include, but are not limited to:
    - all ESC measures will be inspected on a weekly basis and within 24 hours of each rainstorm event that is likely to impair the function of performance of the controls.
    - any required maintenance or improvements to control measures will be undertaken immediately.
    - SRPs will be clean out before the volume of accumulated sediment reaches 20% of the total volume of the pond. Forebays will be cleaned out more regularly, as sediment deposition occurs.
    - sediment deposits against the silt fences will be removed as necessary and before sediment accumulation reaches 20% of the fabric height.
    - all erosion and sediment control measures will be maintained in accordance with NTESCG; and
    - weather forecasts will be monitored on a daily basis.

- A record will be maintained of the date and time of inspections undertaken, any maintenance requirements identified, and any maintenance undertaken.
- All ESC measures are to be monitored and maintained throughout the works until the site is stabilised.

The ESCMP includes:
- Pre and post rain event monitoring.
- Rainfall trigger event monitoring when rainfall exceeds 25mm within a 24-hour period.
- During a rainfall trigger event, the site's ESC measures will be checked, and performance of the sediment control measures tested by clarity and pH.
- The discharge targets are:
  - >100mm of clarity measured at the outlet end of the sediment control measure
  - A pH between 5.5 and 8.5 when using chemical treatment.

1.5 Rainfall Response and Contingency Measures

- Best management practices will be used to minimise sediment yields and monitor any potential effects. In addition to the visual inspections and weekly self-auditing refer above, if a severe weather event is forecast, (a severe weather event is defined as greater than a 5% AEP across the project works area) the following actions will be implemented.
- Pre-Weather Event Procedure:
  - Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;
  - Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
  - As far as practicable, stabilise disturbed areas; and
  - Photograph critical ESC measures prior to the weather event to document pre-weather event condition.
- During the severe weather event that results in the discharge of treated discharges from the sediment retention devices water quality inspections will be undertaken where practical at discharge locations where treated discharge could leave the site. The discharges will be checked to document water quality.

1.6 Spill Management and Contingency

- Spill kits will be located at the site sign in station. Fire extinguishers will be located in all site vehicles.
- All refuelling will be undertaken a minimum of 20m away from a water course or overland flow path.
- If there is a chemical spill onsite it shall be immediately contained using earth bunds, or silt socks to prevent it entering water bodies. The spilt chemical shall be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it shall be mixed with a volume of soil to allow the spilt chemical to be collected along with the contaminated soil. The material will then be removed off site to an authorised facility.
- If there is a spill of chemical into ponded water, discharge from the pond to natural water shall be prevented.

  If there is a spill of chemical into flowing water:

  1) Nelson City Council shall be advised immediately.

  2) The volume of the spill shall be recorded.

  3) If possible, the water and spilt chemical shall be pumped into a bund or pond until all the spilt chemical has been removed from the watercourse.

  4) If the chemical cannot be removed from the watercourse any downstream users shall be identified and advised.

1.7 Staff Contact Details

Position	Name	Ph Number
Construction Manager	Neil Donaldson	[redacted]
Earthworks Manager	Malcolm Edridge	[redacted]
Site Engineer	TBC	TBC
Environmental / ESC Advisor	Campbell Stewart Zac Woods	[redacted]

Stage 5

Stage 5 is located to the northwest of the Stage 4 earthworks boundary. Works are required to continue the road up the hill. A SSESCP will be provided for Stage 5 and provided to NCC for review prior to works commencing within this stage.

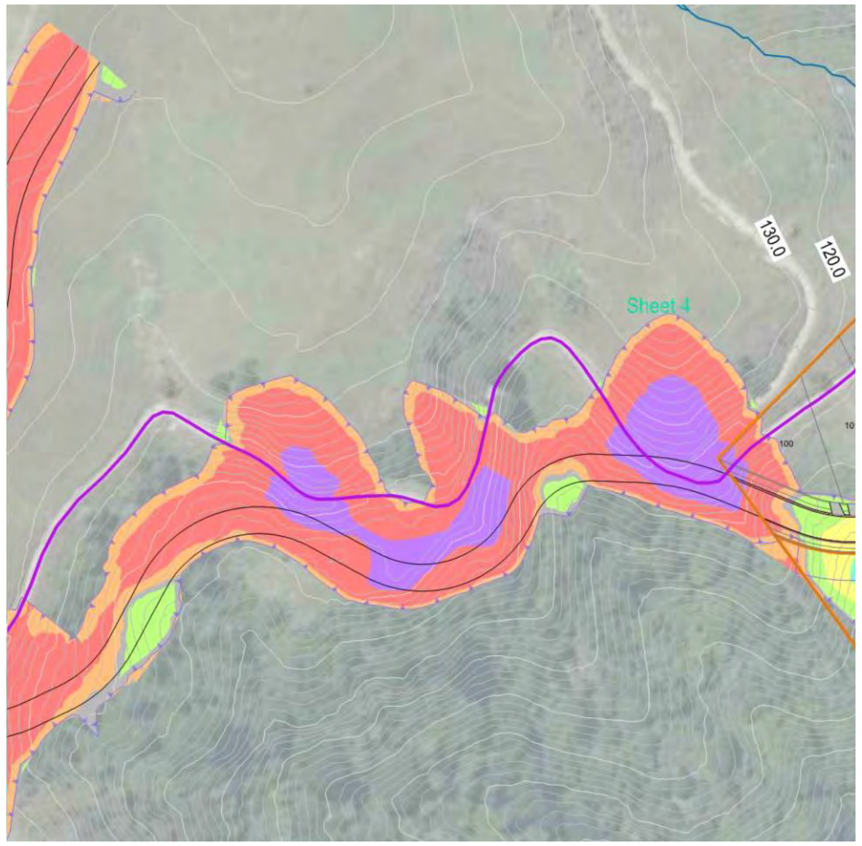
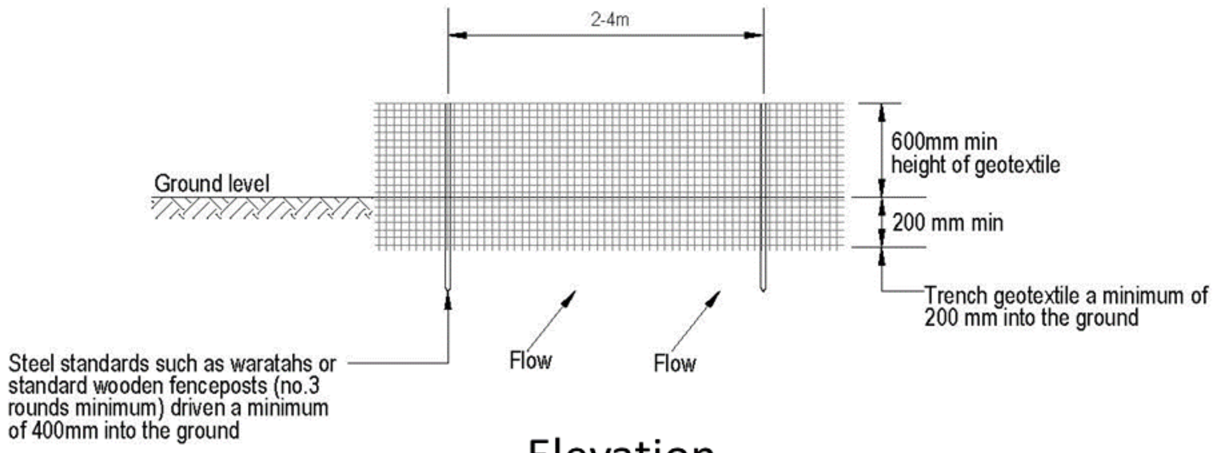
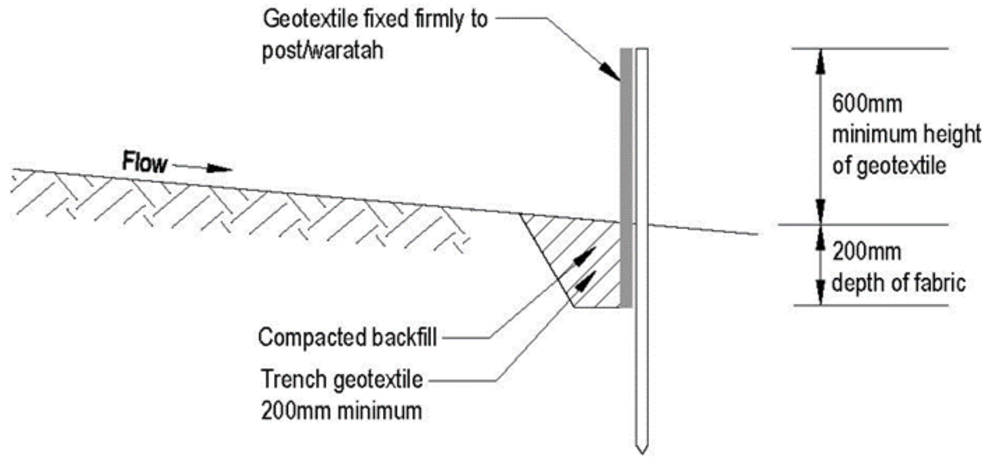


Figure 1: Indicative extent of Stage 5 earthworks.

