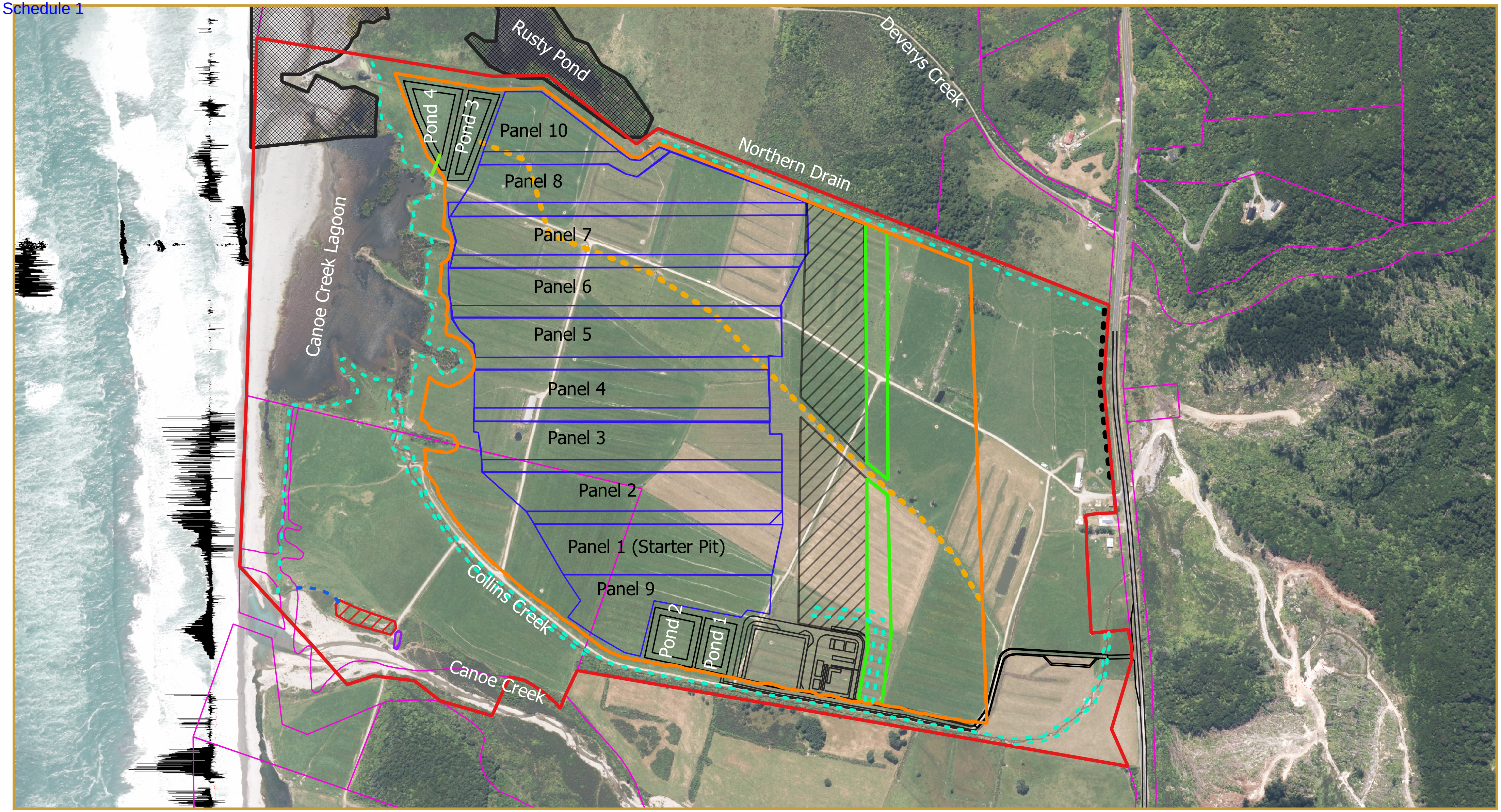
Schedule 1



Tai Poutini RESOURCES

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TiGa
Consent Application

Produced for: TiGa
by Luke McNeish on 18/01/2024

0 125 250 m

1:8,000 @ A3

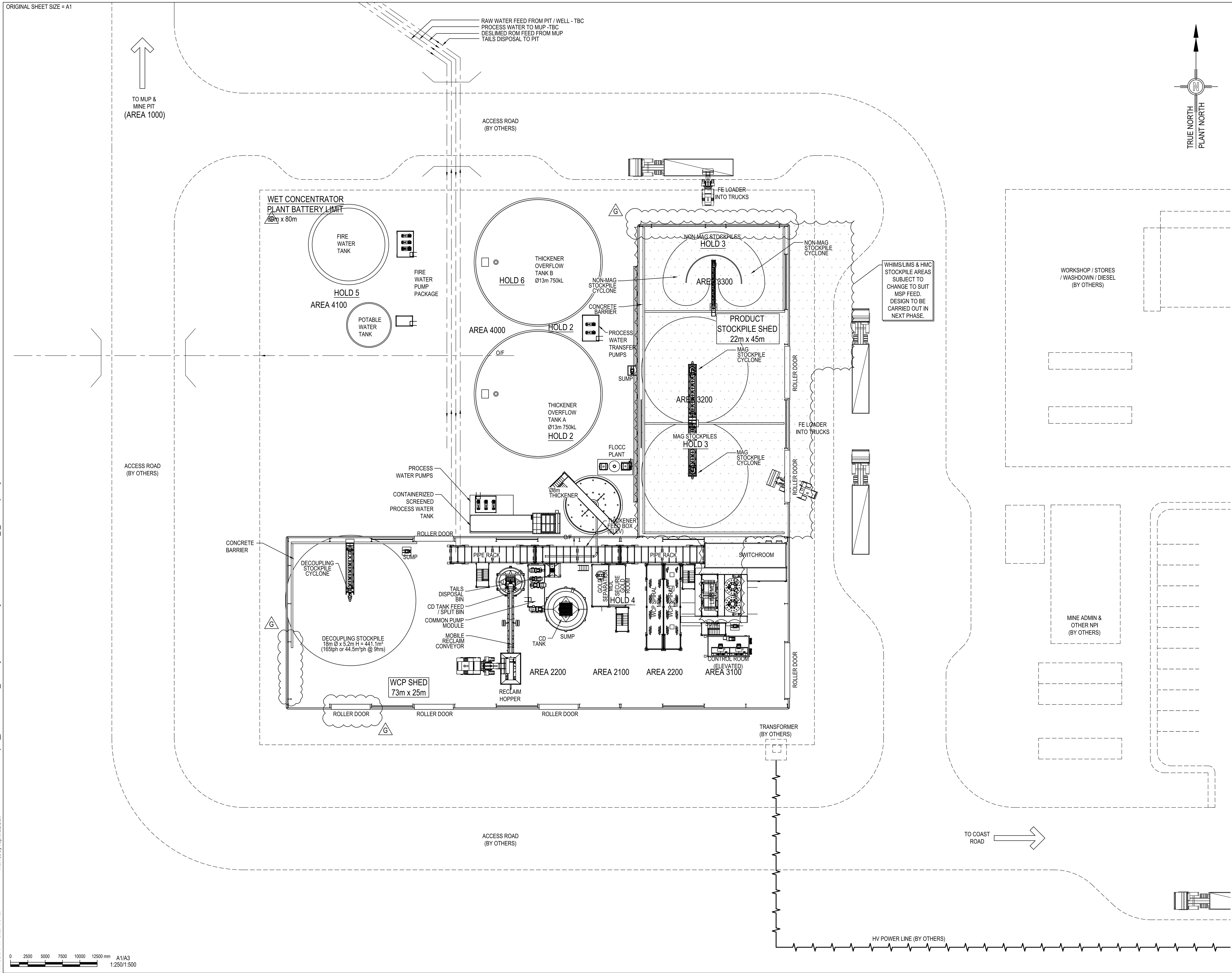
Projection: WSG84 / NZTM2000
Background Imagery: ESRI Satellite
Data Sources: LINZ, Client and or TPRL Data

Legend:

- Planting
- Stockpile Area
- Mining Disturbance Area
- TiGa Application Area
- Bund
- Gallery Water Take
- Premining ore stockpile
- Overflow Channel
- Canoe Creek Infiltration Basin
- Bund and Planting
- Central Drain
- SNA
- Property Boundaries
- Mine Infrastructure
- Overflow Path

Note: Refer to Landscape Mitigation Plan for detailed information on planting and bunds.

Schedule 2



NOTES:

1. PLANT LAYOUT IS PRELIMINARY PENDING FINAL EQUIPMENT SIZING. TO BE CONFIRMED FOLLOWING RELEASE OF HOLDS, 3D MODELLING AND FURTHER DESIGN REVIEWS.

HOLDS:

1. THICKENER SIZING BASED ON 5% SLIMES CONTENT (CONFIRMATION PENDING)
2. THICKENER OVERFLOW & PROCESS WATER TANK SIZING DEPENDENT ON PENDING TEST WORK.
3. STOCKPILE SIZING DEPENDENT ON RATE OF DRAIN DOWN. TBC FOLLOWING TEST WORK.
4. GOLD CIRCUIT SIZED ON PFS VALUES. (PENDING GOLD ASSAY).
5. FIRE WATER DESIGN PENDING COMPLETION.
6. POTABLE WATER TANK SIZING CAPACITY TO BE DETERMINED.

DO NOT USE FOR CONSTRUCTION OR FABRICATION

PRELIMINARY

DRAWING IN PROGRESS

REV	DATE	DESCRIPTION	DRN	CHK	APD
G	06-04-23	ACCESS DOORS REVISED	LR	GS	DP
F	17.02.23	ISSUED FOR REVIEW	LR	GS	DP
E	28.10.22	RE-ISSUED FOR CLIENT REVIEW	GS	SB	TL
D	18.10.22	ISSUED FOR PALARIS INFORMATION	GS	SB	MR
C	27.09.22	ISSUED FOR CLIENT REVIEW	GS	SB	MR
B	20.09.22	ISSUED FOR INTERNAL REVIEW	GS	SB	MR
A	14.09.22	FOR PRELIMINARY DISCUSSION	GS		

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CLIENT

TiGa MINERALS & METALS

PROJECT

BARRYTOWN JV MINERAL SANDS PROJECT

TITLE

WET CONCENTRATOR PLANT GENERAL PROCESS INFRASTRUCTURE SITE LAYOUT

DRAWN	DATE	JOB No.	Dimensions - NOT-SET
GS	02/09/2022	2019	SCALE 1:250 @ A1

CLIENT DRG No.

IHCR DRG No. 2019-G-LAY-0000-0001 REV G

Plot Date:11-04-2023 10:57:23

Plotted By:Reynolds, Liam

Cad File: G:\Projects_\2019 BJV CONCEPTS_DD Drawing Office\2022 - Second Stage\DWGs\2019-G-LAY-0000-0002_F_WCP Site Layout.dwg

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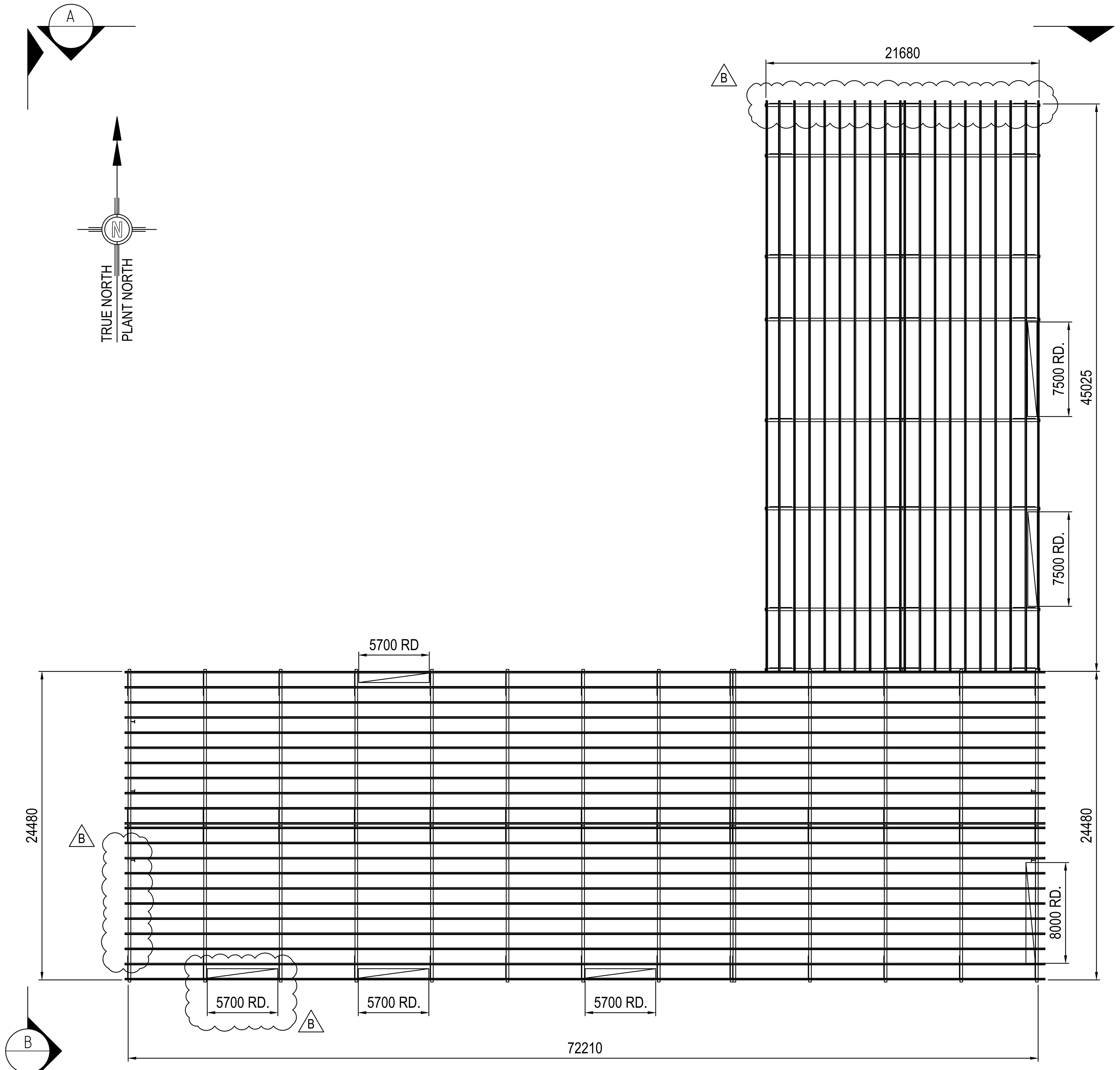
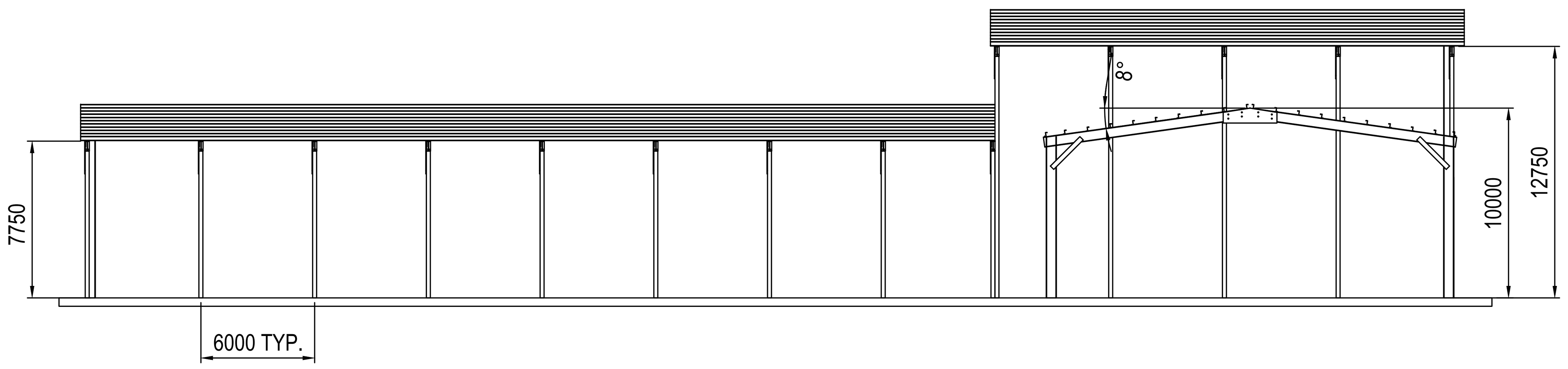
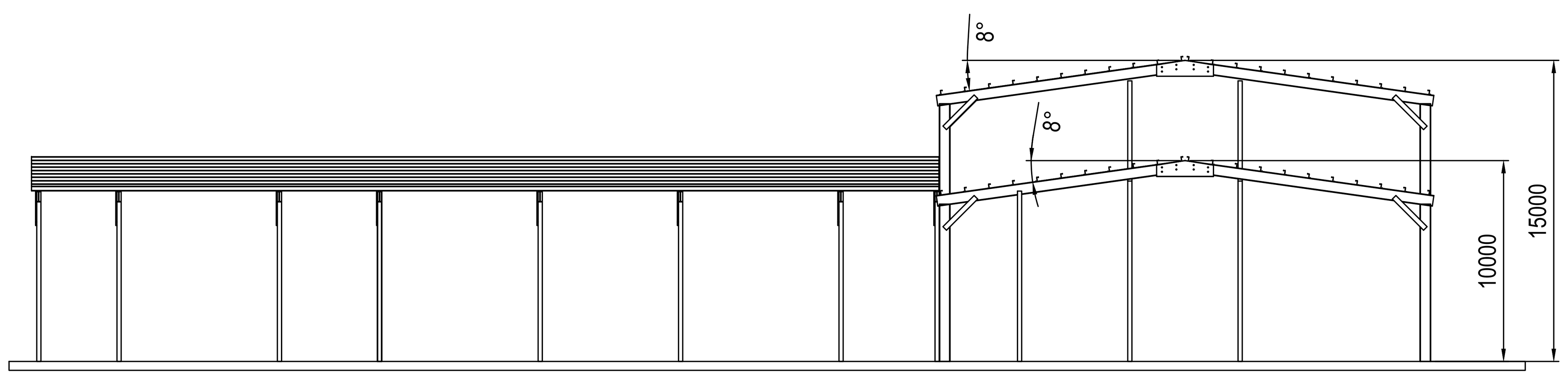