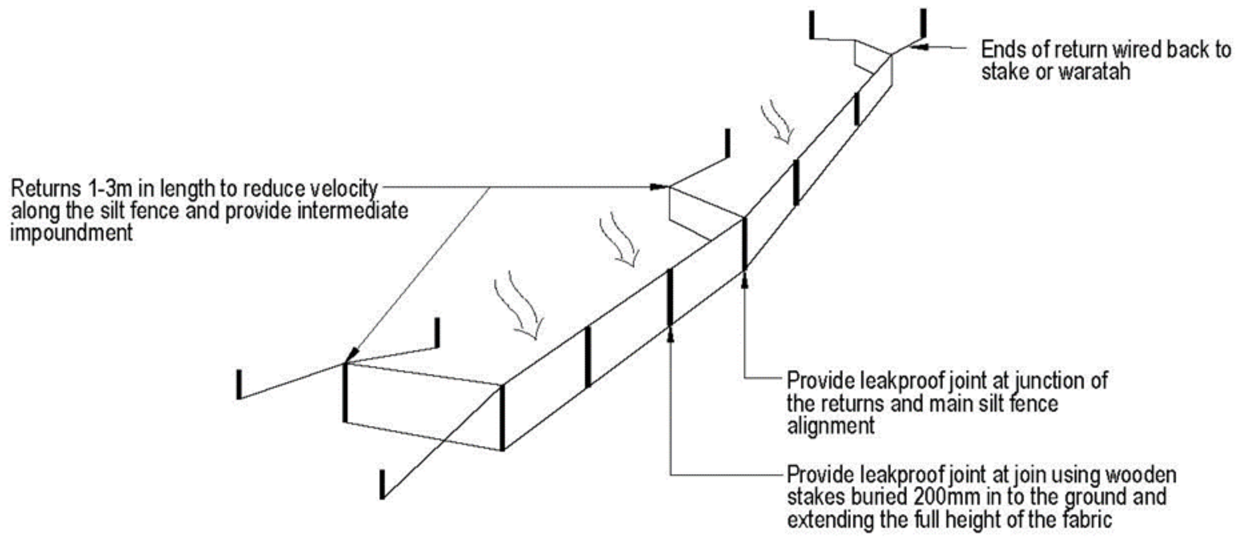
Appendix A – Erosion and Sediment Control Details



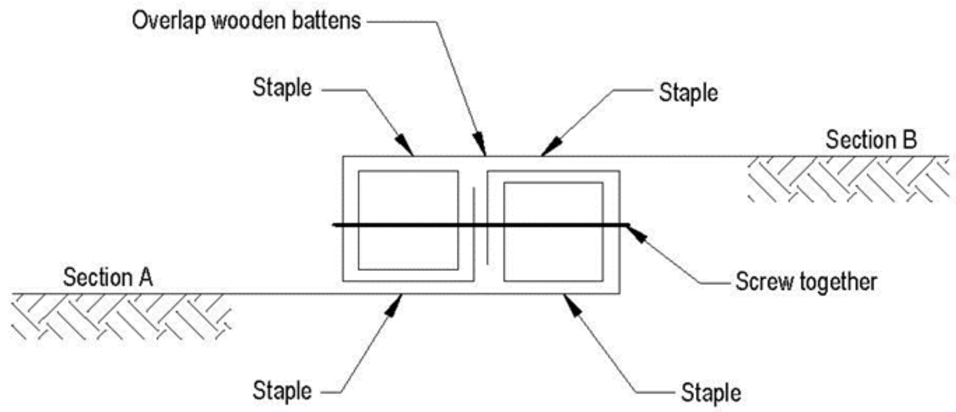
Elevation



Cross-section



Silt fence with returns and support wire



Standard fabric joint

Figure 3: Silt fence cross-section and standard fabric joint.

Figure 2: Schematic of a silt fence.

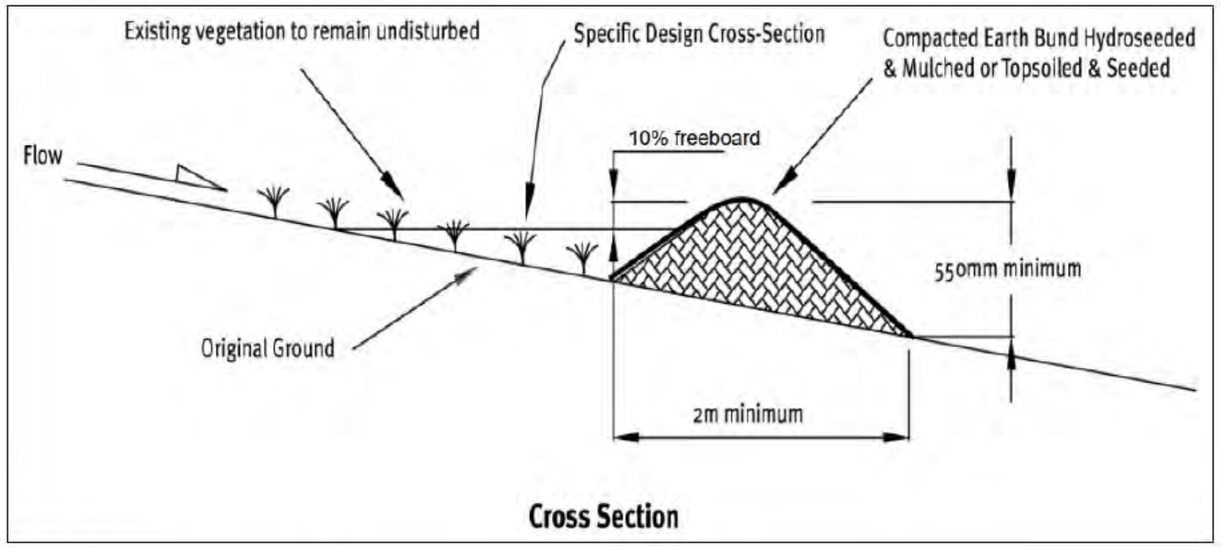


Figure 4: Cross-section of a clean water diversion (permitter bund).

Figure 5: Turfing scraped from within the site to stabilise the perimeter bund. The perimeter bund provides both clean and dirty water control.

Table 1: Clean water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 300mm Freeboard
41mm	5ha	0.17097	0.3m	2%	250	275

A minimum bund height of 500mm will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

All clean water diversions must be stabilised.

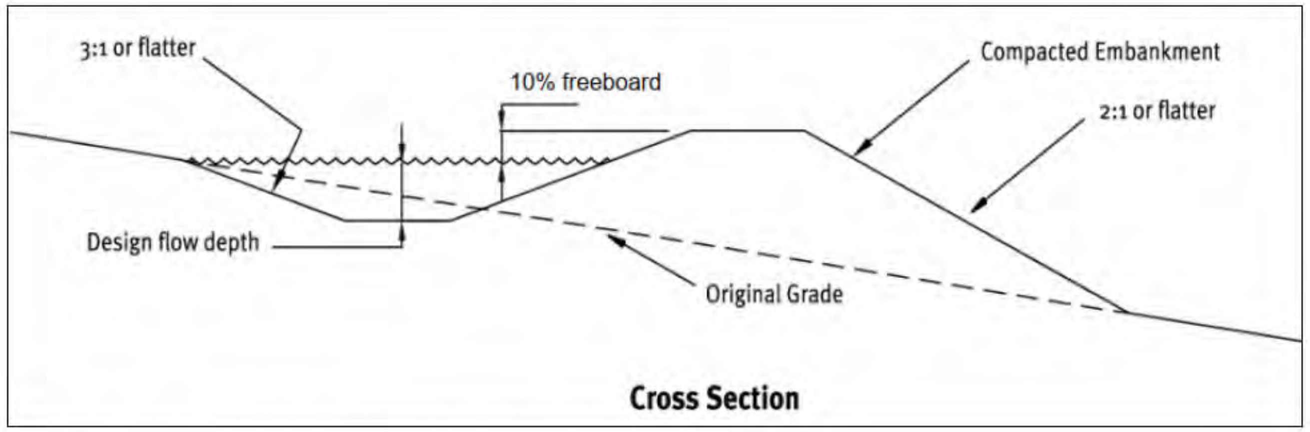


Figure 6: Cross-section of a dirty water diversion.

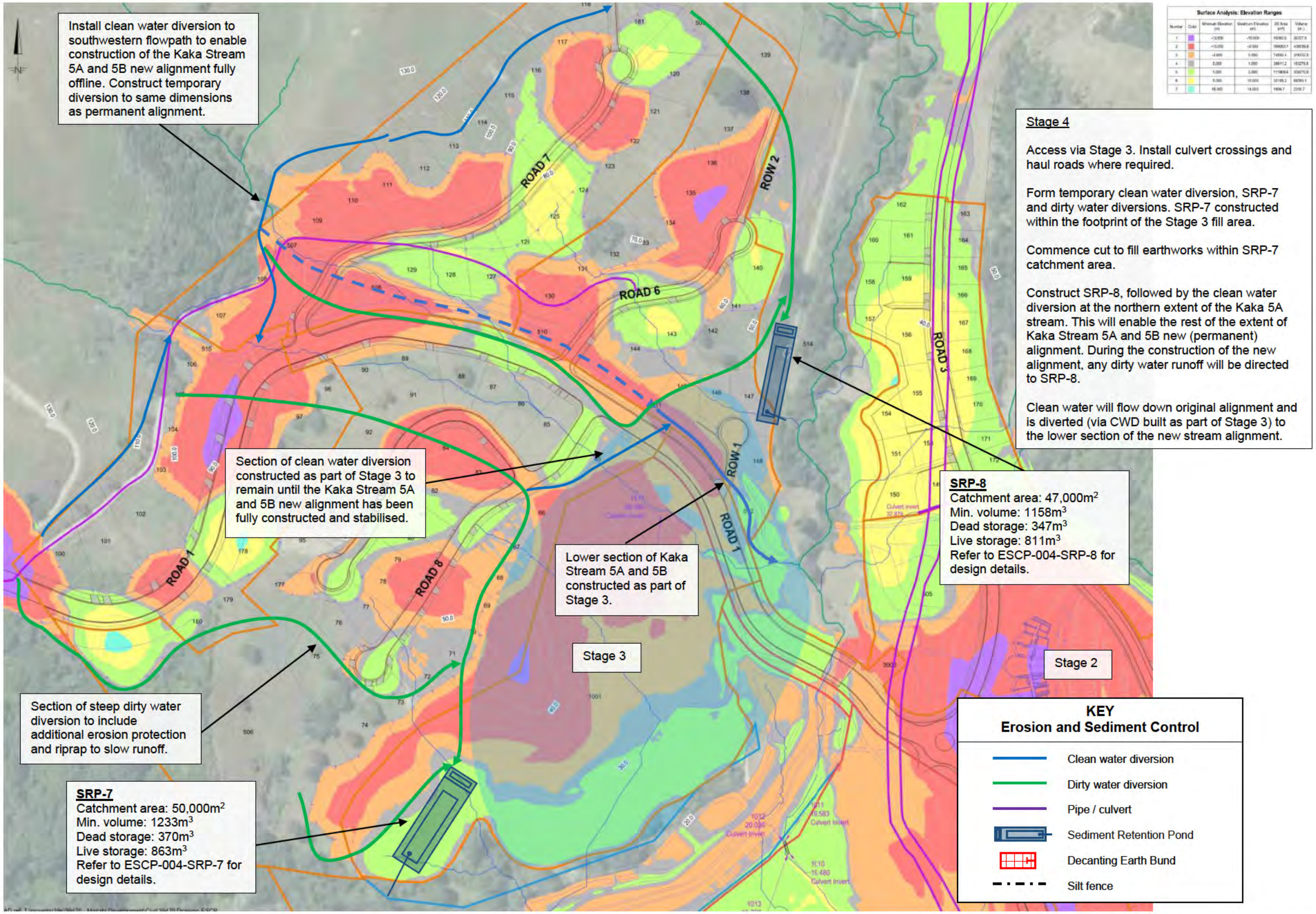
Table 2: Dirty water diversion sizing summary.

Clean water diversions						
1hr, 20yr rainfall intensity	Catchment Area (maximum)	Peak Flow (m3/s)	Base Width	Slope (minimum)	Minimum Design Flow Depth (mm)	Including Minimum 10% Freeboard
41mm	5ha	0.34194	0.5	2%	250	275

A minimum bund height of 500mm will be installed across the project which is designed to convey the 5% annual exceedance probability (AEP) storm.

Appendix B – Erosion and Sediment Control Plans

Title	Drawing No.	Sheet No.	Revision	Date
Erosion and Sediment Control Plan – Stage 4	ESCP-004-01	1	A	09.07.24
Erosion and Sediment Control Plan – Stage 4	ESCP-004-02	2	A	09.07.24
Erosion and Sediment Control Plan – SRP-7 Design Details	ESCP-004-SRP-7	3	A	17.06.24
Erosion and Sediment Control Plan – SRP-8 Design Details	ESCP-004-SRP-8	4	A	17.06.24



GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

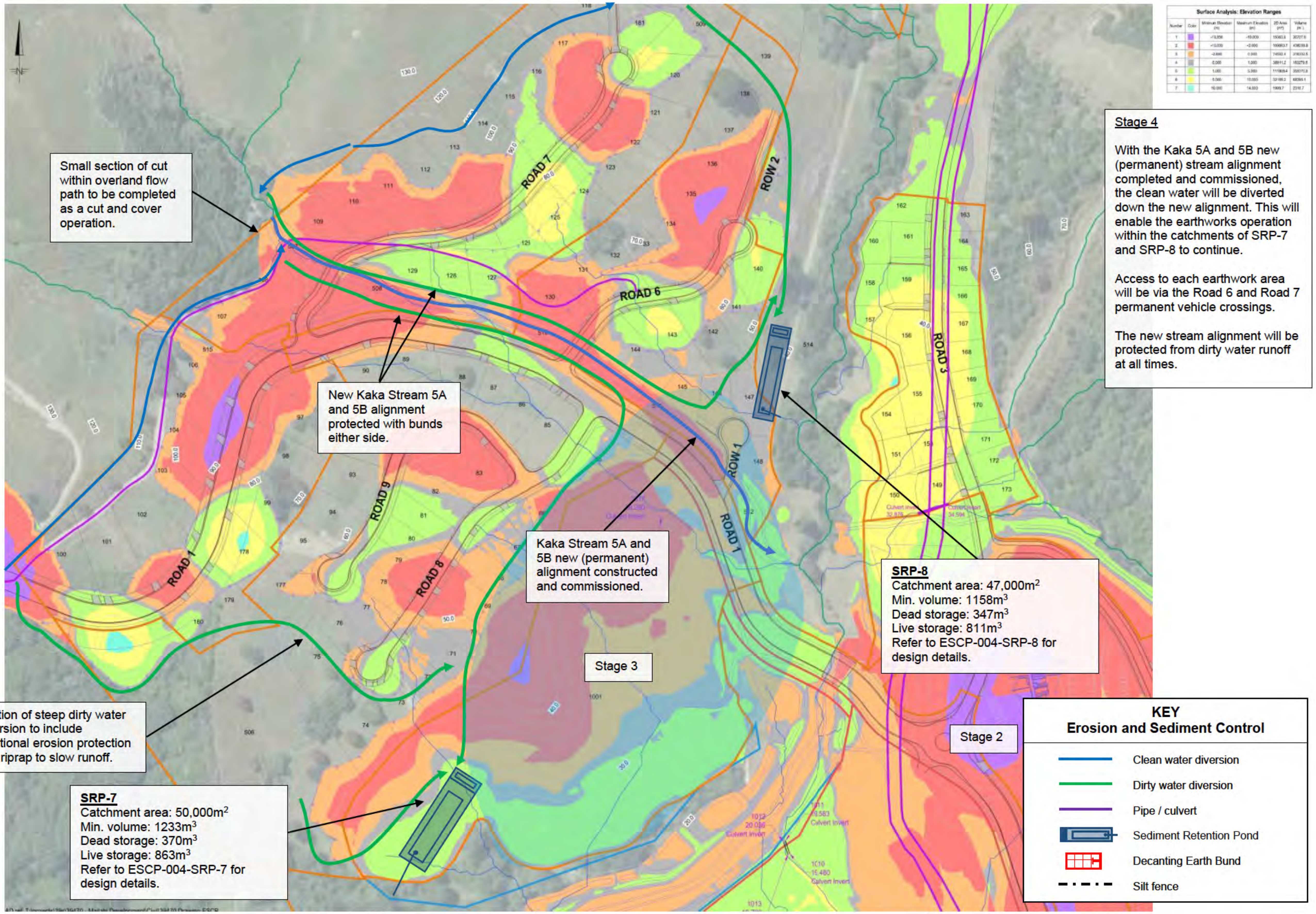
REV	DATE	REVISION DETAILS	APPROVED
A	09.07.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 4

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-004-01	1



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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REV	DATE	REVISION DETAILS	APPROVED
A	09.07.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stage 4

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-004-02	1

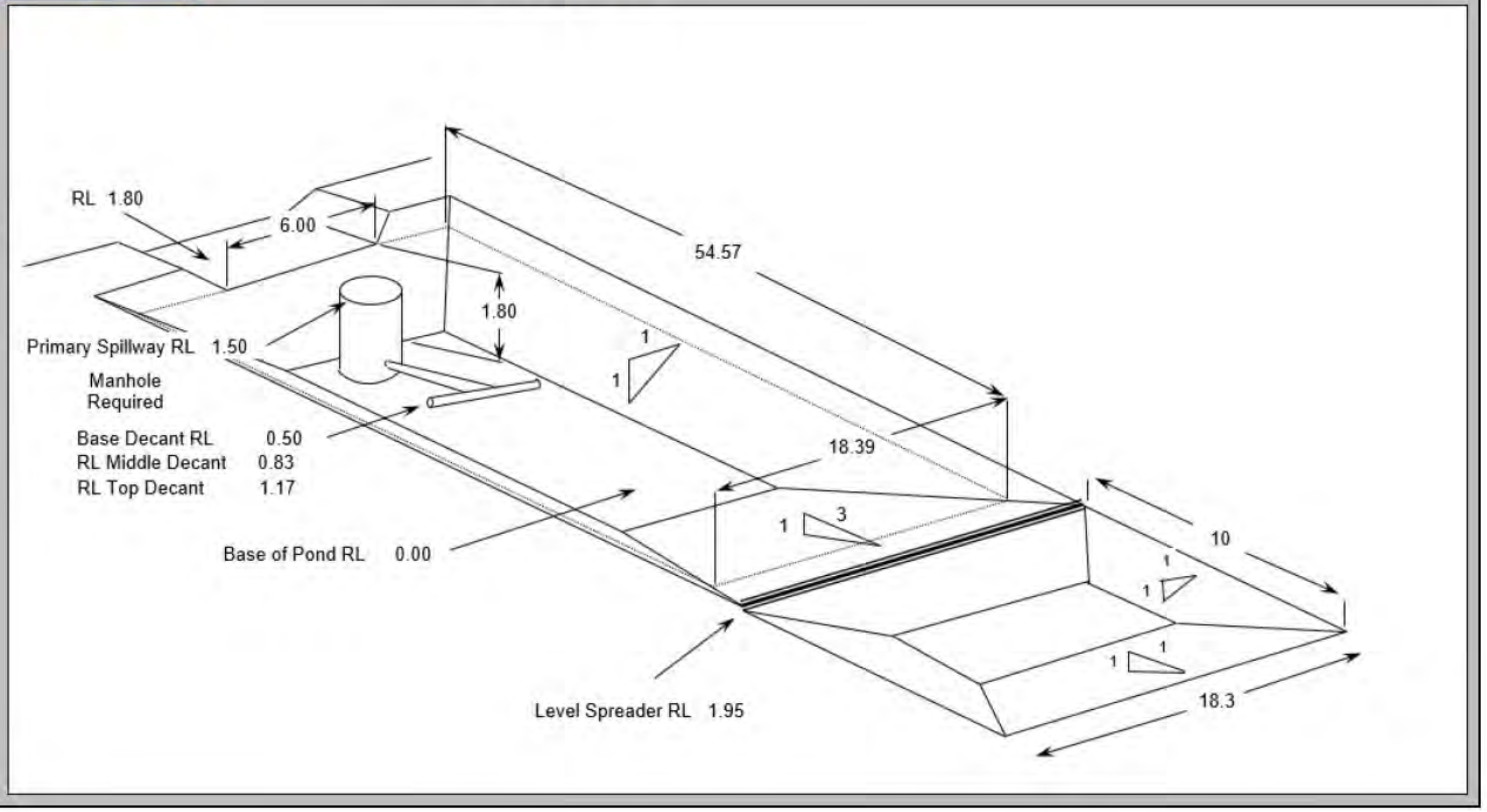
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	3:1	1:1	1.80	0.00