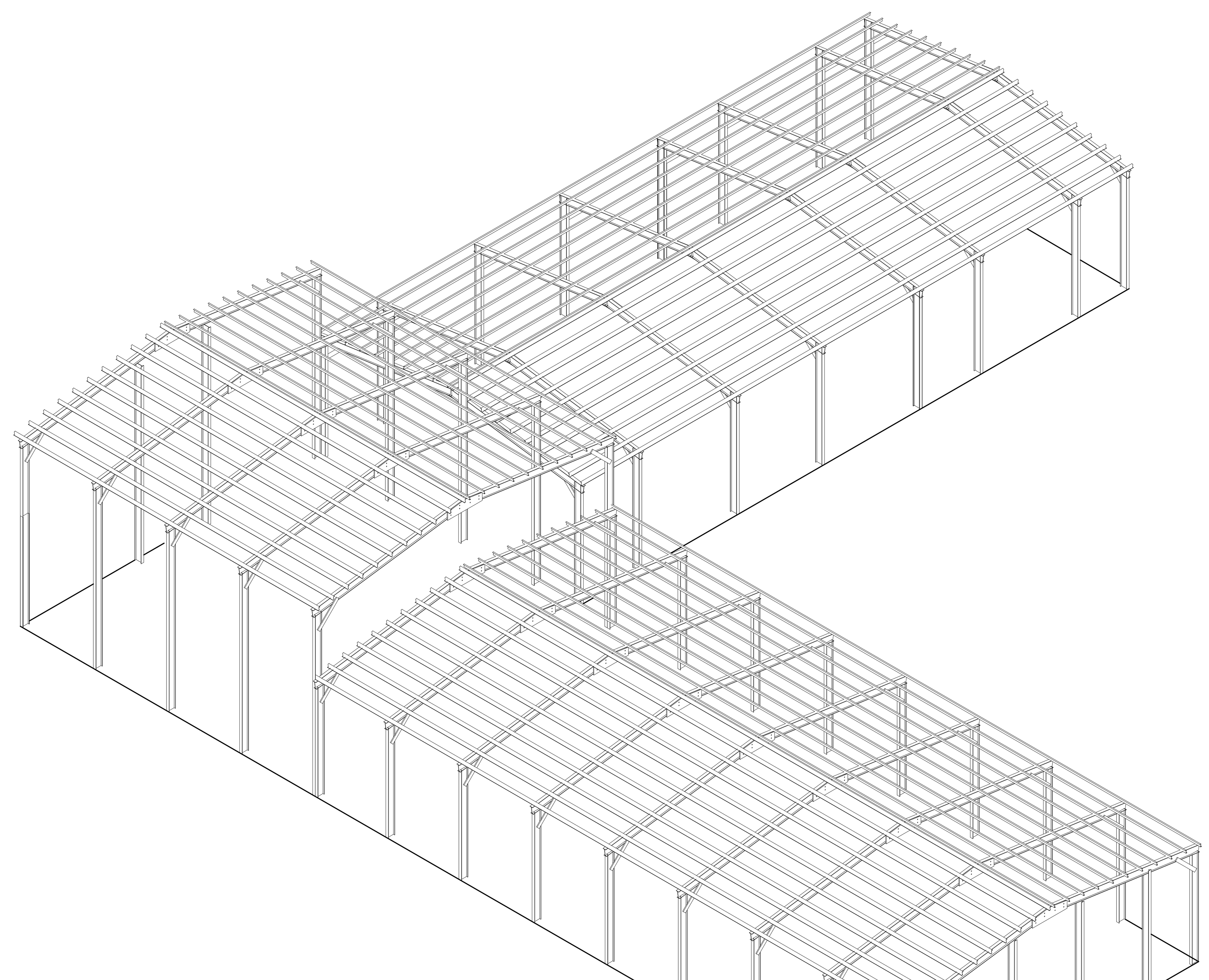
PLAN VIEW
SCALE 1:250



A ELEVATION VIEW
SCALE 1:250



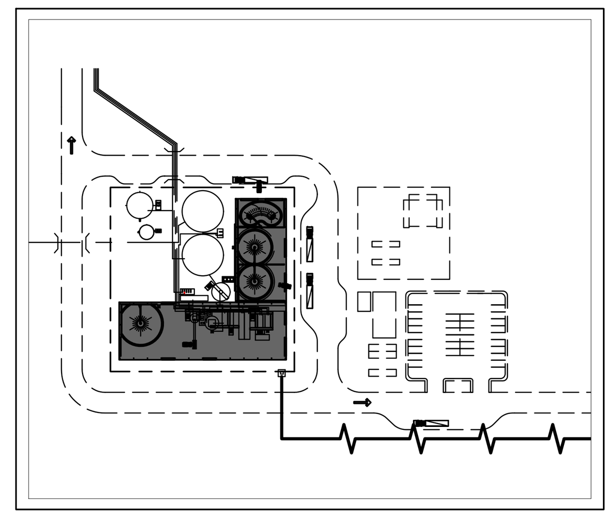
B ELEVATION VIEW
SCALE 1:250



ISO VIEW
SCALE 1:250

0 2500 5000 7500 10000 12500 mm A1/A3 1:250/1:500

NOTES:
1. ALL FOUNDATIONS AND CONC. FLOOR SLABS BY OTHERS.
2. SHED TOTAL AREA = 2783m²
3. CONCEPT FRAME ARRANGEMENT SHOWN, SHED IS TO BE FULLY ENCLOSED.
4. SHED CONTRACTOR TO ALLOW FOR THE FOLLOWING:
- ROOF PURLINS & SHEETING.
- WALL GIRTS & SHEETING.
- ROLLER DOORS AS SHOWN
- 6 No. PERSONNEL DOORS
5. PORTAL FRAME SPACING DIMENSION OF 6m IS ASSUMED. THIS CAN VARY IF DEEMED BENEFICIAL.
6. ROLLER DOORS TO BE MIN. 6m IN HEIGHT.



DO NOT USE FOR CONSTRUCTION OR FABRICATION
INFORMATION
DRAWING IN PROGRESS

REV	DATE	DESCRIPTION	DRN	CHK	APD
B	06.04.23	ACCESS DOORS REVISED	LR	GS	DP
A	01.11.22	FOR INFORMATION	LR	RW	MR

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PROJECT
BARRYTOWN JV MINERAL SANDS PROJECT

TITLE
2019 - BJV CONCEPT
HMC/PROCESS SHEDS SKETCH
STRUCTURE LAYOUT
STAGE 01

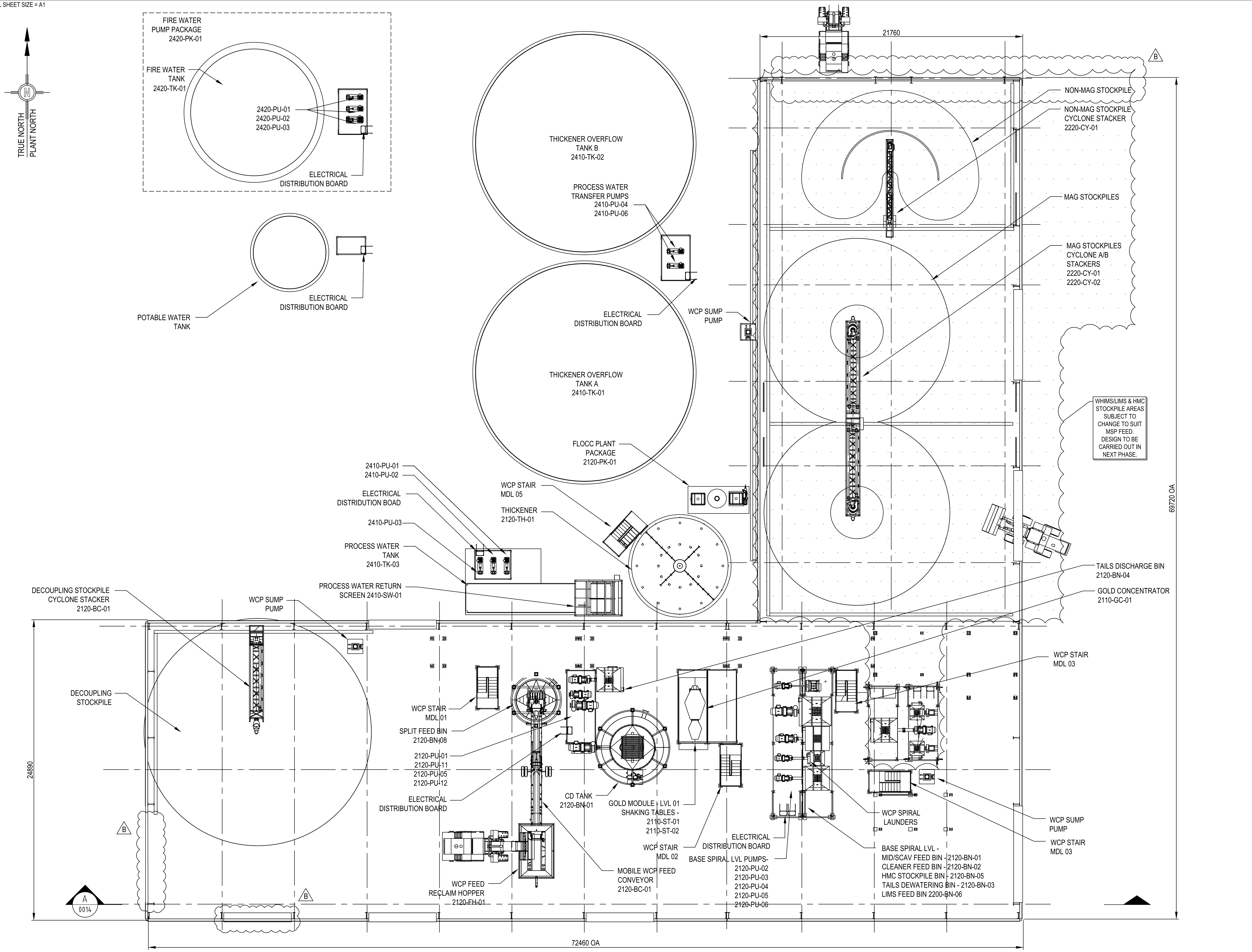
DRAWN	DATE	JOB No.	Dimensions - mm
LR	01/11/2022	2019	SCALE 1:250 @ A1

CLIENT DRG No.

IHCR DRG No. 2019-SK-0000-0009 REV B

Cad File: G:\Projects_\2019 BJV CONCEPTS_DD Drawing Office\2022 - Second Stage\DWGs\2019-SK-0000-0009_A_SHED Layout.dwg
Plotted By:Reynolds, Liam
Plot Date:11-04-2023 10:54:29

ORIGINAL SHEET SIZE = A1



PLAN - TOS BASE LEVEL 0.286m

1:150

A1/A3 1:150/1:300

0 1500 3000 4500 6000 7500 mm

DO NOT USE FOR CONSTRUCTION OR FABRICATION

PRELIMINARY

DRAWING IN PROGRESS

REV	DATE	DESCRIPTION	DRN	CHK	APD
B	06-04-23	ACCESS DOORS REVISED	LR	GS	DP
A	17-02-23	ISSUED FOR REVIEW	LR	GS	DP

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CLIENT
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PROJECT
BARRYTOWN MINERAL SANDS PROJECT

TITLE
WET CONCENTRATOR PLANT (WCP)
AREA 2000
GENERAL PROCESS INFRASTRUCTURE
LVL BASE PLAN VIEW

DRAWN LR | DATE 05/12/2022 | JOB No. 2019 | Dimensions - MILLIMETRES SCALE 1:150

CLIENT DRG No.

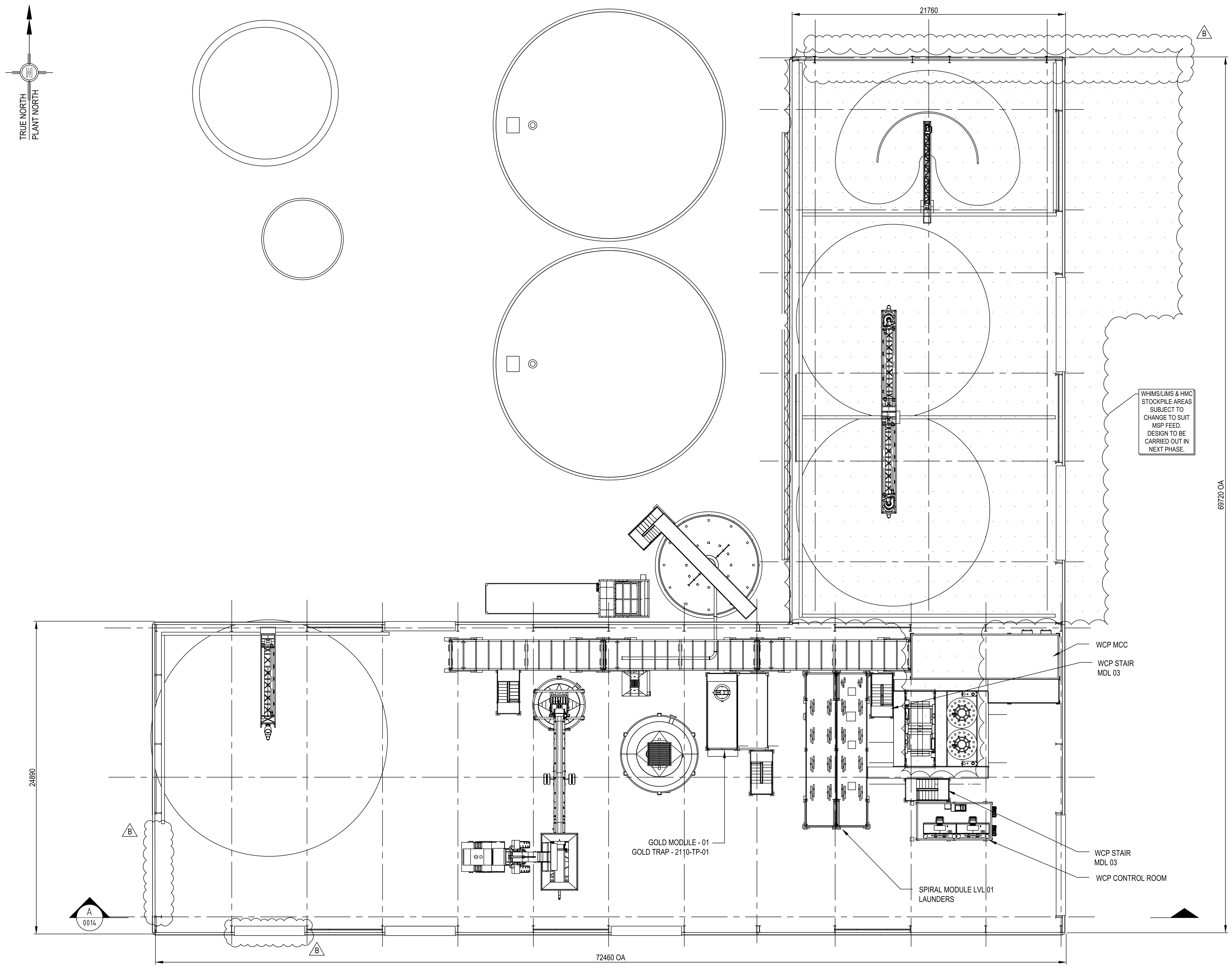
IHCR DRG No. 2019-G-LAY--0000-0011 | REV B

Cad File: G:\Projects_\2019 BJV CONCEPTS_DD Drawing Office\2022 - Second Stage\Plant3D Project File\2019 BJV CONCEPTS PROJ...DWGs\2019-G-LAY--0000-0011_A_ WCP LVL BASE PLAN 2000.dwg

Plotted By:Reynolds, Liam

Plot Date:11-04-2023 11:00:28

ORIGINAL SHEET SIZE = A1



PLAN - TOS LEVEL 1 3.446m

1:150

A1/A3
1:150/1:300

0 1500 3000 4500 6000 7500 mm

DO NOT USE FOR CONSTRUCTION OR FABRICATION

PRELIMINARY

DRAWING IN PROGRESS

REV	DATE	DESCRIPTION	DRN	CHK	APD
B	06-04-23	ACCESS DOORS REVISED	LR	GS	DP
A	17-02-23	ISSUED FOR REVIEW	LR	GS	DP

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PROJECT

BARRYTOWN MINERAL SANDS PROJECT

TITLE

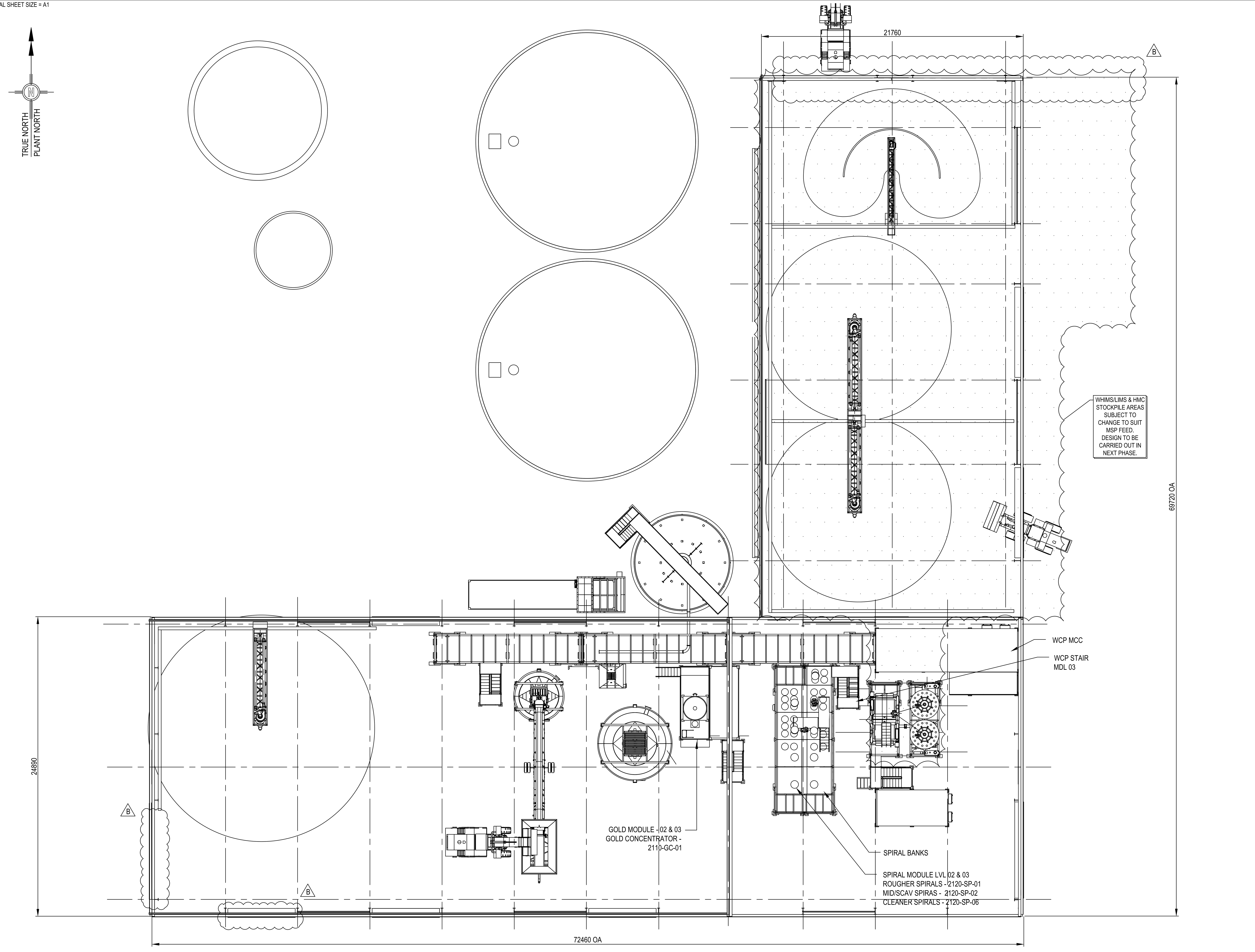
WET CONCENTRATOR PLANT (WCP)
AREA 2000
GENERAL PROCESS INFRASTRUCTURE
LVL 1 PLAN VIEW

DRAWN	DATE	JOB No.	Dimensions - MILLIMETRES
LR	05/12/2022	2019	SCALE 1:150

CLIENT DRG No.