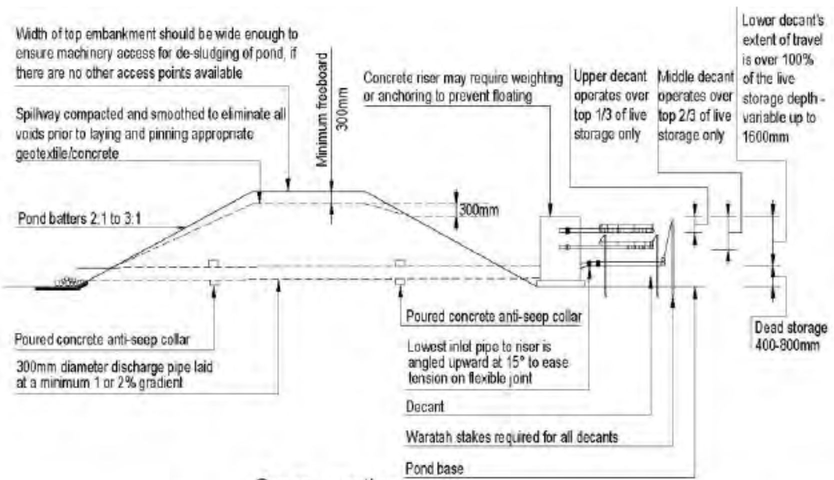
SRP-7

Minimum Storage Volume (m3)	1233
Dead storage (m3)	369.9
Live storage (m3)	863.1
Length at Emergency Spillway Level	54.57
Width at Emergency Spillway Level	18.39
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	Manhole Required
Number of decants	3
Number of holes per decant	182
Minimum outlet diameter	300mm
RL Emergency Spillway	1.80
RL Primary Spillway	1.50
RL Level Spreader (min)	1.95
RL Base Decant	0.50
RL Middle Decant	0.83
RL Top Decant	1.17
Length at Base	47.37
Width at Base	14.79

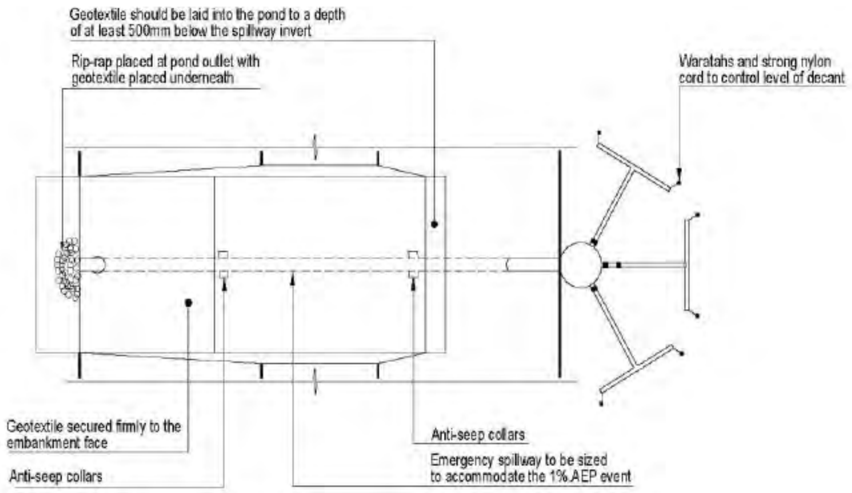
Forebay

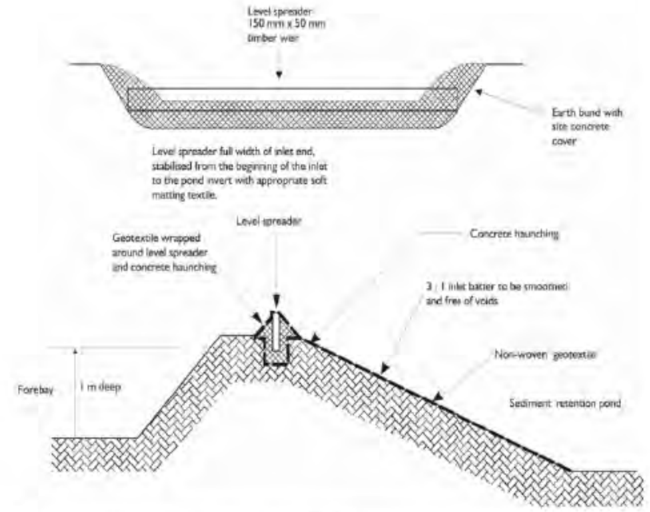
Depth	1 m	min. depth
Width	18.39 m	full width of pond
Length	10 m	min. length
Volume	123.3 m3	min. volume





Cross - section





GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	09.07.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-7 Design Details

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-004-SRP-7	3

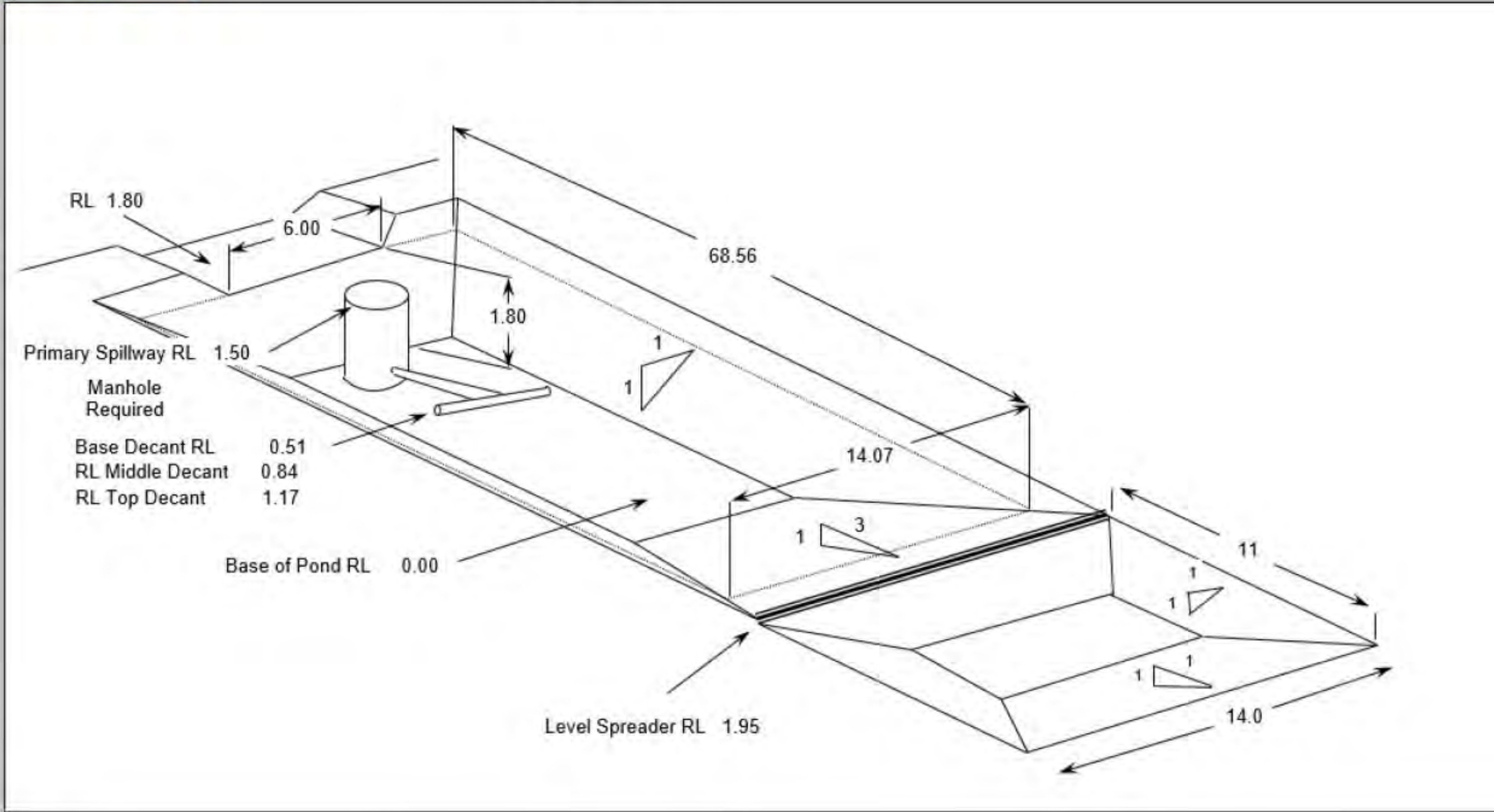
Size criteria	Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
Auto	5:1	1:1	1.80	0.00

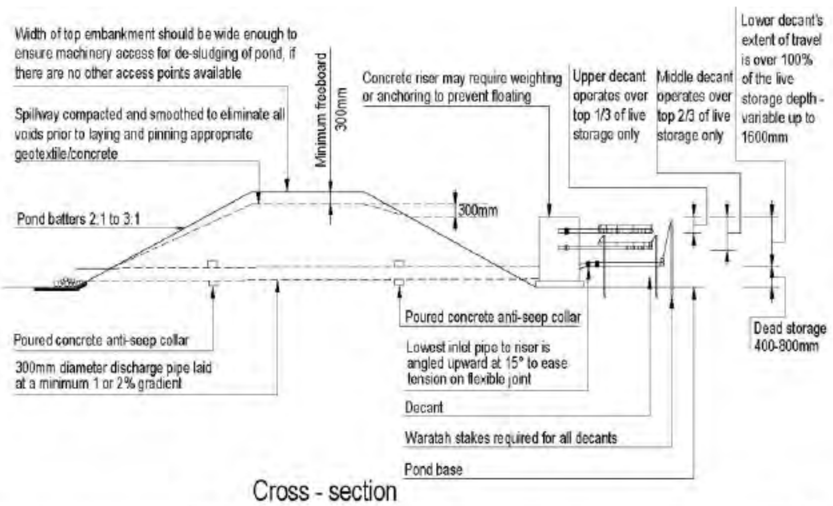
SRP-8

Minimum Storage Volume (m3)	1158
Dead storage (m3)	347.4
Live storage (m3)	810.6
Length at Emergency Spillway Level	68.56
Width at Emergency Spillway Level	14.07
Spillway base width (300mm deep)	6.00
Primary Spillway diameter (min)	Manhole Required
Number of decants	3
Number of holes per decant	171
Minimum outlet diameter	300mm
RL Emergency Spillway	1.80
RL Primary Spillway	1.50
RL Level Spreader (min)	1.95
RL Base Decant	0.51
RL Middle Decant	0.84
RL Top Decant	1.17
Length at Base	61.36
Width at Base	10.47