IHCR DRG No. **2019-G-LAY--0000-0012** REV B

ORIGINAL SHEET SIZE = A1



PLAN - TOS LEVEL 2/3 - 6.308m/10.190m

1:150

A1/A3
1:150/1:300

0 1500 3000 4500 6000 7500 mm

DO NOT USE FOR CONSTRUCTION OR FABRICATION
PRELIMINARY
DRAWING IN PROGRESS

REV	DATE	DESCRIPTION	DRN	CHK	APD
B	06-04-23	ACCESS DOORS REVISED	LR	GS	DP
A	17-02-23	ISSUED FOR REVIEW	LR	GS	DP

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PROJECT
BARRYTOWN MINERAL SANDS PROJECT

TITLE
WET CONCENTRATOR PLANT (WCP)
AREA 2000
GENERAL PROCESS INFRASTRUCTURE
LVL 2/3 PLAN VIEW

DRAWN	DATE	JOB No.	Dimensions - MILLIMETRES
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CLIENT DRG No.

IHCR DRG No. 2019-G-LAY-0000-0013 REV B

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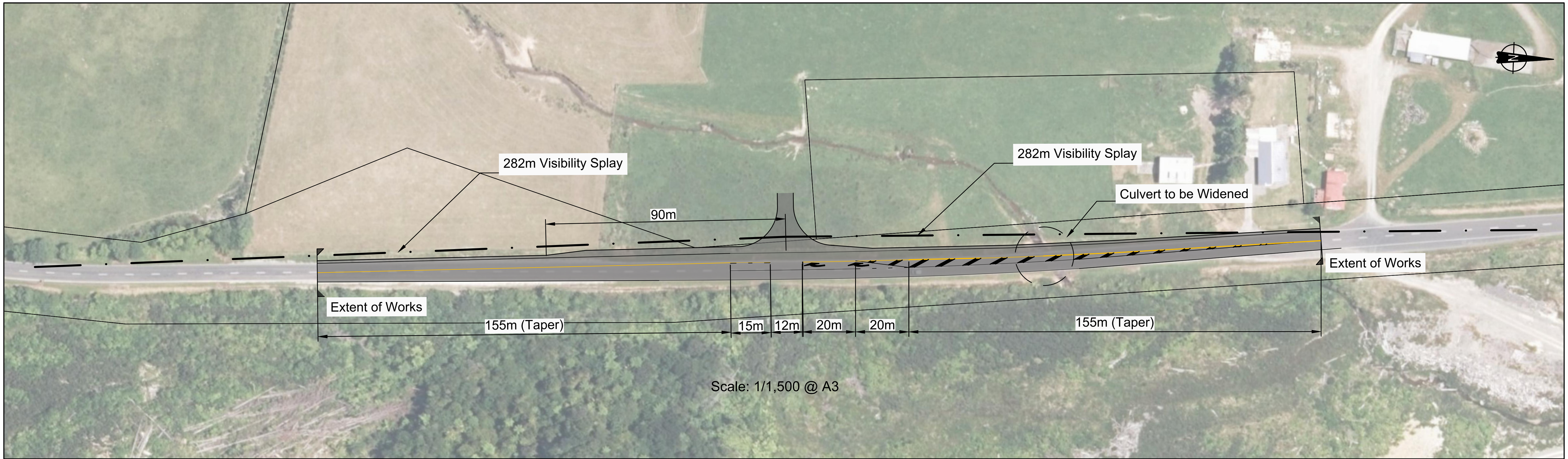
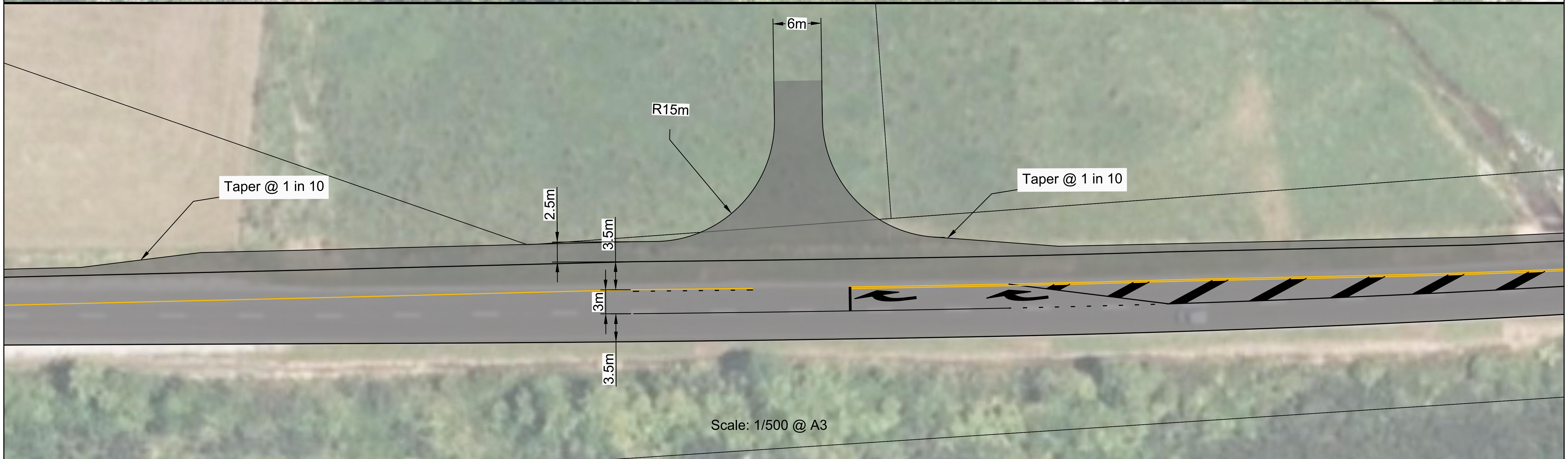
Plotted By:Reynolds, Liam
Plot Date:11-04-2023 11:01:23

Schedule 3





novo group Planning. Traffic. Development.	**Barrytown Mine** **TiGa Minerals & Metals Ltd**	Sheet **746-001-T1001-I**
Novo Group Limited PO Box 365 Christchurch 8014	**Indicative Access Arrangement**	Scale @A3 As Shown
	For Resource Consent	Date 13/06/2023 By N Fuller
NovoGroup.co.nz	Drawing: 746-001-TR-I	Project # 746-001

Appendix G – Seabirds

Key points

Seabirds spend most of their lives at sea, only coming ashore to nest. All species are vulnerable to the effects of lighting. Seabirds active at night while migrating, foraging or returning to colonies are most at risk.

Fledglings are more affected by artificial lighting than adults due to the synchronised mass exodus of fledglings from their nesting sites. They can be affected by lights up to 15 km away.

Key management measures

The physical aspects of light that have the greatest impact on seabirds are intensity and colour (wavelength). Consequently, management of these aspects of artificial light will have the most effective result.

Seabirds are birds that are adapted to life in the marine environment (Figure 28). They can be highly pelagic or coastal, or in some cases spend a part of the year away from the sea entirely. They feed from the ocean either at or near the sea surface. In general, seabirds live longer, breed later and have fewer young than other birds and invest a great deal of energy in their young. Most species nest in colonies, which can vary in size from a few dozen birds to millions. Many species undertake long annual migrations, crossing the equator or circumnavigating the earth in some cases (Ross et al. 1996).

Artificial light can disorient seabirds and potentially cause injury and/or death through collision with infrastructure. Birds may starve as a result of disruption to foraging, hampering their ability to prepare for breeding or migration. High mortality of seabirds occurs through grounding of fledglings as a result of attraction to lights (Rodríguez et al. 2017a) and through interaction with vessels at sea.

Figure 28 Flesh-footed Shearwater at sunset

Photo: Richard Freeman.

Conservation status

Migratory seabird species in Australia are protected under international treaties and agreements including the Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention), the Ramsar Convention on Wetlands and the Agreement on the Conservation of Albatrosses and Petrels (ACAP), and through the East Asian–Australasian Flyway Partnership. The Australian Government has bilateral migratory bird agreements with Japan (Japan–Australia Migratory Bird Agreement, JAMBA), China (China–Australia Migratory Bird Agreement, CAMBA) and the Republic of Korea (Republic of Korea–Australia Migratory Bird Agreement, ROKAMBA). In Australia the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) gives effect to these international obligations. Many seabirds are also protected under state and territory environmental legislation.

An estimated 15.5 million pairs of seabirds, from 43 species, breed at mainland and island rookeries (Rodríguez et al. 2017a). Of the 43 species, 35 are listed as threatened and/or migratory under the EPBC Act. Of the 35 EPBC Act listed species, 90% are *Procellariiformes* (petrels, shearwaters, storm petrels, gadfly petrels and diving petrels), which breed in burrows, only attend breeding colonies at night (Warham 1990) and are consequently most at risk from the effects of artificial light. Short-tailed Shearwaters comprise 77% (11.9 million pairs) of the total breeding seabird pairs.

Distribution

Seabirds in Australia belong to both migratory and residential breeding species. Most breeding species, include both temperate and tropical shearwaters and terns that undergo extensive migrations to wintering areas outside Australia's Exclusive Economic Zone (EEZ). However, there are significant numbers of residential species that remain within the EEZ throughout the year and undergo shorter migrations to non-breeding foraging grounds within the EEZ.

Timing of habitat use

Most seabird breeding occurs during the austral spring/summer (September–January), but this may extend in some species to April/May. The exceptions are the austral winter breeders, a handful of species, largely comprising petrels, that may commence nesting in June. Breeding occurs almost exclusively on many of the offshore continental islands that surround Australia. Seabirds spend most of their time flying at sea, and so are usually found on breeding islands only during the breeding season, or along mainland coastal sandbars and spits or island shorelines when roosting during their non-breeding period.

Important habitat for seabirds

Seabirds may be affected by artificial light at breeding areas, while foraging and while migrating. For the purposes of these guidelines, important habitat for seabirds includes all areas that have been designated as habitat critical to the survival of seabirds and/or as biologically important areas (BIAs), and areas designated as important habitat in wildlife conservation plans and in species-specific conservation advice.

- The National Recovery Plan for threatened albatrosses and petrels (2022)[1] lists designated habitat critical to the survival of these species. Where a recovery plan is not in force for a listed threatened species, see relevant approved conservation advice.
- Actions in Antarctica should consider important bird areas in Antarctica (Harris et al. 2015).
- BIAs are areas where listed threatened and migratory species display biologically important behaviour such as breeding, foraging, resting and migration. Seabird BIAs can be explored through the National Conservation Values Atlas.
  - Designation as a BIA recognises that biologically important behaviours are known to occur, but the absence of such a designation does not preclude the area from being a BIA. Where field surveys identify biologically important behaviour occurring, the habitat should be managed accordingly.

Effects of artificial light on seabirds

Seabirds have been affected by artificial light sources for centuries. Humans used fire to attract seabirds to hunt them for food (Murphy 1936) and reports of collisions with lighthouses date back to 1880 (Allen 1880). More recently artificial light associated with the rapid urbanisation of coastal areas has been linked to increased seabird mortality (Gineste et al. 2016), and today 56 petrel species worldwide are known to be affected by artificial lighting (Rodríguez et al. 2017a; Rodríguez et al. 2017b). Artificial light can disorient seabirds, causing collision, entrapment, stranding, grounding, and interference with navigation (being drawn off course from the usual migration route). These behavioural responses may cause injury or death.

All species active at night are vulnerable, as artificial light can disrupt their ability to orient towards the sea. Problematic sources of artificial light include coastal residential and hotel developments, street lighting, vehicle lights, sporting facility floodlights, vessel deck and search lights, cruise ships, fishing vessels, gas flares, commercial squid vessels, security lighting, navigation aids and lighthouses (Rodríguez et al. 2017b; Gineste et al. 2016; Ainley et al. 2001; Black 2005; Deppe et al. 2017; Merkel & Johansen 2011; Raine 2007; Rodríguez, Rodríguez & Lucas 2012). Seabirds, particularly petrel species in the Southern Ocean, can be disoriented by vessel lighting and may land on the deck, from which they are unable to take off. The effect of artificial light may be exacerbated by moon phase (Deppe et al. 2017), wind direction and strength (Rodríguez et al. 2014; Syposz et al. 2018), precipitation, cloud cover, and the proximity of nesting sites or migrating sites to artificial light sources (Rodríguez et al. 2015; Rodríguez, Rodríguez & Negro 2015; Troy et al. 2013). The degree of disruption is determined by a combination of physical, biological and environmental factors including the location, visibility, colour and intensity of the light, proximity to other infrastructure, landscape topography, moon phase, atmospheric and weather conditions, and species present.

Seabirds that are active at night while migrating, foraging or returning to colonies and are directly affected include petrels, shearwaters, albatross, noddies, terns and some penguin species. Less studied are the effects of light on the colony attendance of nocturnal

[1] The recovery plan will sunset in 2032.

Procellariiformes, which could lead to higher predation risks by gulls, skuas or other diurnal predators; and the effects on species that are active during the day, including extending their activities into the night as artificial light increases perceived daylight hours.

High rates of fallout, or the collision of birds with structures, have been reported in seabirds nesting adjacent to urban or developed areas (Rodríguez et al. 2017a; Montevecchi 2006; Podolsky et al. 1998) and at sea where seabirds interact with offshore oil and gas platforms (Bourne 1979; Burke et al. 2005). A report on interactions with oil and gas platforms in the North Sea identified light as the likely cause of hundreds of thousands of bird deaths annually. It noted that this could be a site-specific impact (Ronconi, Allard & Taylor 2015).

Gas flares also affect seabirds. One anecdote describes 24 burnt carcasses of seabirds (Wedge-tailed Shearwaters) in and around an open-pit gas flare. It is likely that the birds were attracted to the light and noise of the flare and, as they circled the source, became engulfed, combusting in the super-heated air above the flame (K Pendoley pers. obs. 1992).

Mechanisms by which light affects seabirds

Most seabirds are diurnal. They rest during dark hours and have less exposure to artificial light. Among species with a nocturnal component to their life cycle, artificial light affects the adult and fledgling differently.

Adults are less affected by artificial light. Many *Procellariiformes* species (shearwaters, storm petrels, gadfly petrels) are vulnerable during nocturnal activities, which make up part of the annual breeding cycle. Adult *Procellariiformes* species are vulnerable when returning to and leaving the nesting colony. They may leave or enter to re-establish their pair bonds with breeding partners, repair nesting burrows, defend nesting sites, or forage. Adults feed their chicks by regurgitating partially digested food (Imber 1975). A recent study shows that artificial light disrupts adult nest attendance and thus affects weight gain in chicks (Cianchetti-Benedetti et al. 2018).

Fledglings are more vulnerable due to the naivety of their first flight, the immature development of ganglions in the eye at fledging, and the potential connection between light and food (Montevecchi 2006; Mitkus et al. 2016). Burrow-nesting seabirds are typically exposed to light streaming in from the burrow entrance during the day. Parents feeding their young enter the burrow from the entrance, creating an association between light and food in newly fledged birds (Rodríguez et al. 2017b). Much of the literature concerning the effect of lighting upon seabirds relates to the synchronised mass exodus of fledglings from their nesting sites (Deppe et al. 2017; Raine et al. 2007; Rodríguez et al. 2015; Rodríguez, Rodríguez & Negro 2015; Le Corre et al. 2002; Reed, Sincock & Hailman 1985). Fledging *Procellariiformes* leave the nesting colony for the sea at night (Warham 1990), returning to breed several years later. In Australia, the main fledgling period for shearwaters occurs in April/May (Serventy, Serventy & Warham 1971).

Emergence during darkness is believed to be a predator-avoidance strategy (Watanuki 1986), and artificial lighting may make fledglings more vulnerable to predation (Reed, Sincock & Hailman 1985). Artificial lights are thought to override the sea-finding cues provided by moonlight and starlight at the horizon (Telfer et al. 1987), and fledglings can be attracted back to onshore lights after reaching the sea (Rodríguez et al. 2014; Podolsky et al. 1998). It is possible that fledglings that survive their offshore migration cannot imprint their natal colony, preventing them from returning to nest when they mature (Raine et al. 2007). The consequences of exposure to artificial light on the viability of a breeding population of seabirds is unknown (Griesemer & Holmes 2011).

Eye structure and sensitivities

Seabirds, like most vertebrates, have an eye that is well adapted to see colour. Typically, diurnal birds have 6 photoreceptor cells which are sensitive to different regions of the visible spectrum (Vorobyev 2003). All seabirds are sensitive to the violet–blue region of the visible spectrum (380 nm to 440 nm) (Capuska et al. 2011). The eyes of the Black Noddy (*Anous minutus*) and Wedge-tailed Shearwater (*Puffinus pacificus*) are characterised by a high proportion of cones sensitive to shorter wavelengths (Hart 2001). This adaptation is likely due to the need to see underwater, and the optimum wavelength for vision in clear blue oceanic water is between 425 nm and 500 nm. There is no ecological advantage to having many long-wavelength-sensitive photoreceptors in species foraging in this habitat (Hart 2001).

Many diurnal birds can see in the UV range (less than 380 nm (Bowmaker et al. 1997)); however, of the over 300 seabird species, only a few have UV-sensitive vision (Capuska et al. 2011). In all seabirds, their photopic vision (daylight adapted) is most sensitive in the long-wavelength range of the visible spectrum (590 nm to 740 nm, orange to red) while their scotopic (dark adapted) vision is more sensitive to short wavelengths of light (380 nm to 485 nm, violet to blue).

Petrel vision is most sensitive to light in the short-wavelength blue (400 nm to 500 nm), region of the visible spectrum. Relative to diurnal seabirds, such as gulls and terns, petrels have a higher number of short-wavelength-sensitive cones. This is thought to be an adaptation that increases prey visibility against a blue-water foraging field favoured by petrels (Hart 2001).

Little has been published on vision in penguins. Penguins are visual foragers whose success in fish capture is linked directly to the amount of light present (Cannell & Cullen 1998). The eyes of the Humbolt Penguin (*Spheniscus humboldti*) are adapted to the aquatic environment, seeing well in the violet to blue to green region of the spectrum, but poorly in the long wavelengths (red) (Bowmaker & Martin 1985).

Wavelength, intensity and direction

The intensity of light may be a more important cue than colour for seabirds. Very bright light will attract them, regardless of colour (Raine et al. 2007). There are numerous, although sometimes conflicting, reports of the attractiveness of different wavelengths of artificial light to seabirds. White light has the greatest effect on seabirds as it contains all wavelengths of light (Rich & Longcore 2006); Deppe et al. 2017; Wiltschko & Wiltschko 1999). Seabirds have reportedly been attracted to the yellow/orange colour of fire (Murphy 1936), while white mercury vapour and broad-spectrum LED is more attractive to Barau's Petrel (*Pterodroma baraui*) and Hutton's Shearwater (*Puffinus huttoni*) than either low-pressure or high-pressure sodium vapour lights (Deppe et al. 2017). Bright white deck lights and spot lights on fishing vessels attract seabirds at night, particularly on nights with little moonlight or low visibility (Black 2005; Merkel & Johansen 2011; Montevecchi 2006).

A controlled field experiment on Short-tailed Shearwaters at Phillip Island tested the effect of metal halide, LED and HPS lights on fledging groundings (Rodríguez, Dann & Chiaradia 2017). The results suggested that the shearwaters were more sensitive to the wider emission spectrum and higher blue content of metal halide and LED lights than to HPS light. The authors strongly recommended using HPS or filtered LED and metal halide lights with purpose-designed LED filters to remove short-wavelength light for use in the vicinity of shearwater colonies (Rodríguez, Dann & Chiaradia 2017).

The first studies of penguins exposed to artificial light at a naturally dark site found they preferred lit paths over dark paths to reach their nests (Rodríguez et al. 2018). While artificial light might enhance penguin vision at night, reducing predation risk and making it easier for them to find their way, their proven attraction to light could attract them to undesirable lit areas. This study concluded that the penguins were habituated to artificial lights and were unaffected by a 15 lux increase in artificial illumination (Rodríguez et al. 2018). However, the authors were unable to rule out an effect of artificial light on penguin behaviour due to natural differences between the sites, potential complexity of penguin response to the interaction between artificial light and moonlight, and probable habituation of penguins to artificial lights.

Environmental impact assessment of artificial light on seabirds

As a minimum, infrastructure with artificial lighting that is externally visible should have Best practice lighting design implemented. Where there is important habitat for seabirds within 20 km of a project, an EIA should be undertaken. The following sections step through the EIA process, with specific considerations for seabirds.

The 20 km buffer for considering important seabird habitat is based on the observed grounding of seabirds in response to a light source at least 15 km away (Rodríguez et al. 2014).

The spatial and temporal characteristics of migratory corridors are important for some seabird species. Species typically use established migratory pathways at predictable times, and artificial light intersecting with an overhead migratory pathway should be assessed in the same way as for ground-based populations.

Where artificial light is likely to affect seabirds, consideration should be given to mitigation measures at the earliest point in project development, including to inform the design phase.

Associated guidance

- National Recovery Plan for threatened albatrosses and petrels (2022)[2]
- EPBC Act Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species

Qualified personnel

Lighting design/management and the EIA process should be undertaken by appropriately qualified personnel. Light management plans should be developed and reviewed by appropriately qualified lighting practitioners, who should consult with an appropriately trained marine ornithologist and/or ecologist.

People advising on the development of a lighting management plan, or the preparation of reports assessing the effect of artificial light on seabirds, should have relevant qualifications

[2] The recovery plan will sunset in 2032.

equivalent to a tertiary education in ornithology or equivalent experience as evidenced by peer-reviewed publications in the last 5 years on a relevant topic, or other relevant experience.

Step 1: Describe the project lighting

The type of information collated during this step should consider the biological Effects of artificial light on seabirds. Seabirds are susceptible when active at night while migrating, foraging or returning to colonies. The location and type of light source (both direct and skyglow) should be considered in relation to breeding and feeding areas. Seabirds are sensitive to both short-wavelength (blue/violet) and long-wavelength (orange/red) (Reed 1986) light, and some species are able to detect UV light. However, the intensity of lights may be more important than colour.

Step 2: Describe seabird population and behaviour

The species, life stage and behaviour of seabirds in the area of interest should be described. This should include the conservation status of the species; the abundance of birds; how widespread/localised the population is; the regional importance of the population; and the seasonality of seabirds utilising the area.

Relevant information can be found in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016, the Protected Matters Search Tool, the National Conservation Values Atlas, conservation advices, wildlife conservation plans, state and territory listed species information, scientific literature, and local and Indigenous knowledge.

Where there are insufficient data to understand the population's importance or demographics, or where it is necessary to document existing seabird behaviour, field surveys and biological monitoring may be necessary.

Biological monitoring of seabirds

Any biological monitoring associated with a project should be developed, overseen and have the results interpreted by an appropriately qualified biologist or ornithologist to ensure reliability of the data.

The objectives of monitoring in an area likely to be affected by light are to:

- understand the habitat use and behaviour of the population (for example, migrating, foraging, breeding)
- understand the size and importance of the population
- describe seabird behaviour prior to the introduction or upgrading of artificial lighting.

The data will be used to inform the EIA process and assess whether mitigation measures are successful. Suggested minimum monitoring parameters (what is measured) and techniques (how to measure them) are summarised in Table 7.

Table 7 Recommended minimum biological information necessary to assess the importance of a seabird population

Targeted age class	Survey effort	Duration	Reference
Adult nesting	In colonial nesting burrows or for surface nesting species with fixed or transient nesting sites, a single survey timed to coincide with predicted peak laying period. • A minimum of 3 sampling areas (transects/quadrants) appropriate for nest density to capture ~100 nests per transect. Status of nests recorded (used/unused – chick stage). For transient surface nesting species, use aerial or drone footage to estimate numbers of chicks in crèches. • A minimum of 3 sampling areas (transects/quadrants) appropriate for nest density to capture ~100 nests per transect. Status of nests recorded (used/unused – egg or chick).	Minimum 2 breeding seasons	Henderson & Southwood (2016) Surman & Nicholson (2014b) Survey Guidelines for Australia's Threatened Birds (Commonwealth of Australia 2010)
Fledgling	In colonial nesting burrows or for surface nesting species with fixed nesting sites, a single survey timed to coincide with predicted maximum fledging period.	Minimum 2 breeding seasons	Henderson & Southwood (2016) Surman & Nicholson (2014a)

Note: the information in this table is not prescriptive and should be assessed on a case-by-case basis.

Additional seabird monitoring

- Monitor fledging behaviour before a project begins, to establish a benchmark for assessing changes in fledging behaviour during construction and operations.
- Monitor fallout by assessing breeding colonies prior to fledging to assess annual breeding output/effort and measure against fallout (expecting greater fallout in years with higher reproductive output).
- Install camera traps at key locations to monitor fallout.
- Conduct nightly assessments of target lighting/areas to identify and collect grounded birds.
- Conduct observations post-dusk and pre-dawn with night vision goggles to assess activity/interactions.
- Track movement using land-based radar to determine existing flight paths (Raine et al. 2007).

As a minimum, qualitative descriptive data on visible light types, location and directivity should also be collected at the same time as the biological data. Handheld camera images can help to describe the light. Quantitative data on existing skyglow should be collected, if possible, in a biologically meaningful way, recognising the technical difficulties in obtaining these data. See Appendix C – Measuring biologically relevant light for a review.

Step 3: Risk assessment

The objective is that light should be managed in such a way that seabirds are not disrupted within or displaced from important habitat and are able to undertake critical behaviours such as foraging, reproduction and dispersal. These consequences should be considered in the risk assessment process. The aim of the process is to ensure that at important seabird rookeries, burrow usage remains constant, adults and fledglings are not grounded, and fledglings launch successfully from the rookery.

In considering the likely effect of light on seabirds, the assessment should consider the existing light environment, the proposed lighting design and mitigation/management, and the behaviour of seabirds at the location. Consideration should be given to how the birds perceive light. This should include both wavelength and intensity information and perspective. To discern how or whether seabirds are likely to see light, a site visit should be made at night and the area viewed from the seabird rookery. Similarly, consideration should be given to how seabirds will see light when in flight.

Using this perspective, the type and number of lights should be considered/modelled to determine whether seabirds are likely to perceive the artificial light and what the effects of the artificial light on their behaviour are likely to be.

Step 4: Light management plan

This should include all relevant project information (Step 1) and biological information (Step 2). It should outline proposed mitigation. For a range of seabird-specific mitigation measures see Seabird light mitigation toolbox. The plan should also outline the types of and schedule for biological and light monitoring to ensure mitigation is meeting the objectives of the plan, and triggers for revisiting the risk assessment phase of the EIA.

The plan should outline contingency options to implement if biological and light monitoring or compliance audits indicate that mitigation is not meeting objectives (for example, light is visible in seabird rookeries or fallout rates increase).

Step 5: Biological and light monitoring and auditing

The success of the impact mitigation and light management should be confirmed through monitoring and compliance auditing. The monitoring and audit results should be used to facilitate an adaptive management approach for continuous improvement.

Relevant biological monitoring is described in Step 2. Concurrent light monitoring should be undertaken and interpreted in the context of how seabirds perceive light and within the limitations of monitoring techniques described in Appendix C – Measuring biologically relevant light. Artificial light auditing, as described in the light management plan, should be undertaken.

Step 6: Review

The EIA should incorporate a continuous improvement review process that allows for upgraded mitigations, changes to procedures and renewal of the light management plan.

Seabird light mitigation toolbox

Appropriate artificial lighting design, controls and impact mitigation will be site, project and species-specific. Table 8 provides a toolbox of management options relevant to seabirds. These options should be implemented in addition to the 6 Best practice lighting design principles. Not all mitigation options will be practicable for every project. Table 9 provides a suggested list of light types appropriate for use near seabird rookeries and those to avoid.

A comprehensive review of the effects of land-based artificial lights on seabirds found that the most effective mitigation techniques were:

- turning lights off during fledging periods
- modifying light wavelengths
- removing external lights and closing window blinds to shield internal lights
- shielding the light source and preventing upward light spill
- reducing traffic speed limits and displaying warning signs
- implementing a rescue program for grounded birds (Rodríguez et al. 2017a).

Additional mitigation measures listed but not assessed for effectiveness were:

- using rotating or flashing lights, because research suggests that seabirds are less attracted to flashing lights than to constant light
- keeping light intensity as low as possible. Most bird groundings are observed in very brightly lit areas (Rodríguez et al. 2017a).

Table 8 Light management options for seabirds

Management action	Detail
Implement management actions during the breeding season.	Most seabird species nest during the austral spring and summer. Light management should be implemented during the nesting and fledgling periods.
Maintain a dark zone between the rookery and the light sources.	Avoid installing lights or manage all outdoor lighting within 3 km of a seabird rookery (Rodríguez, Rodríguez & Negro 2015). This is the median distance between nest locations and grounding locations. Avoiding the installation of lights in this zone would reduce the number of grounding birds by 50%.
Turn off lights during fledgling season.	If it is impossible to extinguish lights, consider curfews, dimming options, or changes in light spectra (preferably towards lights with low blue emissions). Fledglings can be attracted back towards lights on land as they fly out to sea.
Use curfews to manage lighting.	Extinguish lights around the rookery during the fledgling period by 7 pm, as fledglings leave their nest early in the evening.
Aim lights downwards and direct them away from nesting areas.	Aim light onto only the surface area requiring illumination. Use shielding to prevent light spill into the atmosphere and outside the footprint of the target area. This action can reduce fallout by 40% (Rodríguez et al. 2017a).
Use flashing/intermittent lights instead of fixed beam.	For example, small red flashing lights can be used to identify an entrance or delineate a pathway.
Use motion sensors to turn lights on only when needed.	Use motion sensors for pedestrian or street lighting within 3 km of a seabird rookery.
Prevent indoor lighting reaching outdoor environment.	Use fixed window screens or window tinting on fixed windows and skylights to contain light inside buildings.
Manage artificial light on jetties, wharves, marinas etc.	Fledglings and adults may be attracted to lights on marine facilities and become grounded or collide with infrastructure.
Reduce unnecessary outdoor deck lighting on all vessels and permanent and floating oil and gas installations in known seabird foraging areas at sea.	Extinguish outdoor/deck lights when not necessary for human safety and restrict lighting at night to navigation lights. Use block-out blinds on all portholes and windows.

Management action	Detail
Night fishing should only occur with minimum deck lighting. Avoid shining light directly onto fishing gear in the water. Ensure lighting enables recording of any incidental catch, including by electronic monitoring systems.	Night is between nautical dusk and nautical dawn (as defined in the Nautical Almanac tables for relevant latitude, local time and date). Light on the water at night can attract seabirds to deployed fishing gear, increasing the risk of seabird bycatch (i.e., killing or injuring birds). Minimum deck lighting should not breach minimum standards for safety and navigation. Record bird strike or incidental catch and report these data to regulatory authorities.
Avoid shining light directly onto longlines and/or illuminating baits in the water.	Light on the water can attract birds and makes it easier for them to detect and consume baits, increasing bycatch in fisheries (killing or injuring birds). Record bird strike or incidental catch and report these data to regulatory authorities.
Vessels working in seabird foraging areas during breeding season should implement a seabird management plan to prevent seabird landings on the ship, manage birds appropriately and report the interaction.	For example, see the International Association of Antarctica Tour Operators (IAATO) Seabirds landing on ships information page.
Use luminaires with spectral content appropriate for the species present.	Consider avoiding specific wavelengths that are problematic for the species of interest. In general, this would include avoiding lights rich in blue light; however, some birds are sensitive to yellow light and other mitigation may be required.
Avoid high-intensity light of any colour.	Keep light intensity as low as possible in the vicinity of seabird rookeries and known foraging areas.
Shield gas flares and locate them inland and away from seabird rookeries.	Manage gas flare light emissions by reducing gas flow rates to minimise light emissions; shielding the flame behind a containment structure; containing the pilot flame for flares within shielding; and scheduling maintenance activity requiring flaring outside of shearwater breeding season or during the day.
Minimise flaring on offshore oil and gas production facilities.	Consider reinjecting excess gas instead of flaring, particularly on installations on migratory pathways.
In facilities requiring intermittent night-time inspections, turn on lights only while operators are moving around the facility.	Use appropriate wavelength, explosion-proof LEDs with smart lighting controls. LEDs have no warm-up or cool-down limitations, so they can remain off until needed and provide instant light when required for routine nightly inspections or in the event of an emergency.
Ensure industrial site/plant operators use head torches.	Consider providing plant operators with white head torches (explosion-proof torches are available) for situations where white light is needed to detect colour correctly or in an emergency.
Supplement facility perimeter security lighting with computer-monitored infrared detection systems.	Perimeter lighting can be operated when night-time illumination is necessary but otherwise remain off.
Tourism operations around seabird colonies should manage torch usage so birds are not disturbed.	Consider installing educational signage around seabird colonies where tourism visitation is generally unsupervised.
Design and implement a rescue program for grounded birds.	This will not prevent birds grounding, but it is an important management action in the absence of appropriate light design. Rescue programs have proven useful in reducing mortality of seabirds. The program should include documentation and reporting of data about the number and location of rescued birds to regulatory authorities.

If all other mitigation options have been exhausted and there is a human safety need for artificial light, see Table 9 for guidance on types of commercial luminaires that are more suitable for use near seabird habitat.

Table 9 Commercial luminaire types that are considered generally less disruptive for use near important seabird mammal habitat, and those to avoid

Light type	Suitability for use near marine turtle habitat
Low-pressure sodium vapour	Suitable
High-pressure sodium vapour	Suitable
Filtered LED **a**	Suitable
Filtered metal halide **a**	Suitable
Filtered white LED **a**	Suitable
LED with appropriate spectral properties for species present	Suitable
White LED	Not suitable
Metal halide	Not suitable
White fluorescent	Not suitable
Halogen	Not suitable
Mercury vapour	Not suitable

a ‘Filtered’ means this type of luminaire can be used only if a filter approved by the manufacturer is applied to remove the problematic wavelength light.

Schedule 5

GLASSON HUXTABLE
LANDSCAPE ARCHITECTS

BARRYTOWN MINERAL SANDS MINING PROJECT

LANDSCAPE EVIDENCE

ANNEXURE 3: LANDSCAPE MITIGATION PLANTING PLANS

JANUARY 2024

CONTENTS

1.0 RECOMMENDED EXTERIOR COLOUR PALETTE

One of these Colorcote swatches will be chosen for the exterior (cladding and roofing) of the Processing Plant and ancillary buildings with the site. This will help structures to be viewed as a recessive colour against the background environment.

ColorCote Colour	Hex Value:	LRV*:
Permanent Green	#495d50	10.66%
Rivergum	#6a776a	18.13%
Mudstone	#656663	16.08%
Ironsand	#545250	9.55%

Recommended colours against views from road (majority).

ColorCote Colour	Hex Value:	LRV*:
Permanent Green	#495d50	10.66%
Rivergum	#6a776a	18.13%
Mudstone	#656663	16.08%
Ironsand	#545250	9.55%

Recommended colours against views from the beach (minority).

*Colour names and LRV from ColorCote.co.nz

2.0 LANDSCAPE PLANT SPECIES AND INDICATIVE GROWTH RATES

Below are the plant species that will be used for mitigation planting.

- An approximate growth rate of 0.40-0.60m per year has been determined in consultation with the project Landscape Architect [Mrs Crawford] and project Ecologist [Mr Bramley]. The combined experience of these two individuals notes that these plants will sit at a lower growth rate for the first two years following planting, and will have an increase in growth rates in following years. It is also noted that larger individual specimens have a longer 'sitting' period than smaller ones.
- Growth rates can be influenced by seasonal fluctuations, maintenance, moisture/precipitation, exposure, ground conditions, and type of plant species.

Note: The plant species proposed to be used are shown in Schedule of Species below, although other similar species may be used in addition to those listed (e.g., if a particular species is unavailable to source or if for any reason a species is deemed unsuitable at a later stage).

PLANT GROWTH

PROJECT YEAR	MINE STAGE	NATIVE PLANT HEIGHT
1	-	Seed Collection
2	-	0.4 - 0.6m at planting
3	1	0.8 - 1.2m
4	2	1.2 - 1.8m
5	3	1.6 - 2.4m
6	4	2.0 - 3.0m
7	5	2.4 - 3.6m
8	6	2.8 - 4.2m
9	7	3.2 - 4.8m

SCIENTIFIC NAME	COMMON NAME	BUND	RIPARIAN	WETLAND	COASTAL	ULTIMATE SIZE (m) wxh
Aristotelia serrata	makomako, wineberry	x	x			3 x 6
Carex geminata	rautahi		x	x		1x1
Carex secta	purei		x	x		1.5 x1.5
Carex virgata	pukio		x	x		0.5 x 1
Coprosma propinqua	mikimiki	x	x	x		2.5 x 5
Coprosma robusta	karamu	x	x	x		2.5 x 5
Cordyline australis	tī kouka, cabbage tree	x	x	x		2 x 6
Dacrycarpus dacrydioides	kahikatea, white pine		x	x		5 x 50
Juncus edgariae	edgar's rush		x	x		1 x 1
Metrosideros robusta	northern rata		x	x		3 x 15
Melicytus ramiflorus	māhoe, whiteywood	x	x			2.5 x 8
Phormium tenax	harakeke, korari, New Zealand flax	x	x	x	x	2 x 3
Pittosporum eugenioides	tarata, lemonwood	x	x			3 x 6
Pittosporum tenuifolium	kohuhu	x	x			3 x 6
Typha orientalis	raupō, bull rush			x		1.5 x 2.3

3.0 INDICATIVE STAGING PLAN

Below is an indicative staging plan.

* Bund Type A will need to be planted from established nursery plants, not from seed collected.

** Planting time periods can be condensed if necessary depending on the availability of landscape contractors and plants.

				LANDSCAPE PREPARATION AND ESTABLISHMENT				**				ACTIVE MINING					REHABILITATION		
Year	**2023**	**2024**				**2025**				**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Consent Term	**Year0**	**Year 1**	Q2	Q3	Q4	**Year 2**	Q2	Q3	Q4	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**
Planting Plans																			
Nursery EO1																			
Tender Package																			
Nursery Contract Confirmed																			
Plant Seed Collected																			
Propogation/Growing of Plants																			
Confirmation of Suitable Plants																			
Planting Bund Type A*																			
Planting - Collins Creek																			
Planting - Canoe Creek Lagoon																			
Planting - Northern Neighbour																			
Planting - Coastal																			
Planting - Northern Drain																			
Planting - Bund Type B																			
Planting - CWF																			
Landscape Maintenance During Mining																			
Planting - Enrichment																			
End of Mining - Rehabilitation																			
Planting - CWF Wetland Extension																			
Removal of Stockpile Bund Planting																			

5.0 NURSERY EOI

This Expression of Interest letter was sent out to suitable nurseries in the Punakaiki ecological district, or North Westland ecological region. We are currently in the process of receiving submissions (as at 15/1/24).
Please note that since sending this EOI out, Laurelia novae-zelandiae (pukatea) has been removed from the species list and Metrosideros umbellata (southern rata) has been substituted for Metrosideros robusta (northern rata).

GLASSON HUXTABLE
LANDSCAPE ARCHITECTS

14th December 2023

Re: Supply of Nursery Plants

To whom it may concern,

We are involved in a project north of Greymouth, which is currently in the consenting stage.