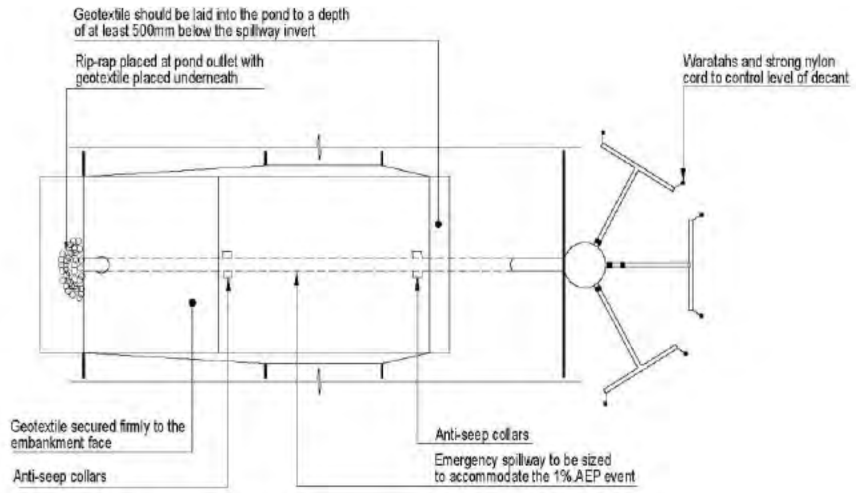
Forebay

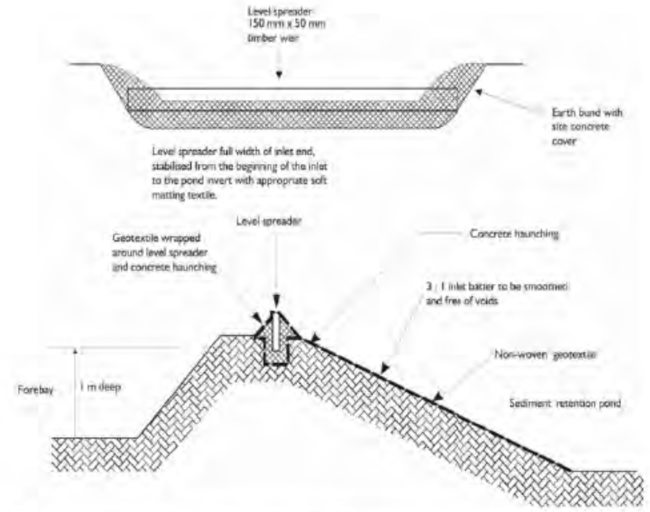
Depth	1 m	min. depth
Width	14.07 m	full width of pond
Length	11 m	min. length
Volume	115.8 m3	min. volume





Cross - section





GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019.*
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

REV	DATE	REVISION DETAILS	APPROVED
A	09.07.24	Draft for Review	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan SRP-8 Design Details

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-004-SRP-8	4

Maitahi Residential Development

CCKV Maitai Dev Co LP

SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN
KAKA STREAM DIVERSION

SSESCP-SW-01

Revision A
26 May 2024

SouthernSkies Environmental

1 KAKA STREAM DIVERSION SSESCP - CONSTRUCTION NOTES

1.1 Scope

This Site-Specific Erosion and Sediment Control Plan (SSESCP) covers the land disturbing activities associated with Kākā Stream diversion of the Maitahi Development.

The lower reach of the Kākā Stream is to be realigned, moving it to an increased channel length along the western side of the valley floor. This will then allow development of the lower gradient areas of the central and eastern side, as well as providing space for permanent stormwater treatment wetlands to service the permanent development. The realigned channel will tie in with the downstream end of the existing alignment and discharge to the Maitahi River at the existing location (Dennes Hole).

The proposed erosion and sediment control (ESC) measures and methodology have been designed in accordance with the *Nelson Tasman Erosion and Sediment Control Guidelines, July 2019 (NTESCG).*

The ESC measures are detailed on the erosion and sediment control (ESC) drawings provided in Appendix B.

1.2 Methodology

- Prior to the commencement of any works the Project Manager/Earthworks Manager will inspect the site to confirm the suitability of the proposed controls and methodology.
- A final version of this SSESCP will be completed and provided to NCC for certification prior to commencement of earthworks within this stage.
- At the approximate location, as detailed in the attached drawings, the erosion and sediment controls will be constructed.
- A staged methodology is to be undertaken to ensure that the works are undertaken offline as follows:

<u>Kākā Stream – Stream Diversion Stage 1 (ESCP-SW-001-01)</u>

Kākā Stream will continue to flow through the existing alignment. No works within the stream required during Stage 1.

- Install silt fences at lower extent of each section of the stream diversions as shown in drawing ESCP-SW-001-01.
- Construct two sections of temporary stream diversion offline while Kākā Stream continues to flow through the existing alignment.
- Cut material to be placed within fill area, refer to SSESCP-001.
- Stabilise temporary stream diversion from top working towards the bottom.
  - Construction and stabilisation to be confirmed with ecologist.
  - Stabilisation likely to be limited to hydroseeding the batters.
  - Base of stream likely to be gravel rock.

<u>Kākā Stream –Stream Diversion Stage 2 (ESCP-SW-001-02)</u>

Stage 2 includes works within the stream to divert the Kākā Stream through the two sections of temporary stream diversion. Refer to drawing ESCP-SW-001-02 for details.

- At the two sections of completed temporary stream diversion (works to be undertaken one section at a time) dam and over pump of the Kākā Stream water to complete downstream tie ins, followed by the dam and over pump Kākā Stream water to complete upstream tie ins.
- Once stabilised, a temporary dam (sandbags or similar) will be installed to divert the Kākā Stream through the sections of the temporary stream diversion.

<u>Kākā Stream –Stream Diversion Stage 4 (ESCP-SW-001-03)</u>

With the alignment of the permanent stream diversion now offline (approx. 470m) the construction of the permanent stream diversion will commence. Refer to drawing ESCP-SW-001-03

- The stream diversion will be constructed in approximately 150m sections with a decanting earth bund (DEB) installed at the bottom of each section as the main form of sediment control. This equates to approximately 3,000 m^2 of stream diversion.
- Storage volumes in the DEB will increase as the cut progresses upslope.
- The section of stream diversion will be progressively stabilised from the top, working downslope.
- Each DEB will remain in place until this full extent of stream diversion is complete. Once complete, and fully stabilised, each DEB will be removed and area stabilised.

Once the stream diversion has been competed, and signed off by the project ecologist, the dams will be removed, and the Kākā Stream allowed to pass through its new alignment.

As-Builts

- An as-built for each sediment control will be completed following their installation certifying that the controls have been constructed in accordance with this ESCP and the NTESCG.

Dust Management

- The emphasis of the site dust strategy will be one of prevention.
- A water cart will be used, as required, to dampen haul roads and prevent dust.
- Speed restrictions will be in place throughout the site to minimise dust generation from vehicles and plant if and where required.
- If dust cannot be managed during excessively windy conditions, then the earthworks will cease until the wind speed drops.

Stabilisation

- The works are to be staged in accordance with the staging details above. As areas are completed, they will be progressively stabilised. Stabilisation will include, topsoil and grass seeded of the batters, including mulching when appropriate, and geotextile in some instances. Note, all sediment control will remain in place until the site is stabilised for the respective catchment area.

Construction Timetable

The Kākā Stream diversion works are expected to commence early in the project, planned for Year 1. The Kākā Stream diversion works are expected to take approximately eight weeks to complete.

1.3 Chemical Treatment

- Chemical treatment will be employed on each sediment control measures. Refer to the site's Chemical Treatment Management Plan (ChemTMP) for details.
- All chemical treatment will be managed in accordance with the site's Chemical Analysis and Reactivity Test (CART) report and ChemTMP.

1.4 Monitoring and Maintenance

- The ESC measures will be inspected and signed off by the Project Manager or Environmental Advisors prior to commencement of earthworks.

- The monitoring and maintenance requirements for the ESC measures will be in accordance with the Erosion and Sediment Control Monitoring Report, best practice procedures and schedules including extreme weather events, remedial actions, and response.
- The ESC monitoring and maintenance requirements will include, but are not limited to:
  - all ESC measures will be inspected on a weekly basis and within 24 hours of each rainstorm event that is likely to impair the function of performance of the controls.
  - any required maintenance or improvements to control measures will be undertaken immediately.
  - DEB's will be clean out before the volume of accumulated sediment reaches 20% of the total volume of the ponded area.
  - sediment deposits against the silt fences will be removed as necessary and before sediment accumulation reaches 20% of the fabric height.
  - all erosion and sediment control measures will be maintained in accordance with NTESCG; and
  - weather forecasts will be monitored on a daily basis.
- A record will be maintained of the date and time of inspections undertaken, any maintenance requirements identified, and any maintenance undertaken.
- All ESC measures are to be monitored and maintained throughout the works until the site is stabilised.

The ESCMP includes:
- Pre and post rain event monitoring.
- Rainfall trigger event monitoring when rainfall exceeds 25mm within a 24-hour period.
- During a rainfall trigger event, the site's ESC measures will be checked, and performance of the sediment control measures tested by clarity and pH.
- The discharge targets are:
  - >100mm of clarity measured at the outlet end of the sediment control measure
  - A pH between 5.5 and 8.5 when using chemical treatment.

1.5 Rainfall Response and Contingency Measures

- Best management practices will be used to minimise sediment yields and monitor any potential effects. In addition to the visual inspections and weekly self-auditing refer above, if a severe weather event is forecast, (a severe weather event is defined as greater than a 5% AEP across the project works area) the following actions will be implemented.
- Pre-Weather Event Procedure:
  - Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;
  - Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
  - As far as practicable, stabilise disturbed areas; and
  - Photograph critical ESC measures prior to the weather event to document pre-weather event condition.
- During the severe weather event that results in the discharge of treated discharges from the sediment retention devices water quality inspections will be undertaken where practical at discharge locations where treated discharge could leave the site. The discharges will be checked to document water quality.

1.6 Spill Management and Contingency

- Spill kits will be located at the site sign in station. Fire extinguishers will be located in all site vehicles.
- All refuelling will be undertaken a minimum of 20m away from a water course or overland flow path.
- If there is a chemical spill onsite it shall be immediately contained using earth bunds, or silt socks to prevent it entering water bodies. The spilt chemical shall be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it shall be mixed with a volume of soil to allow the spilt chemical to be collected along with the contaminated soil. The material will then be removed off site to an authorised facility.
- If there is a spill of chemical into ponded water, discharge from the pond to natural water shall be prevented.

If there is a spill of chemical into flowing water:

1) Nelson City Council shall be advised immediately.

2) The volume of the spill shall be recorded.

3) If possible, the water and spilt chemical shall be pumped into a bund or pond until all the spilt chemical has been removed from the watercourse.

4) If the chemical cannot be removed from the watercourse any downstream users shall be identified and advised.

1.7 Staff Contact Details

Position	Name	Contact Number
Construction Manager	Neil Donaldson	[redacted]
Earthworks Manager	Malcolm Edridge	[redacted]
Site Engineer	TBC	TBC
Environmental / ESC Advisor	Campbell Stewart Zac Woods	[redacted]

Appendix A – Erosion and Sediment Control Details

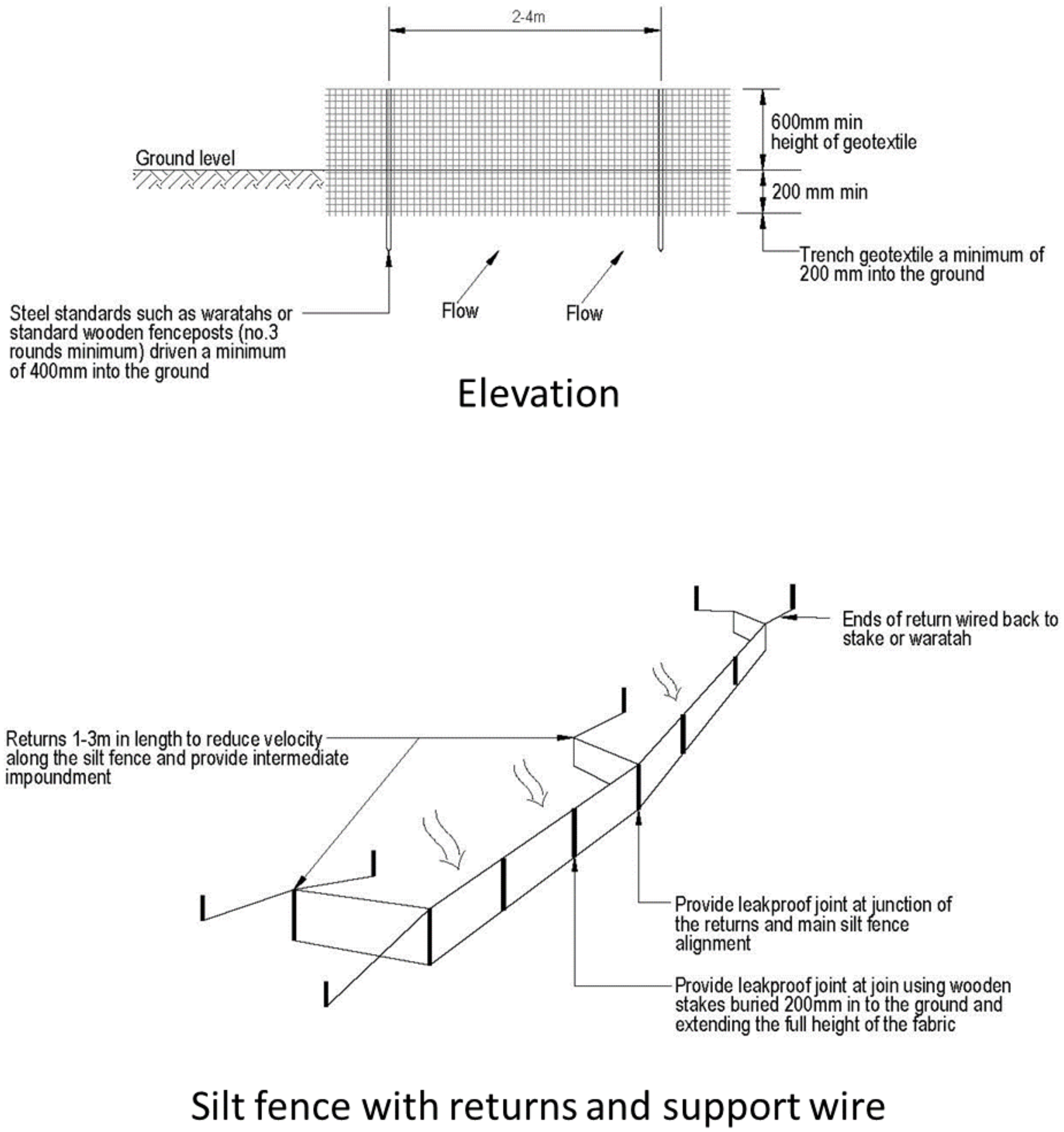


Figure 1: Schematic of a silt fence.