As part of this work, we are seeking expressions of interest from a local plant nursery (or nurseries) to supply the large number of plants that are required. Planting will occur in Years 1-3 and also again in Year 10. It will be located on bunds, near wetlands, in riparian areas and along the coast.

It is worthwhile noting that, that as part of our (proposed) Conditions of Consent, plants will need to be sourced from *"within the Punakaiki Ecological District or North Westland Ecological Region in order of preference. Where this is unable to be achieved, the consent holder shall notify the Council and work with the Council and a suitably qualified practitioner to determine an appropriate alternative plant source."*

We anticipate that plant stock provided in Year 1 will likely come from plants that are already being grown. Whereas planting in later years will likely come from seed collected and propagated specifically for the project.

Below are the anticipated plant species, grade and number required:

Plant species	Size	Total Number
Aristotelia serrata	1m+	822
Carex germinata	1L	2315
Carex secta	1L	1192
Carex virgata	1L	2315
Coprosma propinqua	1L	1487
Coprosma robusta	1L	1250
Cordyline australis	1L	1461
Dacrycarpus dacrydioides	1L	194
Juncus edgariae	1L	2242
Laurelia novae-zelandiae	1L	97
Melicytus ramiflorus	1m+	822
Metrosideros umbellata	1L	194
Phormium tenax	1L	8296
Pittosporum eugenioides	1m+	616
Pittosporum tenuifolium	1m+	616
Typha orientalis	1L	258
Total:		**24,177**

Note: please advise if grades are unavailable and suggest possible alternatives.

If you are interested in supplying the planting for this project, we encourage you to submit an Expression of Interest (EOI) by the **17th of January 2024**. Submissions can be made to naomi@ghla.co.nz.

Within your submission, please provide the following:

- A brief introduction and company overview.
- Your capacity to procure plants in the numbers required.
- Your lead in times for planting.
- Your ability to help with physical implementation (if this is a service you offer).
- Any further recommendations you may have in terms of species, procurement or otherwise.

I look forward to your reply. Please do not hesitate to contact me if you have any questions on the above.

Kind Regards,

N. Crawford.

Naomi Crawford

Director
BDes (Landscape Architecture) Hons, Registered NZILA

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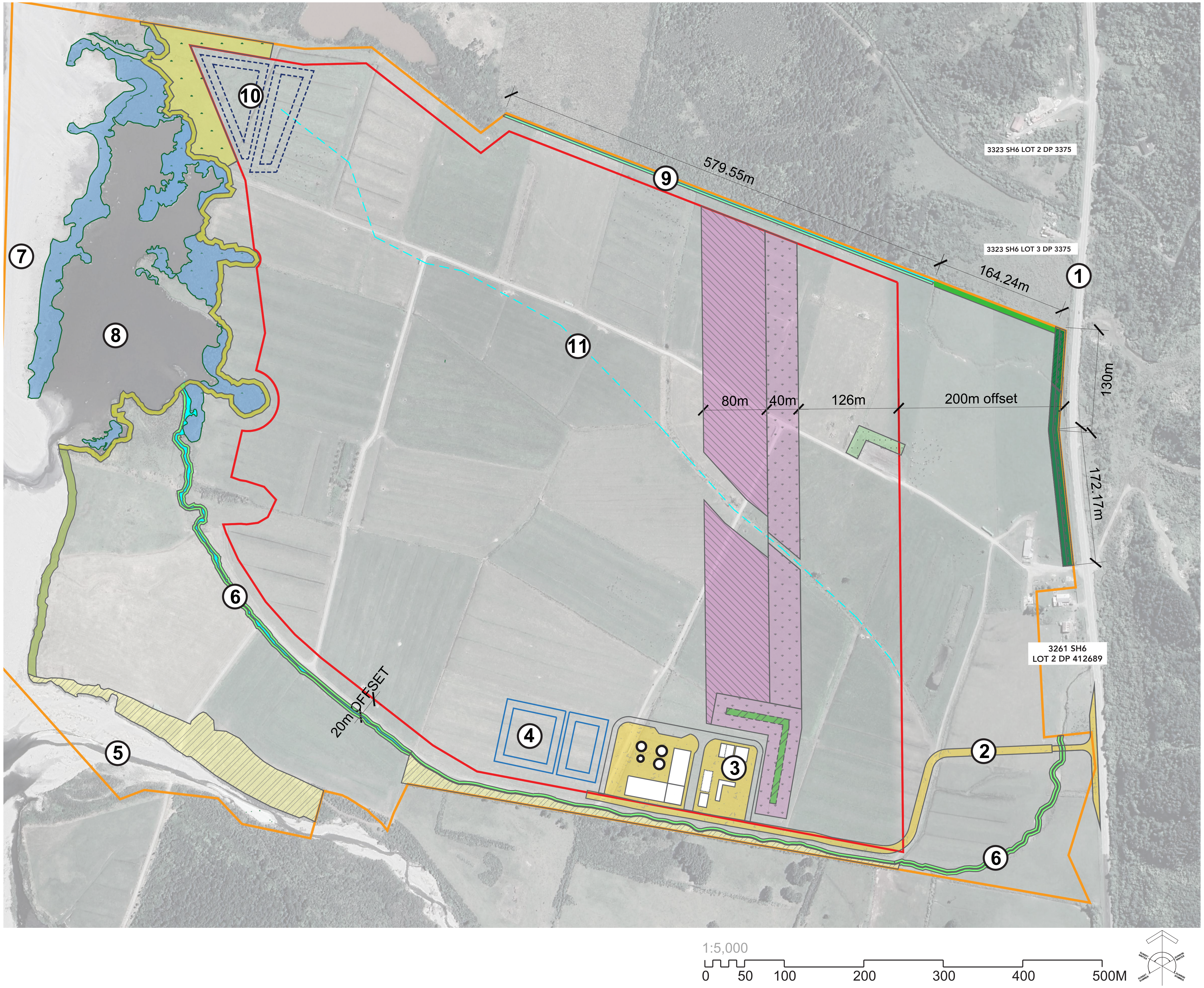
GLASSON HUXTABLE
LANDSCAPE ARCHITECTS

| LANDSCAPE ARCHITECTURE
| URBAN DESIGN
| LAND PLANNING

Glasson Huxtable Ltd, 149 Victoria Street, Christchurch, 8012
www.ghla.co.nz

6.0 GENERAL LAYOUT PLAN



LEGEND

- Bund Type A : 1.8m high Eastern Bund - Planted on eastern face and top
- Bund Type B: Planted on top of Central Stockpile Bund
- Ore Stockpile Area
- Bund Type B: 4.5m high Central Stockpile Bund - Grassed
- Coastal Mitigation Planting: (10m wide)
- Wetland Mitigation Planting (6m wide)
- Clean Water Facility (CWF) Planting
- Riparian Planting Types A, B and C: Along Collins Creek (min. 3m wide one/two sides)
- Riparian Planting Type D: Planting along Northern Drain southern side (3m wide)
- Neighbouring Mitigation Planting (8m wide - if required)
- Existing Wetland Planting
- Internal Access Road and Hardstand
- Existing Stand of Flax to be retained
- Existing Riparian Planting
- Mining Disturbance Area
- Application Site

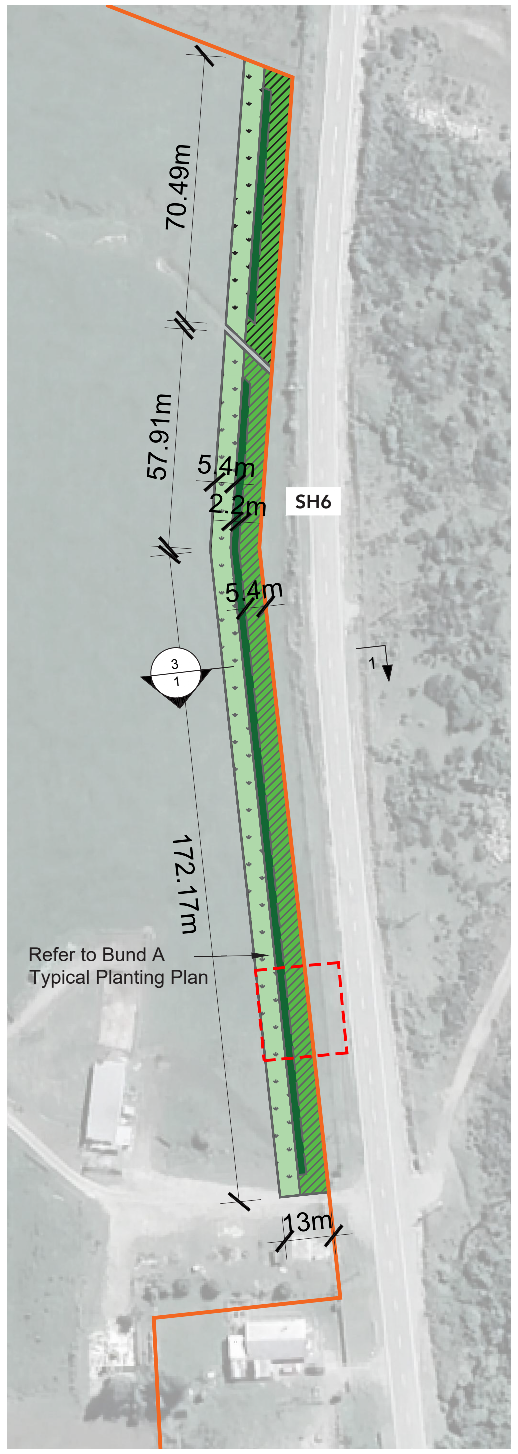
KEY

1. State Highway 6 / Coast Road
2. Internal Access Road and Hardstand
3. Processing Plant and Associated Facilities
4. Mine Water Facility: Pond 1 and 2
5. Canoe Creek
6. Collins Creek
7. Pakiroa Beach
8. Canoe Creek Lagoon
9. Existing Northern Drain
10. Clean Water Facility and Future Wetland Extension
11. New Central Drain

BARRYTOWN MINERAL SANDS MINE	01.01 General Layout Plan	PROJECT NUMBER 2003	REVISION B	SCALE 1:5000@A3 1:2500@A1	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

7.0 DETAILED LANDSCAPE PLANS, SECTIONS AND SCHEDULES

BUND TYPE A - EASTERN BUND SH6



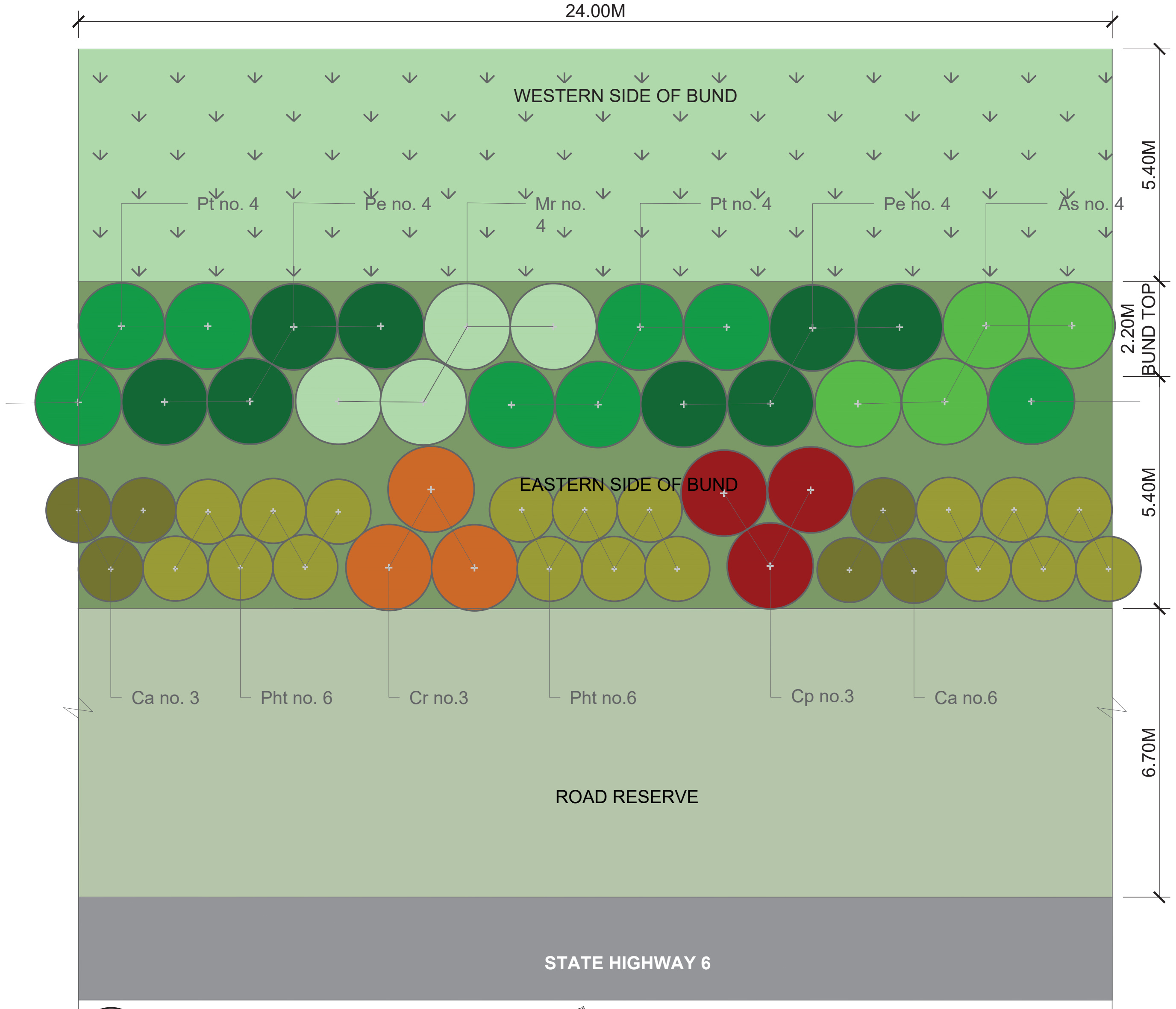
1 Key Plan
Scale: 1:2000

LEGEND

- **Bund Type A - 1.8m high Eastern Bund - Planted on eastern face and top**
- **Grassed Bund**
- **Screening Tree**
- **Application Site**

PLANTING LEGEND

- ***Aristotelia serrata***
- ***Pittosporum eugenioides***
- ***Melicytus ramiflorus***
- ***Pittosporum tenuifolium***
- ***Coprosma robusta***
- ***Coprosma propinqua***
- ***Cordyline australis***
- ***Phormium tenax***



2 Bund Type A Typical Planting Plan
Scale: 1:150

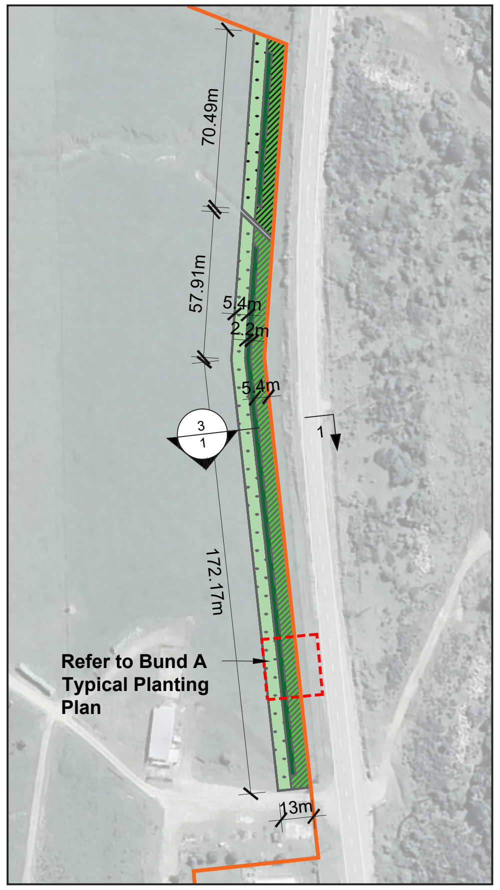
Note: The planting plan is illustrative of a 24m section. Within Planting Area A, it is intended that this section will be repeated along the bund length.

Bund Type A (Eastern Bund)	
Activity	Constructing a 1.8m high planted bund.
Location	Along the eastern boundary of the site, running parallel to SH6. Specifically, from the north-eastern corner of the site, culminating north of the residence at 3261 Coast Road.
Details	The bund will be 1.8m high, with 1:3 sloping sides which gently meet the existing landform. Planting will occur on the top and eastern side of the bund using a densely forming shrub mix.
Desired Outcome	The bund will accelerate the height of the planting. Together the bund and planting will assist to soften and screen onsite structures, movement, and activities for users of SH6.
Timeframe	To be implemented xxx and remain permanently.