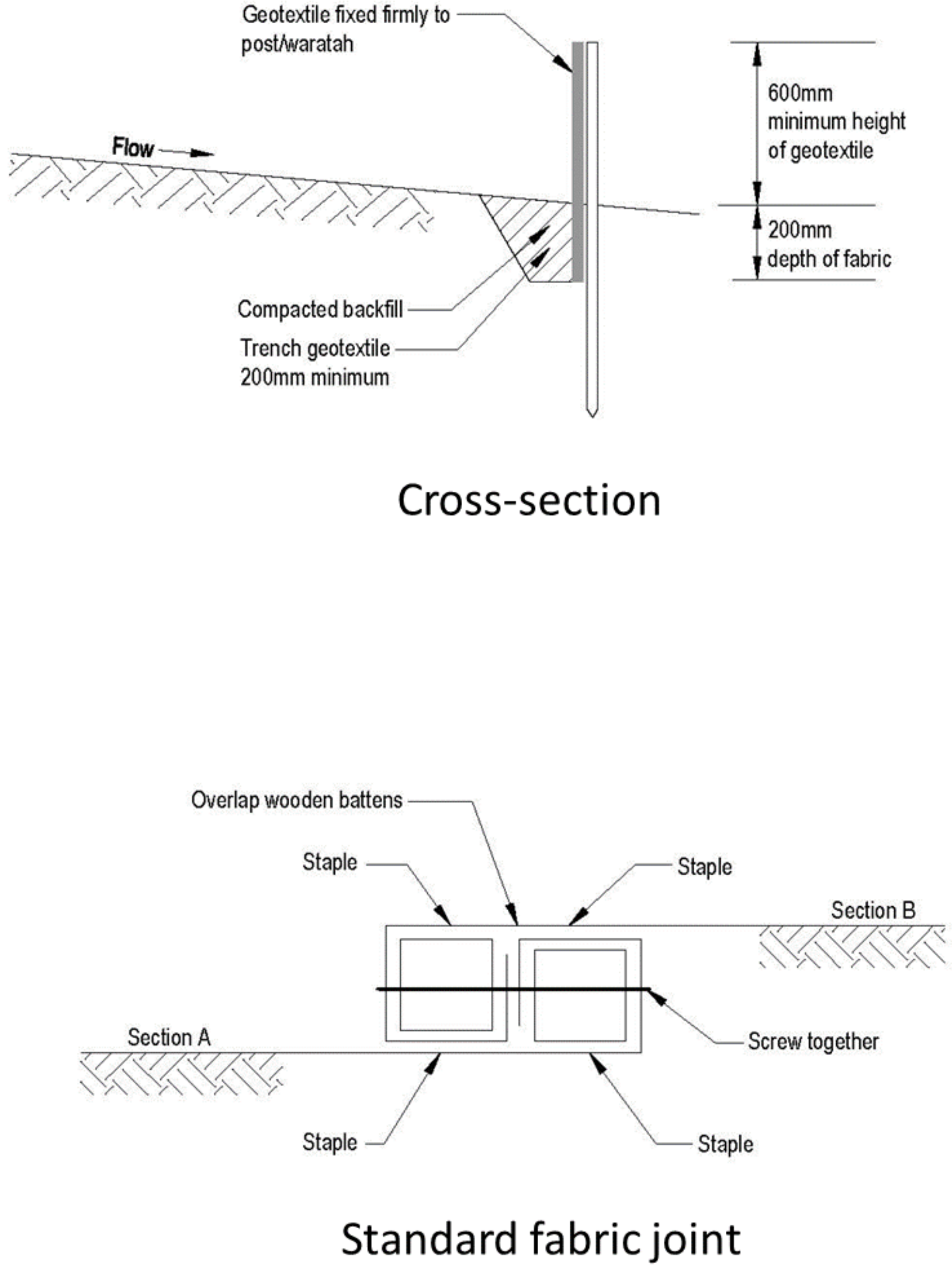
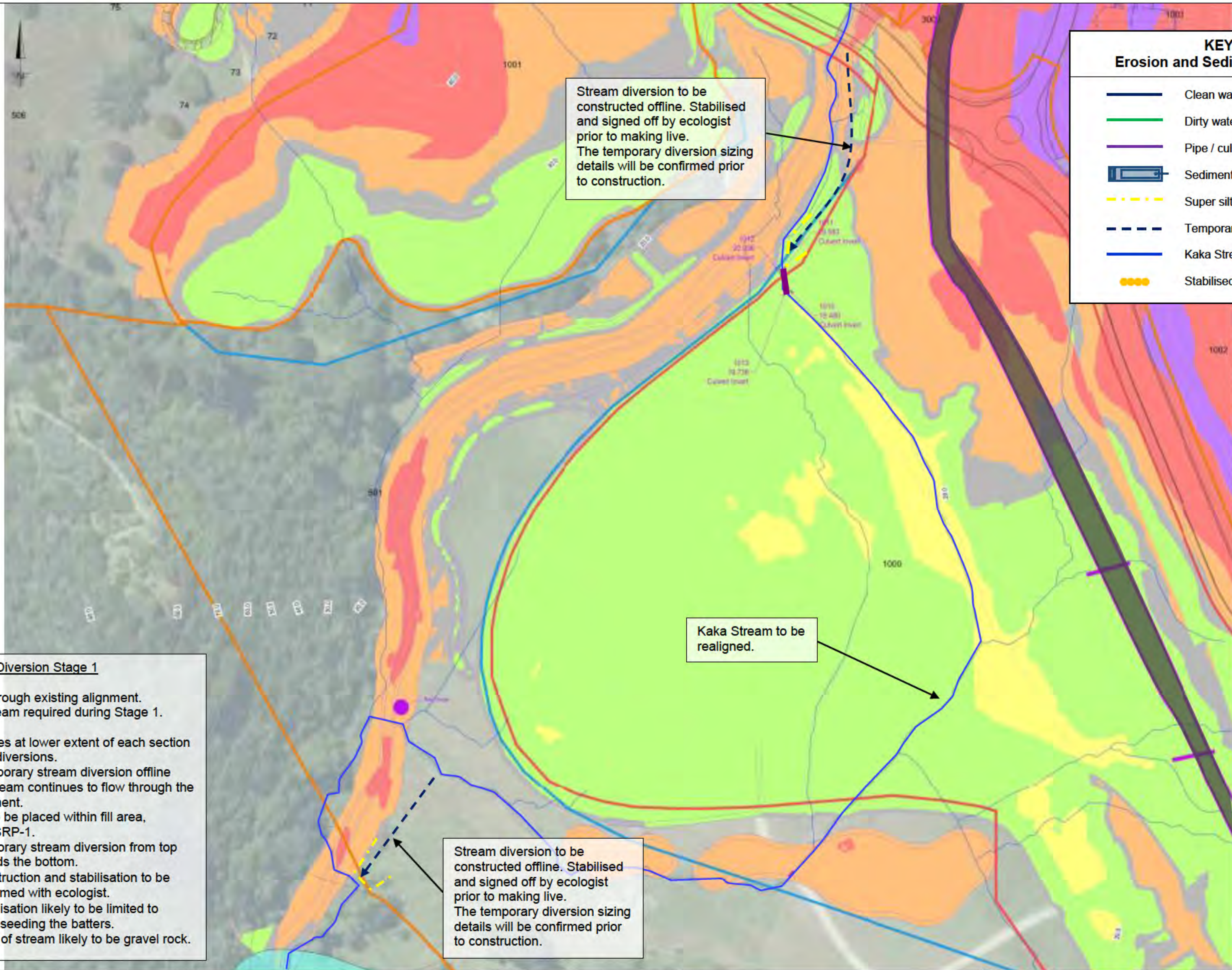


Figure 2: Silt fence cross-section and standard fabric joint.

Appendix B – Erosion and Sediment Control Plans

Title	Drawing No.	Sheet No.	Revision	Date
Erosion and Sediment Control Plan – Stream Diversion	ESCP-SW-001-01	1	A	20.05.24
Erosion and Sediment Control Plan – Stream Diversion	ESCP-SW-001-02	2	A	20.05.24
Erosion and Sediment Control Plan – Stream Diversion	ESCP-SW-001-03	3	A	20.05.24
Erosion and Sediment Control Plan – DEB Design Details	ESCP-SW-001-DEB	4	A	20.05.24



Kaka Stream –Stream Diversion Stage 1

Kaka Stream flowing through existing alignment.
No works within the stream required during Stage 1.

1. Install silt fences at lower extent of each section of the stream diversions.
2. Construct temporary stream diversion offline while Kaka Stream continues to flow through the existing alignment.
3. Cut material to be placed within fill area, contained by SRP-1.
4. Stabilise temporary stream diversion from top working towards the bottom.
   - Construction and stabilisation to be confirmed with ecologist.
   - Stabilisation likely to be limited to hydroseeding the batters.
   - Base of stream likely to be gravel rock.

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Nelson/Tasman *Erosion and Sediment Control Guidelines, July 2019*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

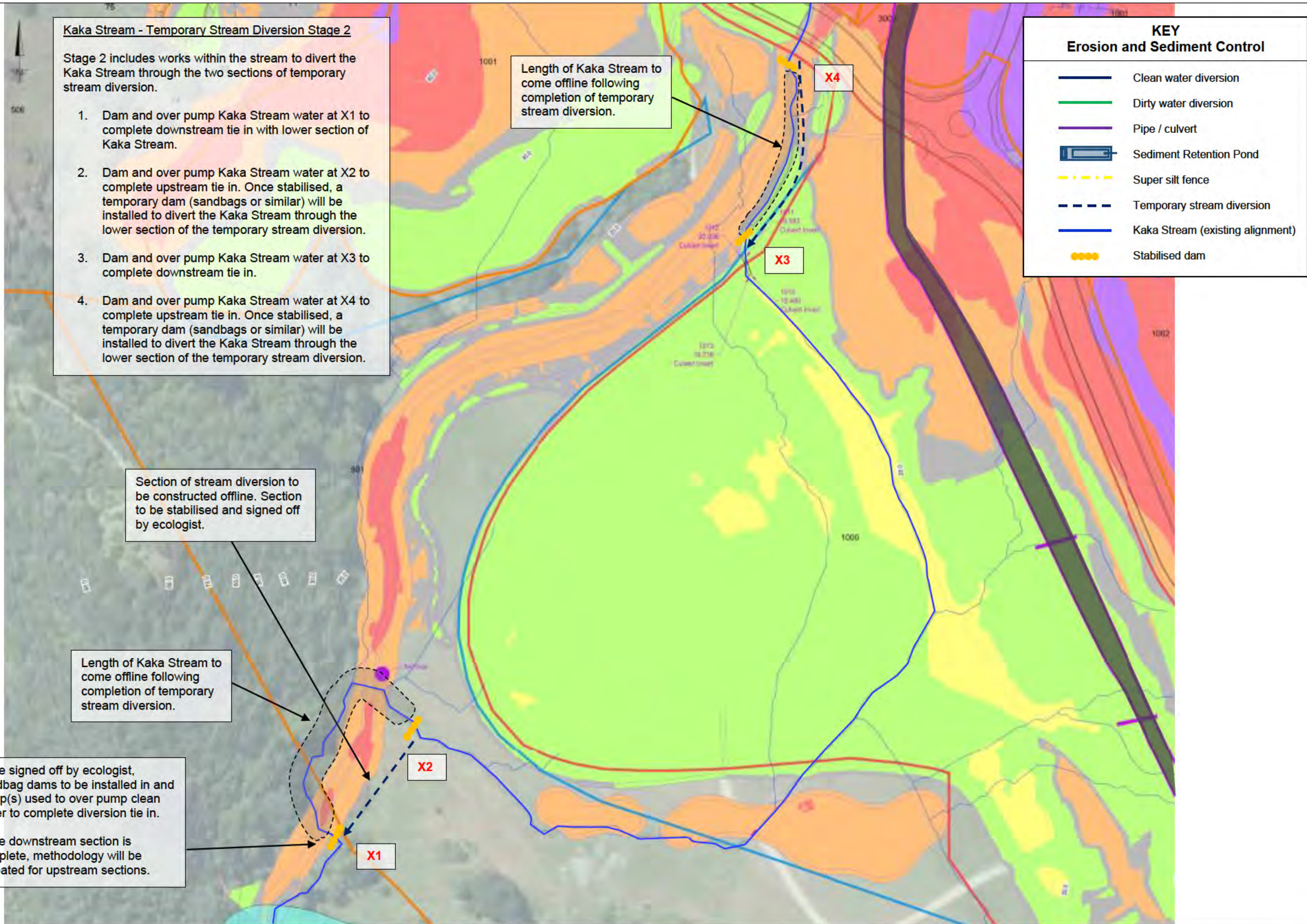
REV	DATE	REVISION DETAILS	APPROVED
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	**MAITAHI DEVELOPMENT**
Title	**Erosion & Sediment Control Plan** **Stream Diversion**