Tree and Planting Schedule

Bund Type A (Eastern Bund) Planting (4 ROWS)

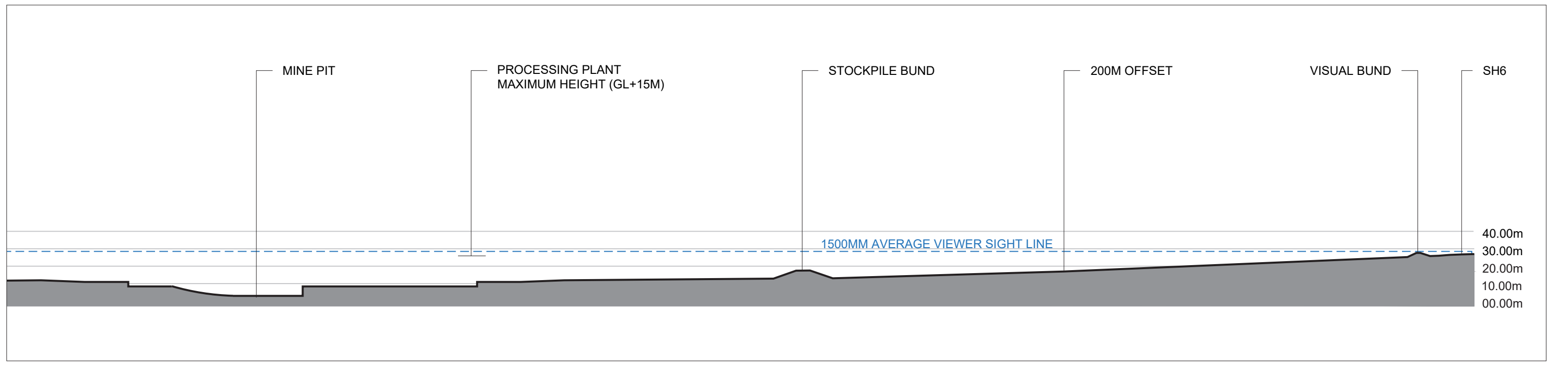
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Plants per 24m block	Mix % of plants	Number of 24 m planting blocks over 300m bund	Total Number
Aristotelia serrata	As	6x3	2	4.0	7.40	12.50	50
Coprosma propinqua	Cp	5x2.5	2	3.0	5.55	12.50	38
Coprosma robusta	Cr	5x2.5	2	3.0	5.55	12.50	38
Cordyline australis	Ca	6x2	1.5	6.0	11.11	12.50	75
Melicytus ramiflorus	Mr	8x2.5	2	4.0	7.40	12.50	50
Phormium tenax	Pht	3x2	1.5	18.0	33.33	12.50	225
Pittosporum eugenioides	Pe	6x3	2	8.0	14.80	12.50	100
Pittosporum tenuifolium	Pt	6x3	2	8.0	14.80	12.50	100
			Total:		100		675



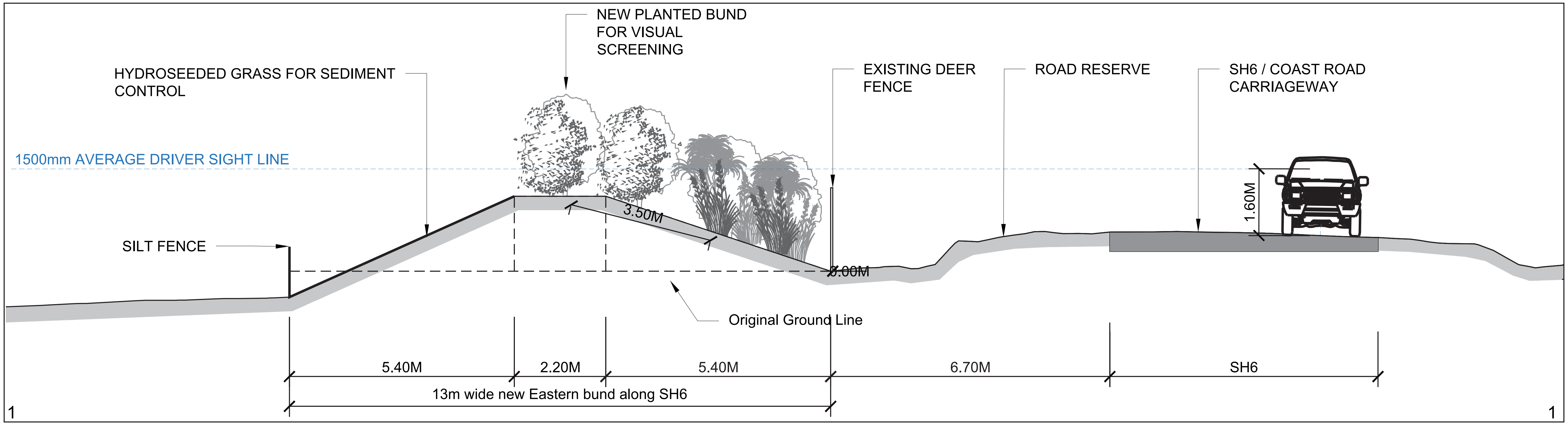
LEGEND

- Bund Type A - 1.8m high Eastern Bund - Planted on eastern face and top
- Grassed Bund
- Screening Tree
- Application Site

1 Key Plan
Scale: 1:3000



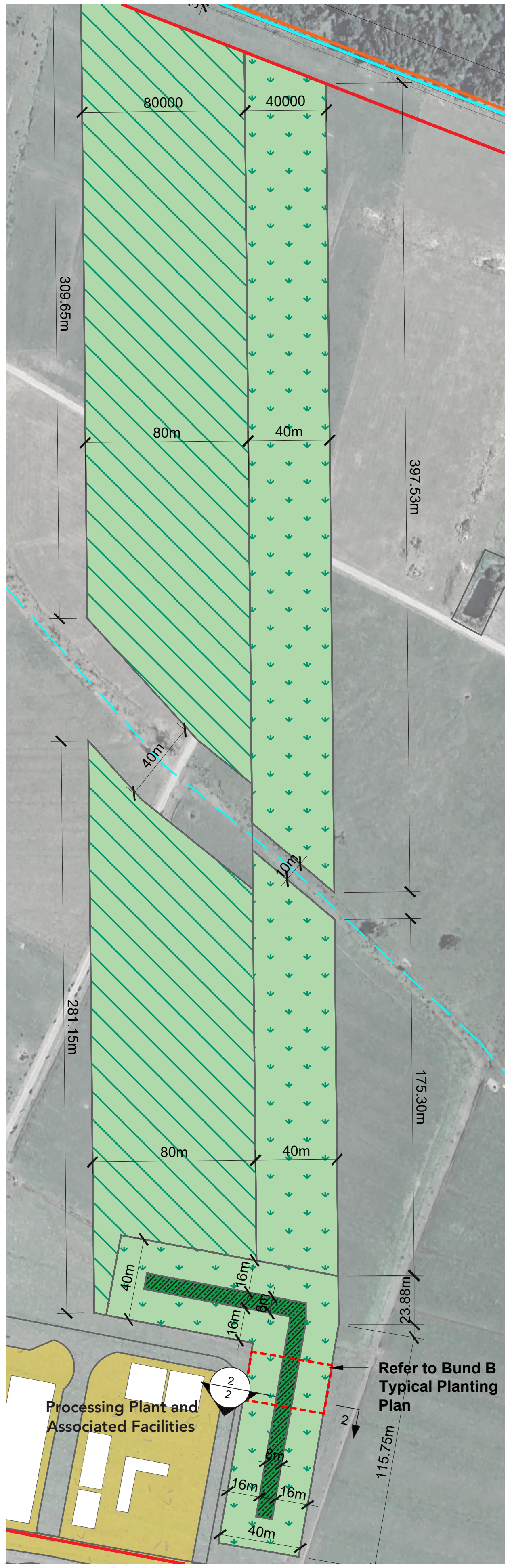
2 Indicative Long Section from SH6 to the Mine Pit
(Not to Scale)



3 Section 1-1_Bund Type A_Typical Eastern Bund
Scale: 1:100

BARRYTOWN MINERAL SANDS MINE	03.02 Bund Type A _Eastern Bund (SH6) Typical Cross Section	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN @A3	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

BUND TYPE B - STOCKPILE BUND



1 Key Plan
Scale: 1:3000

LEGEND

Bund Type B: 4.5m high Central Stockpile Bund - Grassed

Bund Type B - Planted

Ore Stockpile Area

Internal Access Road and Hardstand

Mining Disturbance Area

Application Site

TREE LEGEND

Aristotelia serrata

Pittosporum eugenioides

Melicytus ramiflorus

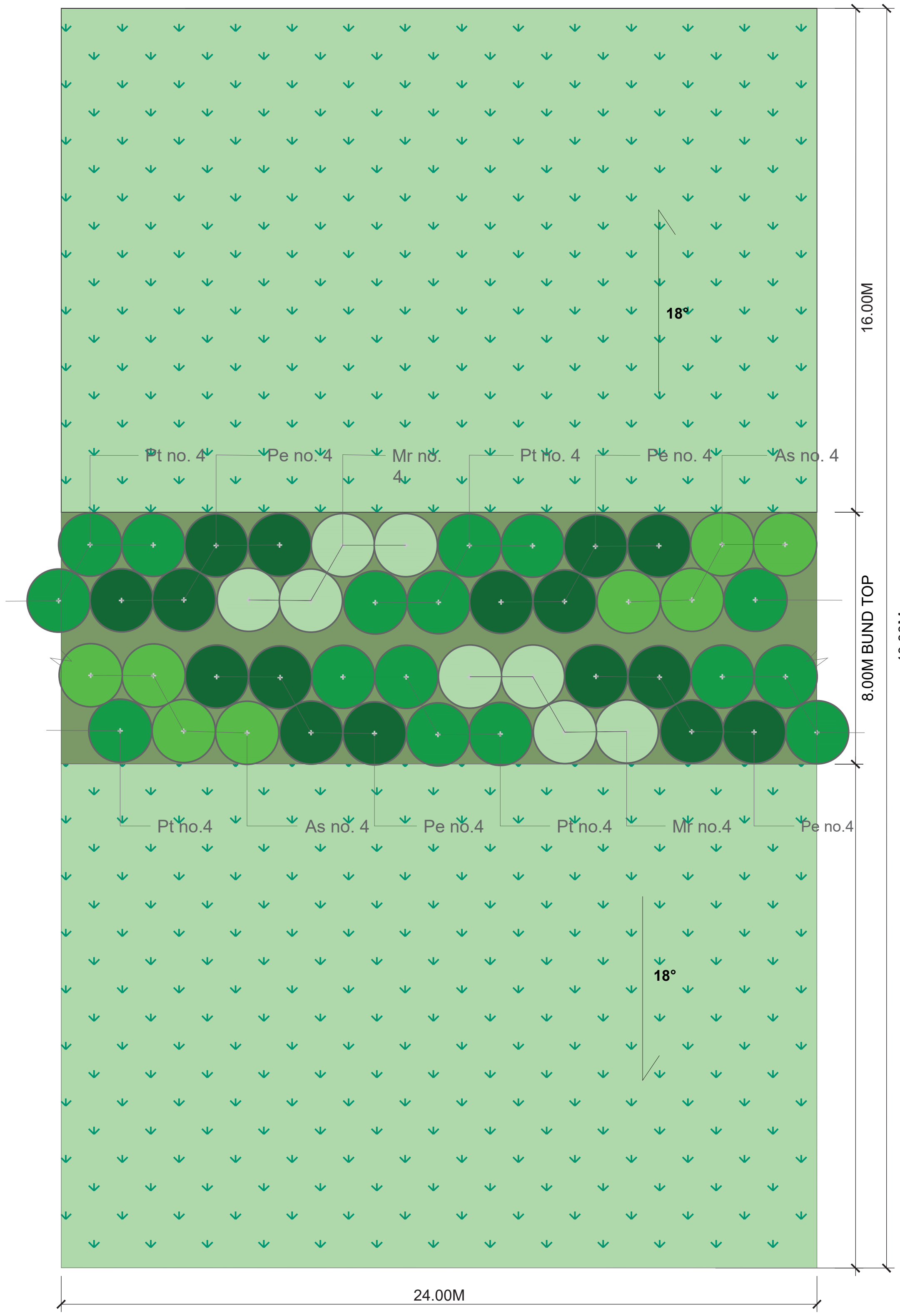
Pittosporum tenuifolium

Tree and Planting Schedule

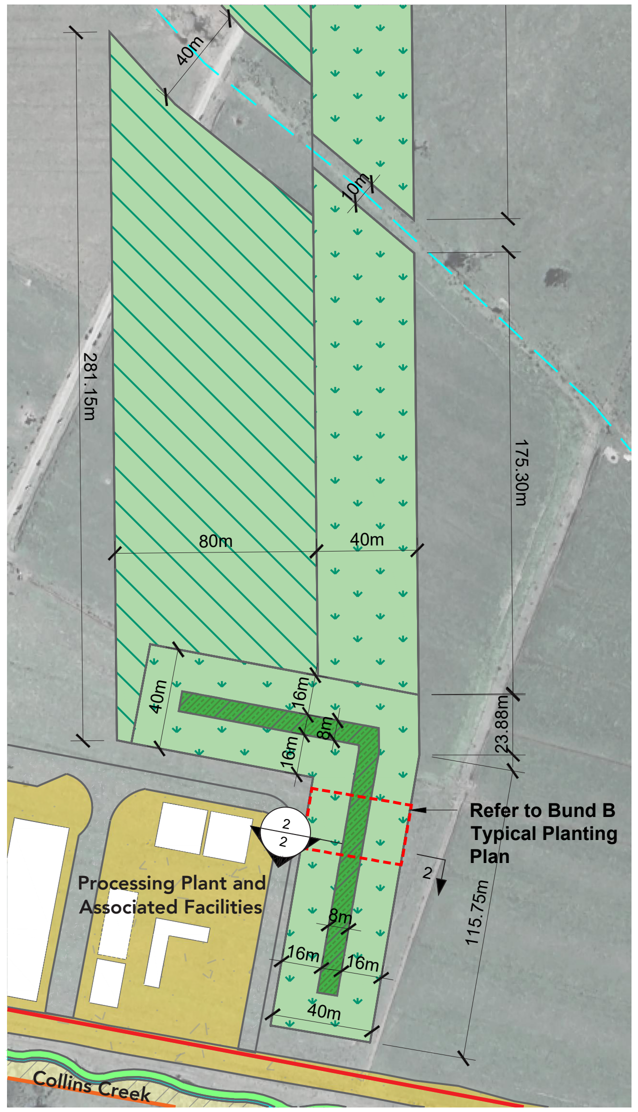
Bund Type B (Stockpile Bund) Planting (4 ROWS)								
Plant species	Abbreviation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length (m)	Total Number
Aristotelia serrata	As	6x3	2	LM	16.60	186.95	62
Melicytus ramiflorus	Mr	8x2.5	2	LM	16.60	186.95	62
Pittosporum eugenioides	Pe	6x3	2	LM	33.30	186.95	125
Pittosporum tenuifolium	Pt	6x3	2	LM	33.30	186.95	125
			Total:		100		373

Bund Type B (Central Stockpile Bund)	
Activity	Utilising the 4.5m high stockpile bund for visual screening.
Location	The southern end of the stockpile bund plus a small extension, wrapping around the north-eastern side of the Processing Plant.
Details	The southern end of the stockpile bund will be planted using a densely forming shrub mix to provide visual mitigation.
Desired Outcome	Planting the southern end of the stockpile bund will soften the lower half of the Processing Plant for users of SH6 and neighbouring properties.
Timeframe	Refer to Staging Plan

Note: The planting plan is illustrative of a 24m section. It is intended that this planting will be repeated along the full length of Bund Type B.



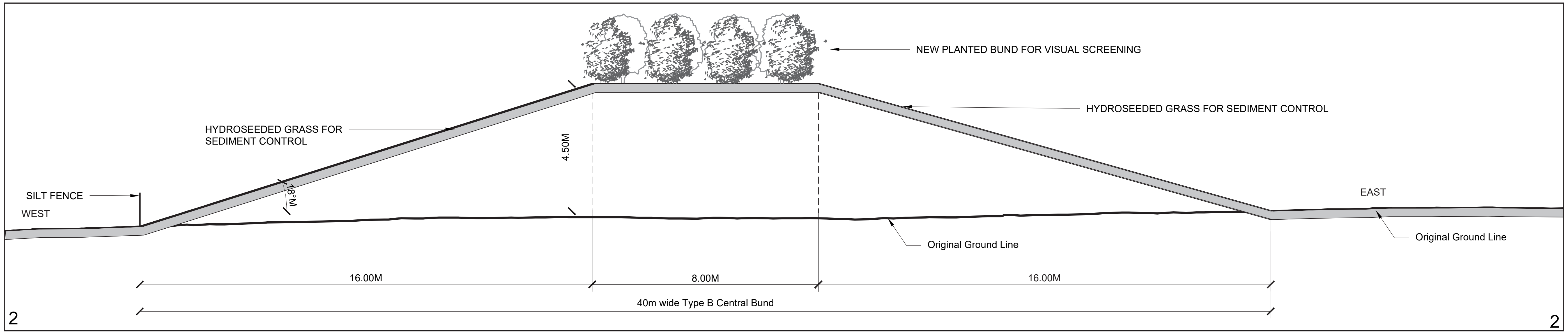
2 Bund Type B Typical Planting Plan
Scale: 1:200



LEGEND

- Bund Type B: 4.5m high Central Stockpile Bund - Grassed
- Bund Type B - Planted
- Ore Stockpile Area
- Internal Access Road and Hardstand
- Mining Disturbance Area
- Application Site

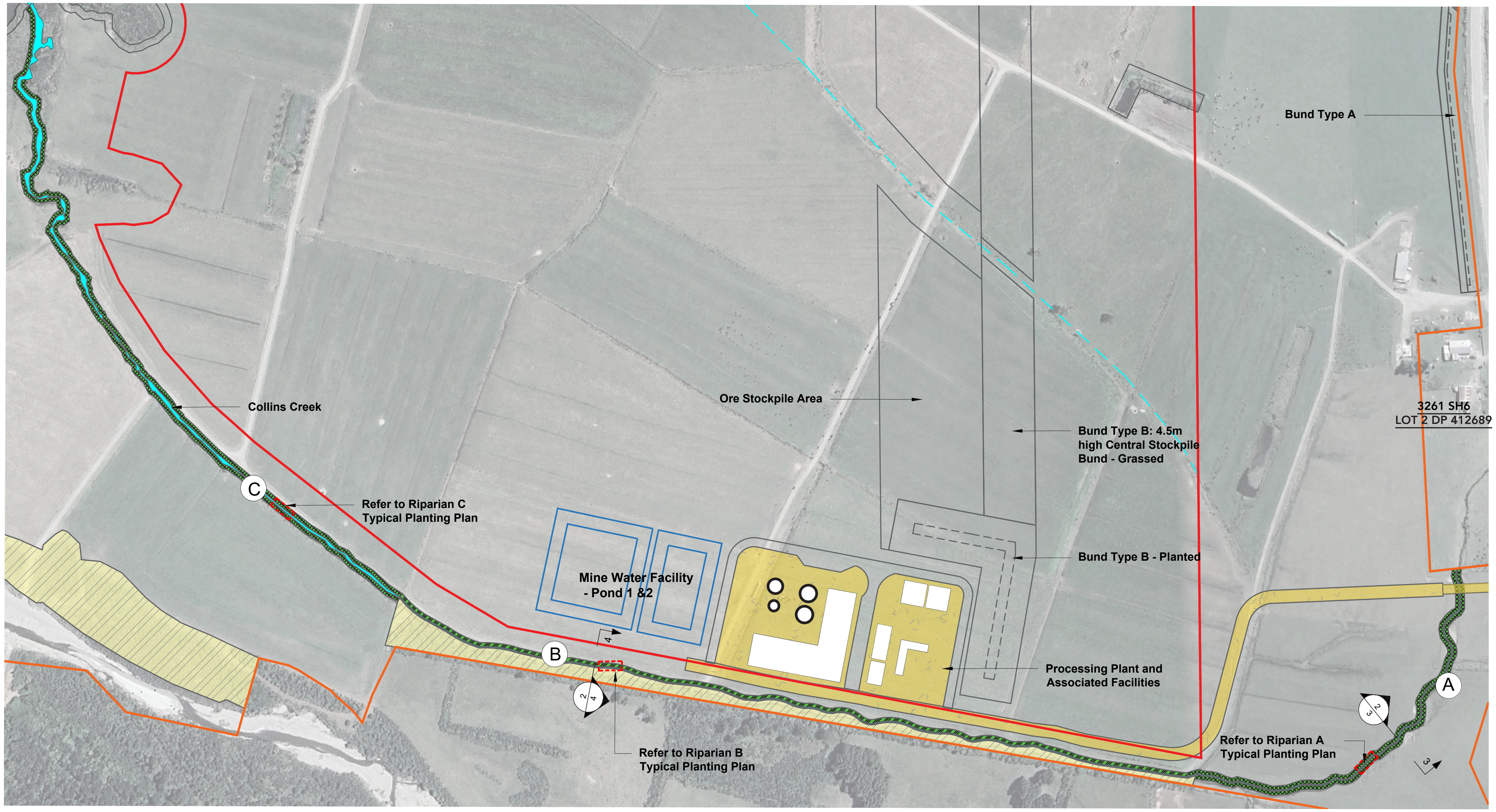
1 Key Plan
Scale: 1:3000



2 Section 2-2_Bund Type B_Stockpile Bund Typical
Scale: 1:150

BARRYTOWN MINERAL SANDS MINE	04.02 Bund Type B_ Stockpile Bund_ Typical Cross Section	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN @A3	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

RIPARIAN TYPES A, B AND C COLLINS CREEK



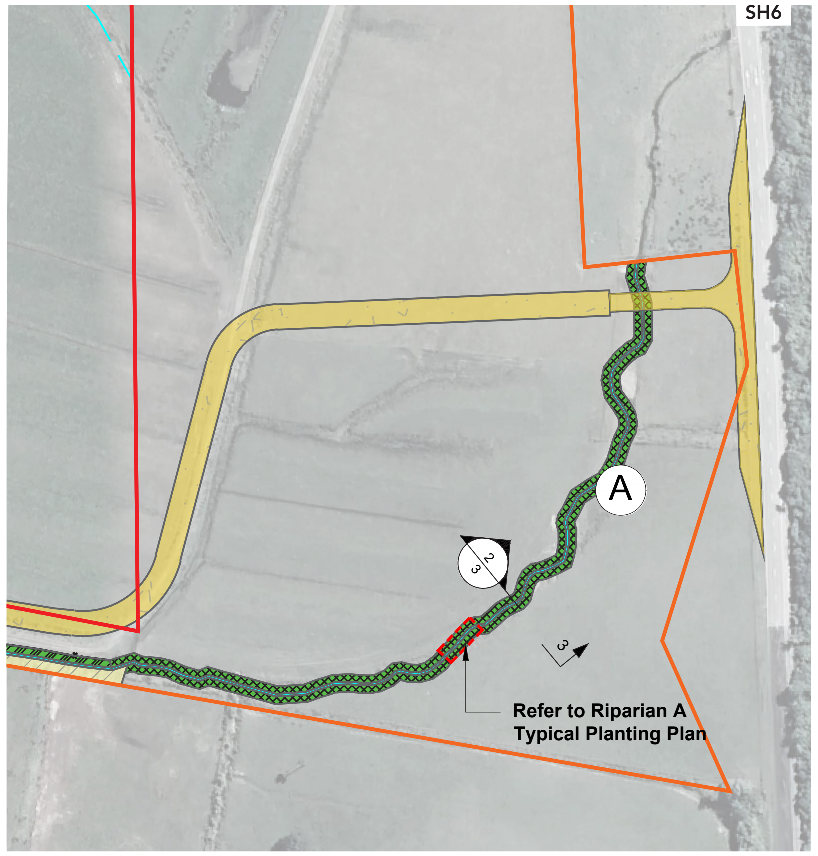
LEGEND

- **Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)**
- **Riparian Planting Type B - Along Collins Creek northern side (3m wide)**
- **Internal Access Road and Hardstand**
- **Existing Riparian Planting**
- **Mining Disturbance Area**
- **Collins Creek**
- **Application Site**

1 Planting Key Plan_Collins Creek
Scale: 1:3500

Riparian Types A, B and C: Collins Creek	
Activity	Planting and fencing the edges of Collins Creek.
Location	Planting will occur alongside Collins Creek within the site.
Details	3m of planting will occur beside Collins Creek with fencing located on the outer edge. Note: In some locations planting will occur on one or both sides of Collins Creek, depending on what planting is already present.
Desired Outcome	Planting Collins Creek will provide visual screening of onsite structures, movement, and activities for neighbouring properties and users of SH6. It will also support stream health, encourage biodiversity, assist to rehabilitate natural character, and ensure the site meets statutory obligations.
Timeframe	Refer to Staging Plan.

RIPARIAN TYPE A COLLINS CREEK



LEGEND

- Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)
- Riparian Planting Type B - Along Collins Creek northern side (3m wide)
- Internal Access Road and Hardstand
- Existing Riparian Planting
- Mining Disturbance Area
- Collins Creek
- Application Site

1 Key Plan
Scale: 1:3000

Tree and Planting Schedule

Collins Creek Riparian Planting A - UPPER MARGINS (DOUBLE ROW)

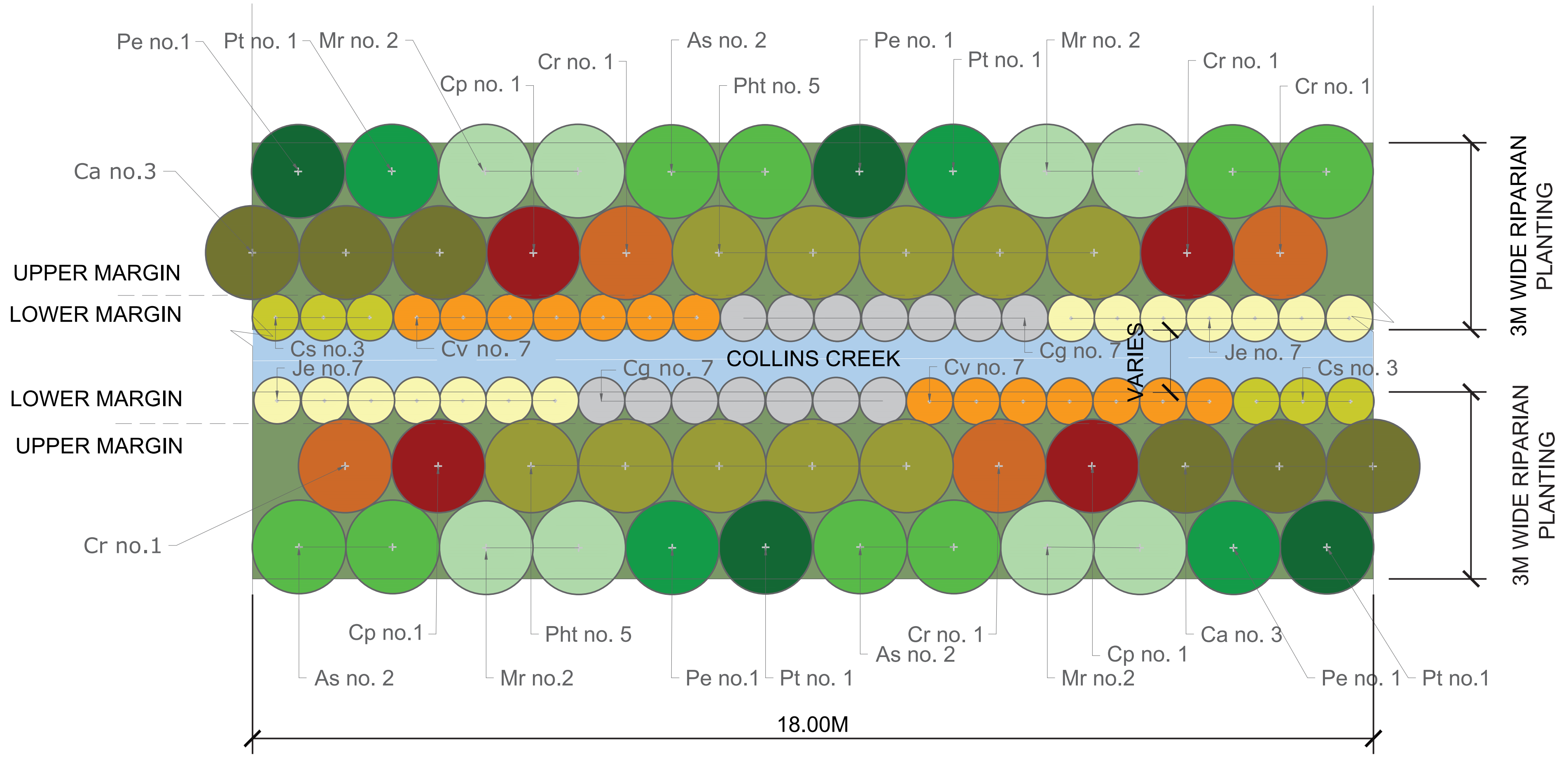
Plant species	Abbrev-iation	Mature Size h x w (m)	Plant Spacing (m)	Per Linear Metre	Mix %	Total Length East Side (m)	Total Number East Side	Total Length West Side (m)	Total Number West Side
Aristotelia serrata	As	6x3	1.5	LM	16.67	319.5	71	314.1	70
Coprosma propinqua	Cp	5x2.5	1.5	LM	8.33	319.5	35	314.1	35
Coprosma robusta	Cr	5x2.5	1.5	LM	8.33	319.5	35	314.1	35
Cordyline australis	Ca	6x2	1.5	LM	12.50	319.5	53	314.1	52
Melicytus ramiflorus	Mr	8x2.5	1.5	LM	16.67	319.5	71	314.1	70
Phormium tenax	Pht	3x2	1.5	LM	20.83	319.5	89	314.1	87
Pittosporum eugenioides	Pe	6x3	1.5	LM	8.33	319.5	35	314.1	35
Pittosporum tenuifolium	Pt	6x3	1.5	LM	8.33	319.5	35	314.1	35
				Total:	100		426		419

Collins Creek Riparian Planting A - LOWER MARGINS (SINGLE ROW)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length East Side (m)	Total Number East Side	Total Length West Side (m)	Total Number West Side
Carex germinata	Cg	1x1	0.75	LM	29.17	313.6	122	318.1	124
Carex secta	Cs	1.5x1.5	0.75	LM	12.50	313.6	52	318.1	53
Carex virgata	Cv	1x0.5	0.75	LM	29.17	313.6	122	318.1	124
Juncus edgariae	Je	1x1	0.75	LM	29.17	313.6	122	318.1	124
				Total:	100		418		424

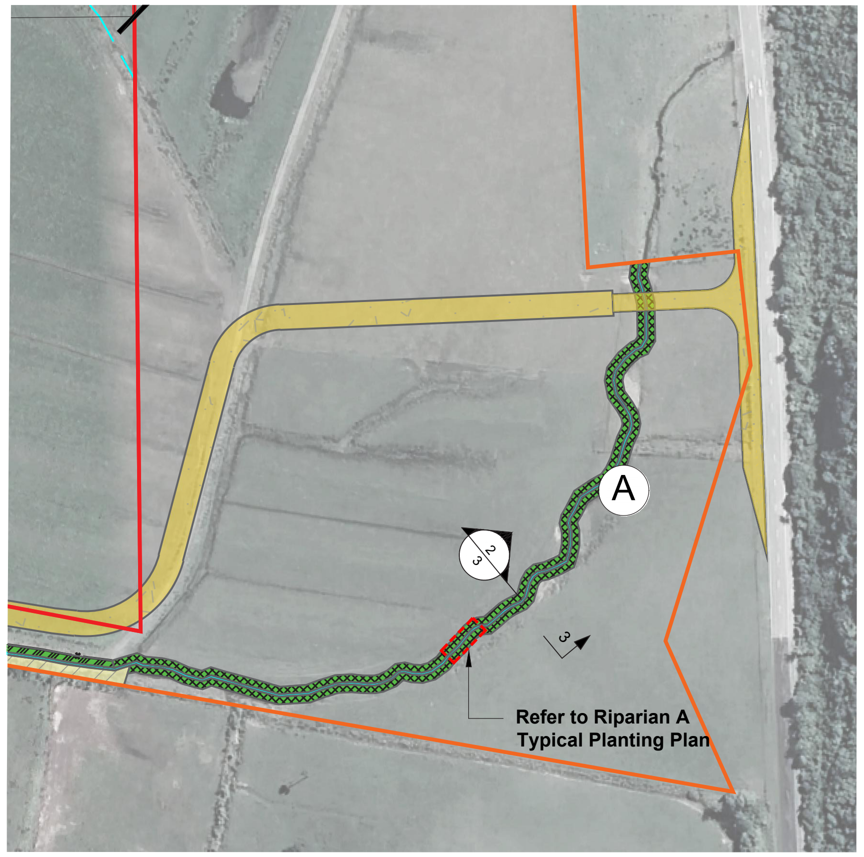
PLANTING LEGEND

- *Aristotelia serrata*
- *Pittosporum eugenioides*
- *Melicytus ramiflorus*
- *Pittosporum tenuifolium*
- *Coprosma robusta*
- *Coprosma propinqua*
- *Cordyline australis*
- *Phormium tenax*
- *Carex secta*
- *Carex germinata*
- *Juncus edgariae*
- *Carex virgata*



Note: The planting plan is illustrative of an 18m section. Within Riparian Planting Area A, it is intended that this section will be repeated along both sides of the banks of Collins Creek.

2 Riparian Type A_Typical Planting Plan_Collins Creek
Scale: 1:100

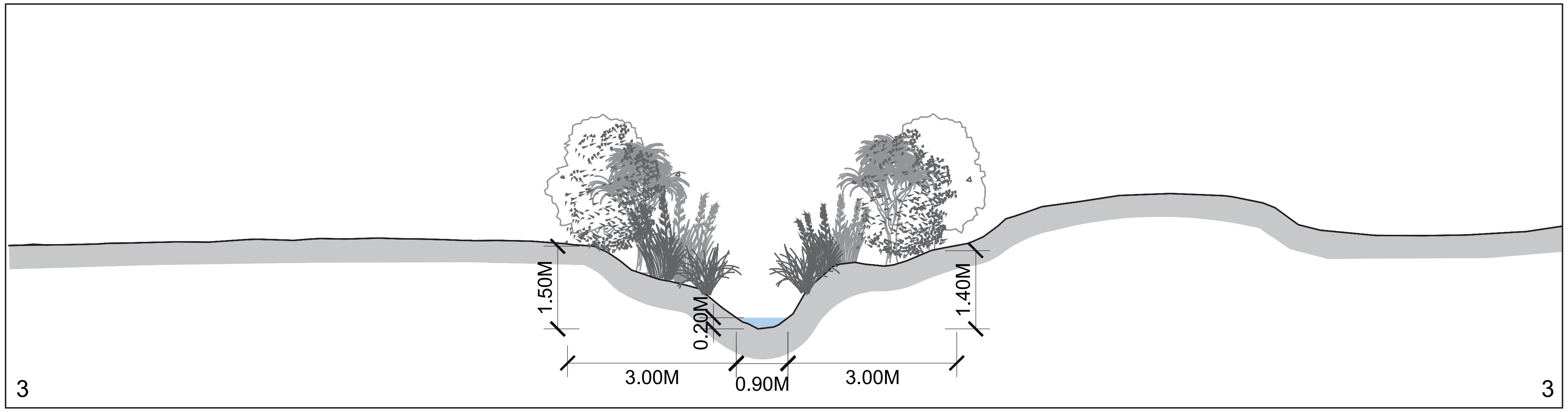


LEGEND

- Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)
- Riparian Planting Type B - Along Collins Creek northern side (3m wide)
- Internal Access Road and Hardstand
- Existing Riparian Planting
- Mining Disturbance Area
- Collins Creek
- Application Site

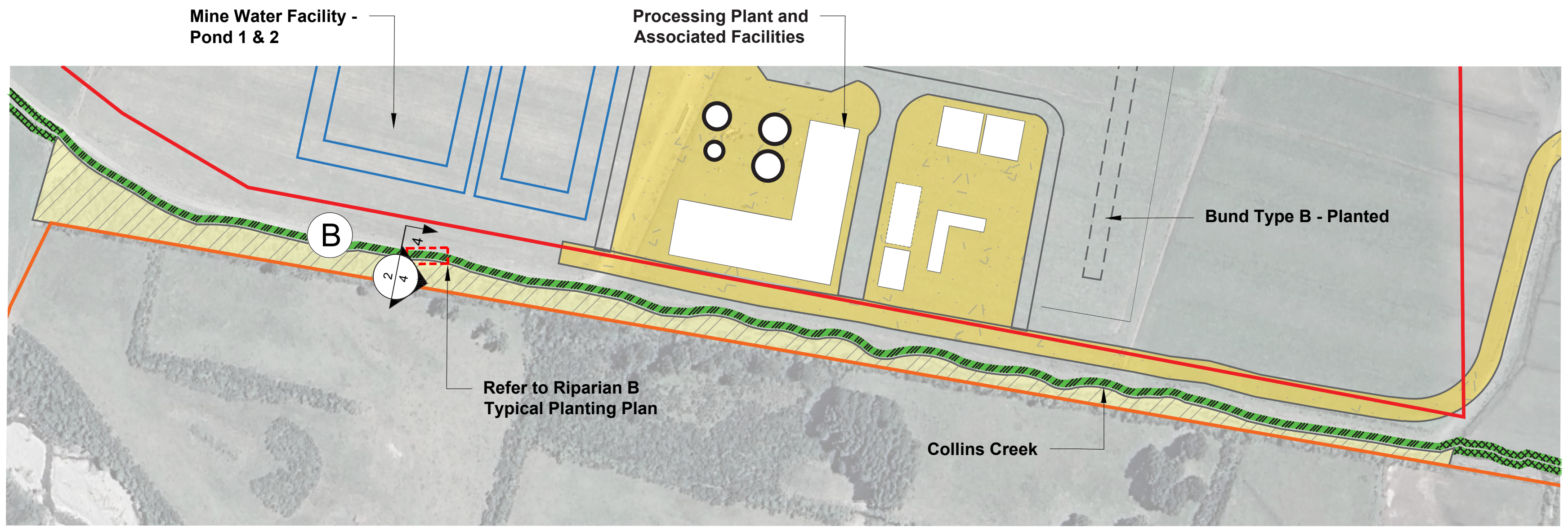
Note: Riparian Type A creek sides have a shallow profile

1 Zoom Plan
Scale: 1:3000



2 Section 3-3_Riparian Type A_Collins Creek Typical
Scale: 1:100

RIPARIAN TYPE B COLLINS CREEK



1 Key Plan
Scale: 1:3000

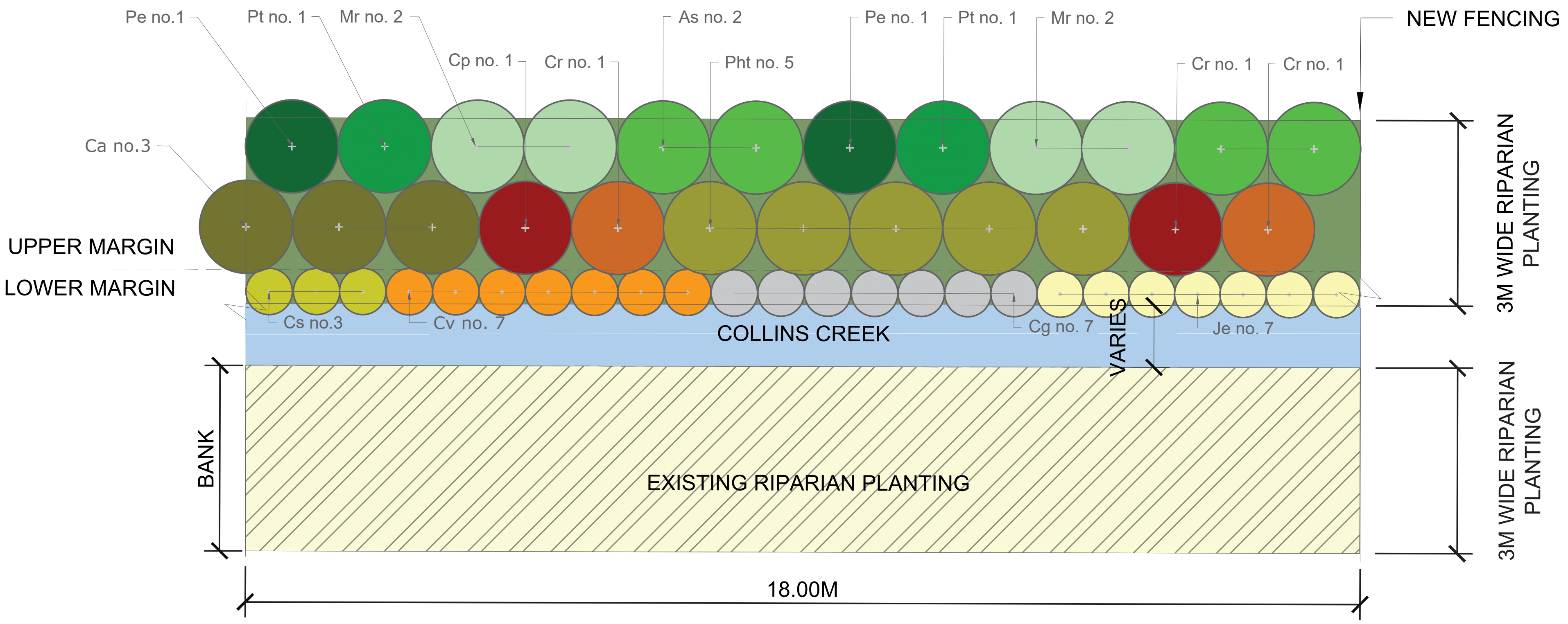
LEGEND

- Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)
- Riparian Planting Type B - Along Collins Creek northern side (3m wide)
- Internal Access Road and Hardstand
- Existing Riparian Planting
- Mining Disturbance Area
- Collins Creek
- Application Site

PLANTING LEGEND

- *Aristotelia serrata*
- *Pittosporum eugenioides*
- *Melicytus ramiflorus*
- *Pittosporum tenuifolium*
- *Coprosma robusta*
- *Coprosma propinqua*
- *Cordyline australis*
- *Phormium tenax*
- *Carex secta*
- *Carex germinata*
- *Juncus edgariae*
- *Carex virgata*

Note: The planting plan is illustrative of an 18m section. Within Riparian Planting Area B, it is intended that this section will be repeated along the northern bank of Collins Creek.