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP-SW-001-01	1



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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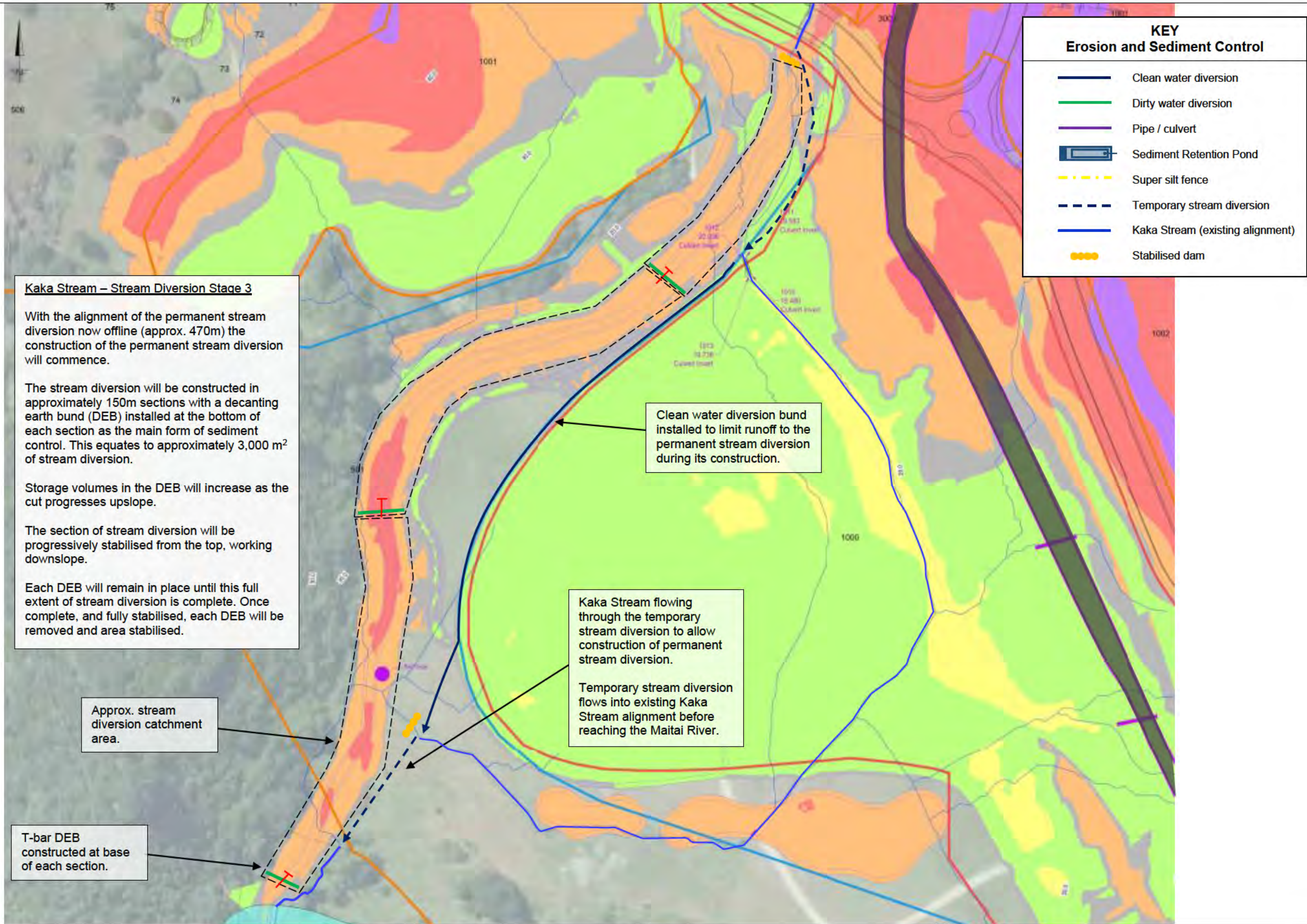
A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stream Diversion

Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP—SW-001-02	2



GENERAL EROSION AND SEDIMENT CONTROL NOTES

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A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL

Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan Stream Diversion

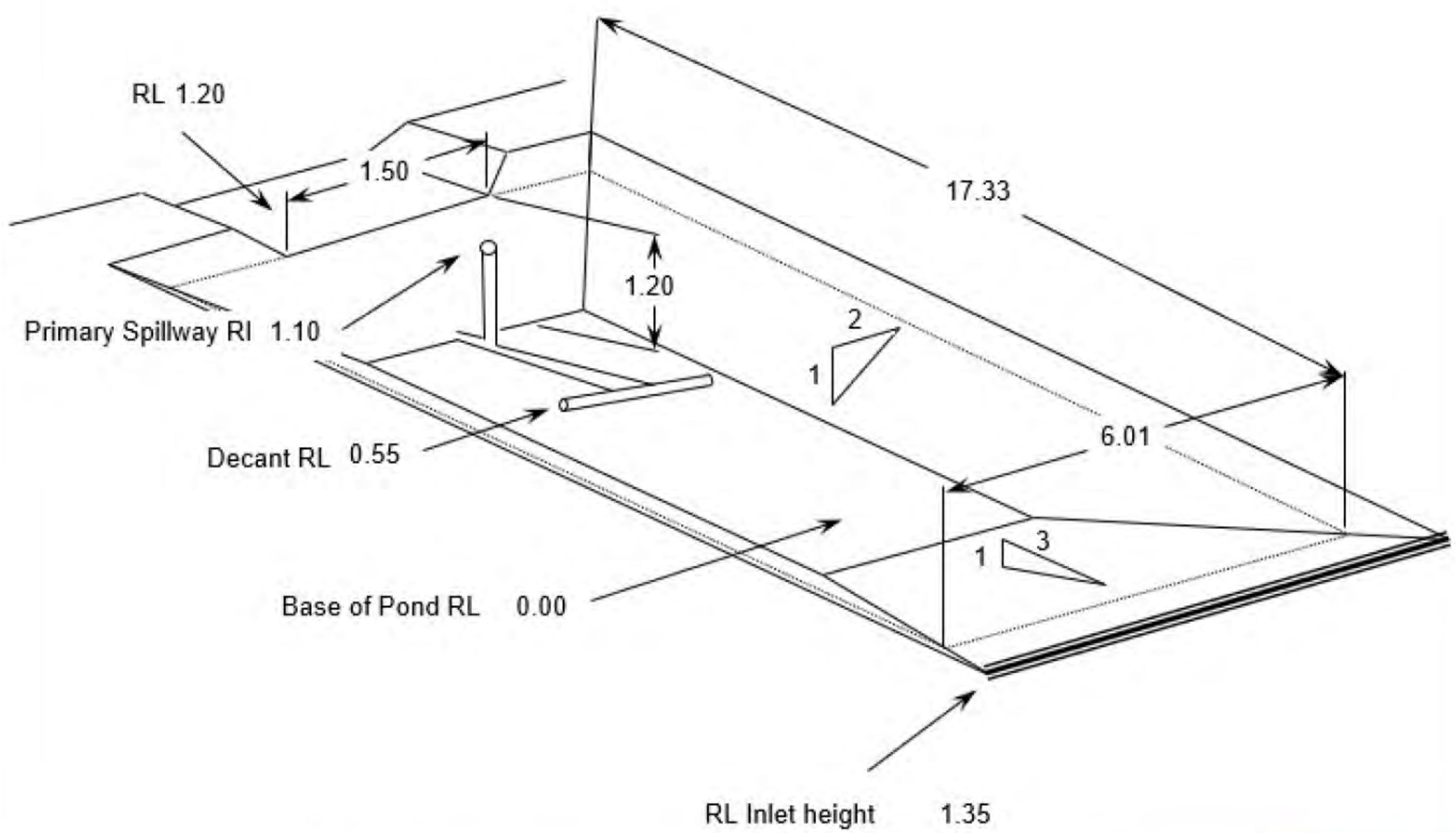
Drawn	Checked	Drawing No.	Sheet No.
ZW	CS	ESCP—SW-001-03	3

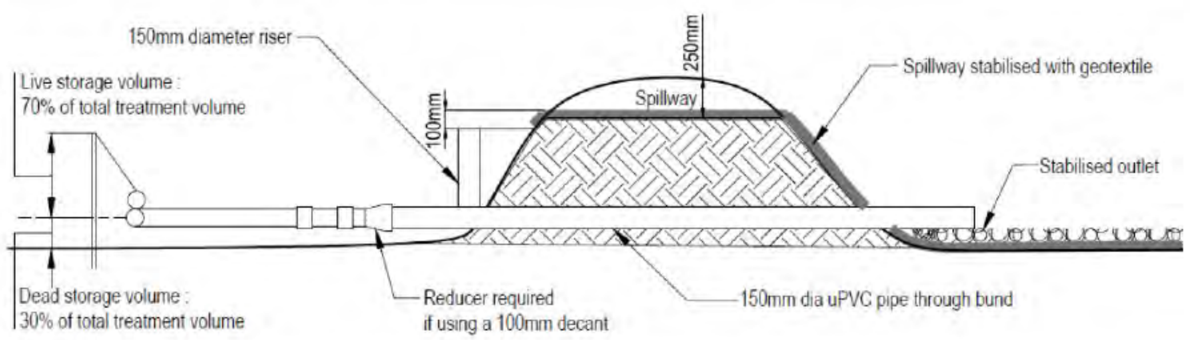
DEB

Length Ratio	Side slopes	Depth from Emergency Spillway	R.L. of Pond Base
3:1	2:1	1.20	0.00

Minimum Storage Volume (m3)	55
Dead storage (m3)	16.5
Live storage (m3)	38.5
Length at Spillway Level	17.33
Width at Spillway Level	6.01
Spillway base width (250mm deep)	1.50
Primary Spillway diameter (min)	150mm
Number of decants	1
Number of holes per decant	37
Minimum outlet diameter	150mm
RL Emergency Spillway	1.20
RL Primary Spillway	1.10
RL Inlet height (min)	1.35
RL Decant	0.55
Length at Base	11.33
Width at Base	1.21

Note, DEB to be installed in the permanent stream channel. Refer to stream channel cross-section profile.





DEB Sizing Calculations

Q =	0.01501	
C =	0.6	Med. Soakage bare soil
i =	30	1hr 5yr rainfall intensity
A =	0.3	Max. catchment area.
V =	**54.0432**	
Q =	0.01501	
D =	3600	

GENERAL EROSION AND SEDIMENT CONTROL NOTES

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A	20.05.24	Draft for review.	

SOUTHERNSKIES ENVIRONMENTAL
Maitahi

Project	MAITAHI DEVELOPMENT
Title	Erosion & Sediment Control Plan DEB Design Details
Drawn	ZW
Checked	CS
Drawing No.	ESCP-SW-001-DEB
Sheet No.	4