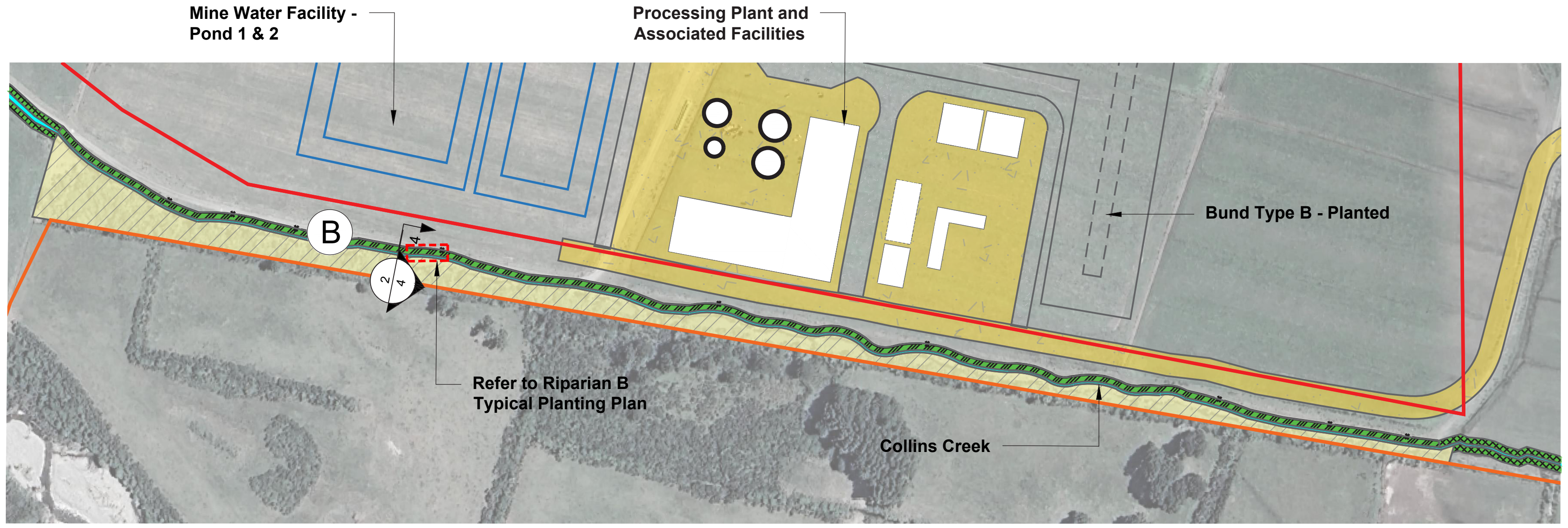


2 Riparian Type B_Typical Planting plan_Collins Creek
Scale: 1:100

Tree and Planting Schedule

Collins Creek Riparian Palnting B - UPPER MARGIN (DOUBLE ROW)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length South Side (m)	Total Number
Aristotelia serrata	As	6x3	1.5	LM	16.67	634.2	141
Coprosma propinqua	Cp	5x2.5	1.5	LM	8.33	634.2	70
Coprosma robusta	Cr	5x2.5	1.5	LM	8.33	634.2	70
Cordyline australis	Ca	6x2	1.5	LM	12.50	634.2	106
Melicytus ramiflorus	Mr	8x2.5	1.5	LM	16.67	634.2	141
Phormium tenax	Pht	3x2	1.5	LM	20.83	634.2	176
Pittosporum eugenioides	Pe	6x3	1.5	LM	8.33	634.2	70
Pittosporum tenuifolium	Pt	6x3	1.5	LM	8.33	634.2	70
			Total:		100		846

Collins Creek Riparian Planting B - LOWER MARGIN (SINGLE ROW)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length South Side (m)	Total Number
Carex germinata	Cg	1x1	0.75	LM	29.17	636.8	248
Carex secta	Cs	1.5x1.5	0.75	LM	12.50	636.8	106
Carex virgata	Cv	1x0.5	0.75	LM	29.17	636.8	248
Juncus edgariae	Je	1x1	0.75	LM	29.17	636.8	248
			Total:		100		849

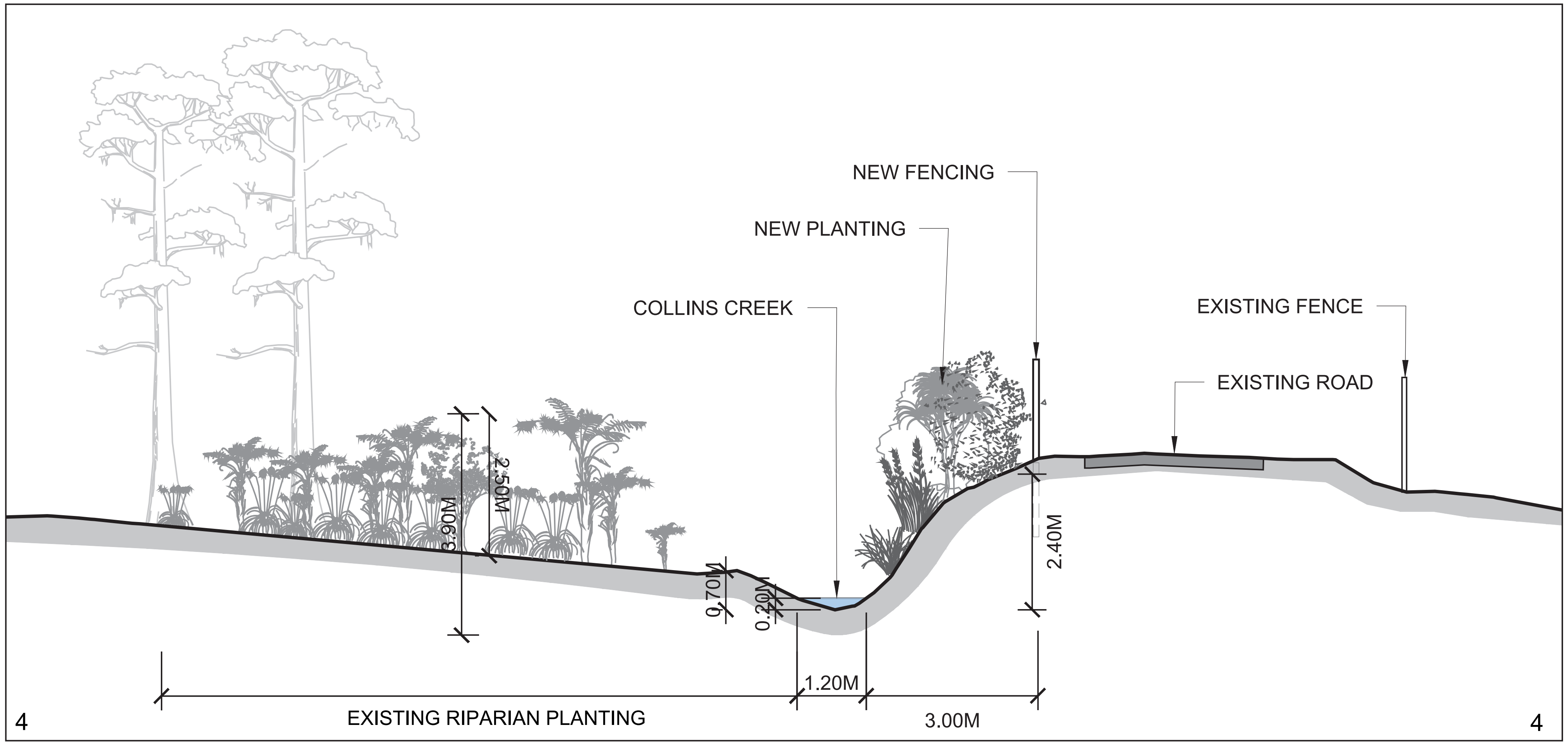


1 Key Plan
Scale: 1:3000

LEGEND

- Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)
- Riparian Planting Type B - Along Collins Creek northern side (3m wide)
- Internal Access Road and Hardstand
- Existing Riparian Planting
- Mining Disturbance Area
- Collins Creek
- Application Site

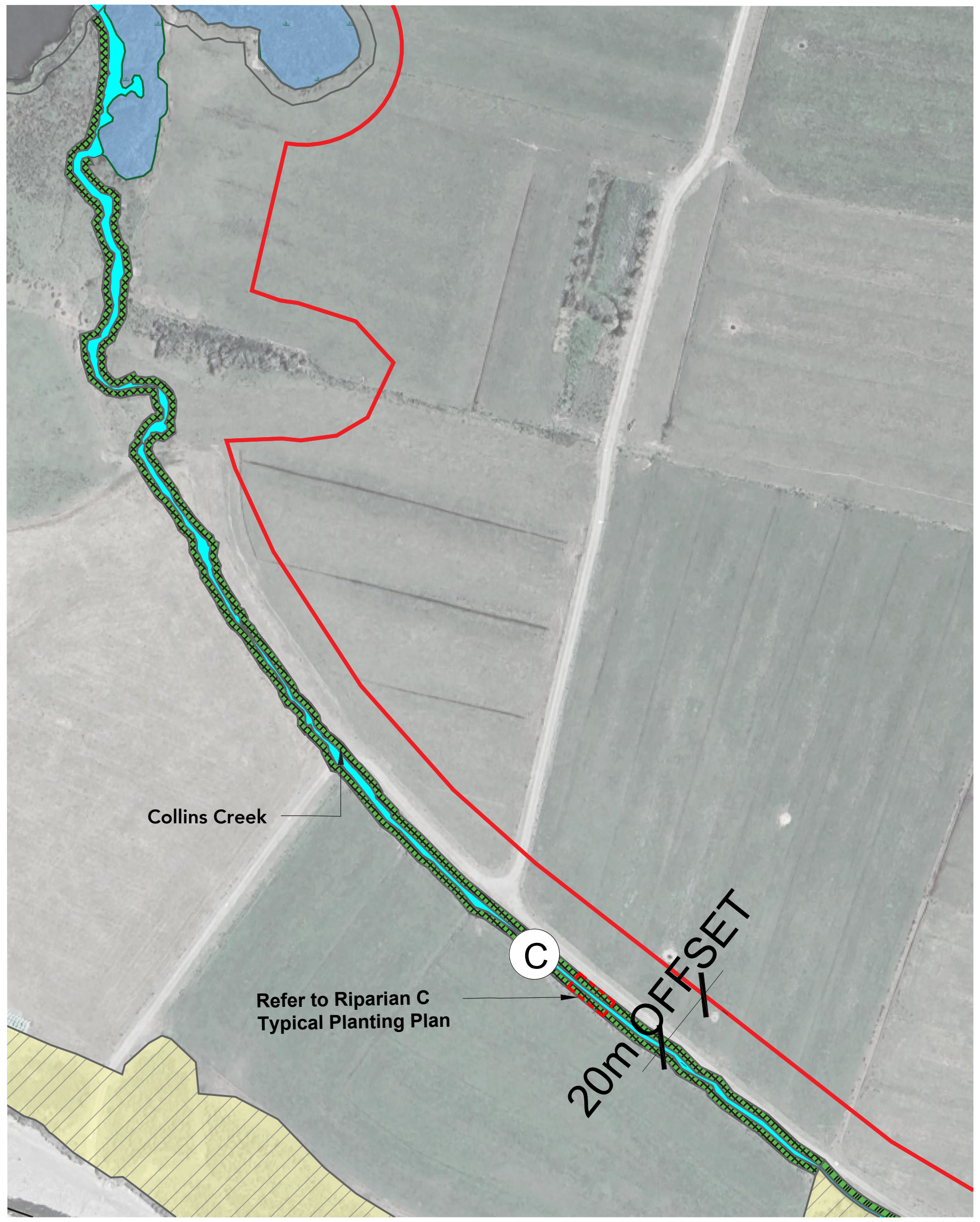
Note: Riparian Type B creek sides have a steep profile



2 Section 4-4_Riparian Type B_Collins Creek Typical
Scale: 1:100

BARRYTOWN MINERAL SANDS MINE	05.05 Riparian Type B Typical Cross Section_Collins Creek	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

RIPARIAN TYPE C COLLINS CREEK



1 Key Plan
Scale: 1:3000

LEGEND

Riparian Planting Types A and C- Along Collins Creek (3m wide both sides)

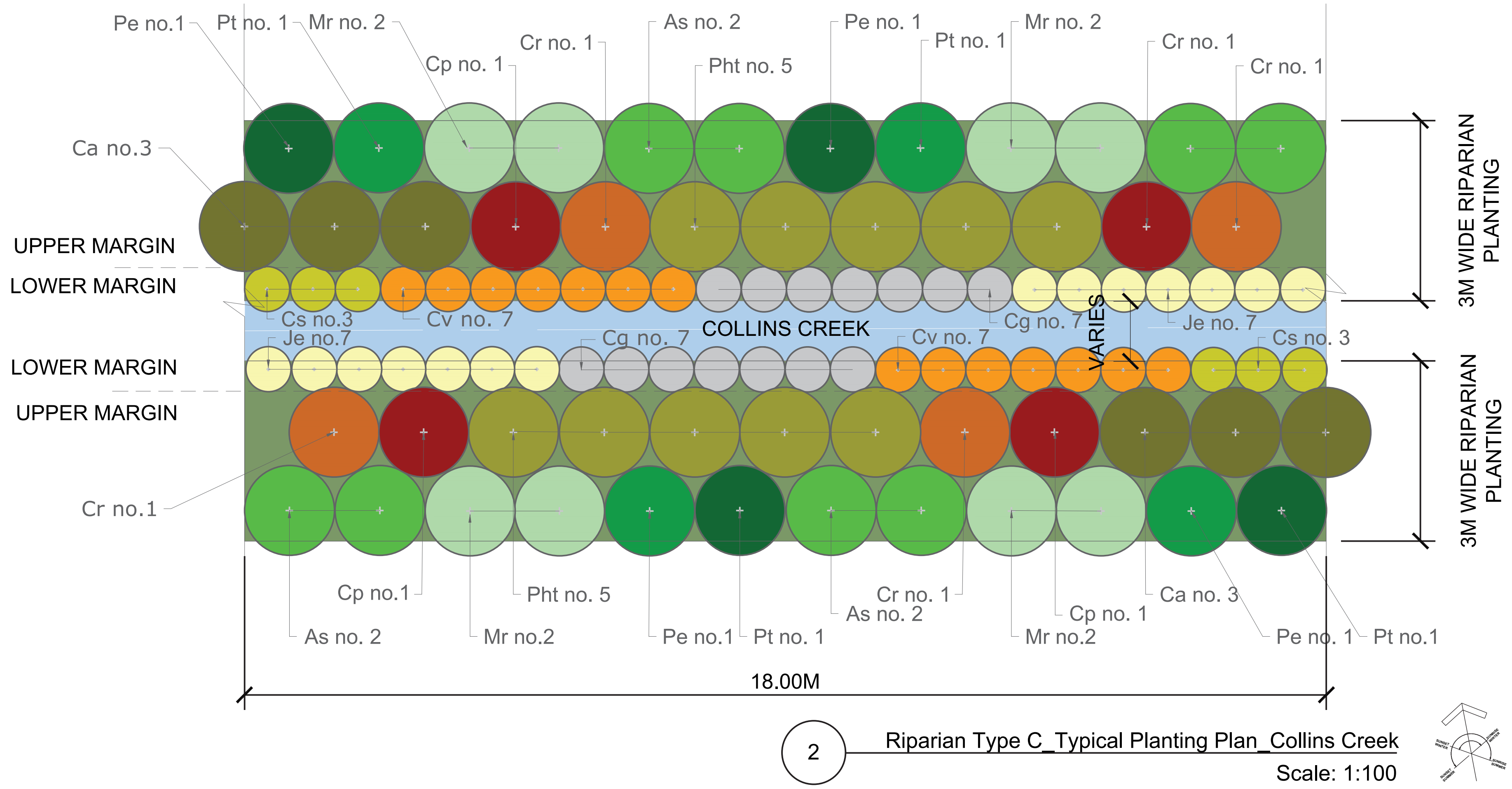
Riparian Planting Type B - Along Collins Creek northern side (3m wide)

Existing Riparian Planting

Mining Disturbance Area

Collins Creek

Note: The planting plan is illustrative of an 18m section. Along Planting Area C, it is intended that this section will be repeated along both sides of the banks of Collins Creek.



2 Riparian Type C_Typical Planting Plan_Collins Creek
Scale: 1:100

Tree and Planting Schedule

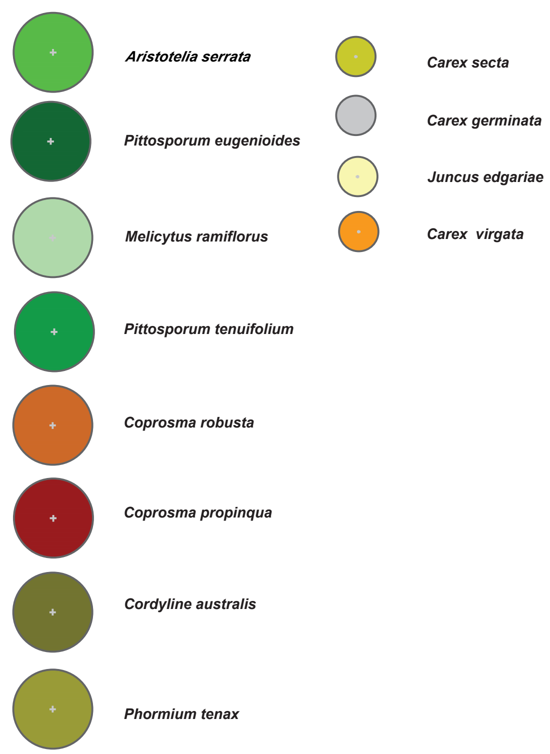
Collins Creek Riparian Planting C - LOWER MARGINS (DOUBLE ROWS)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length East Side (m)	Total Number East Side	Total Length West Side (m)	Total Number West Side
Carex germinata	Cg	1x1	0.75	LM	29.17	619.6	241	625.7	243
Carex secta	Cs	1.5x1.5	0.75	LM	12.50	619.6	103	625.7	104
Carex virgata	Cv	1x0.5	0.75	LM	29.17	619.6	241	625.7	243
Juncus edgariae	Je	1x1	0.75	LM	29.17	619.6	241	625.7	243
			Total:		100		826		834

Collins Creek Riparian Planting C- UPPER MARGINS (DOUBLE ROWS)

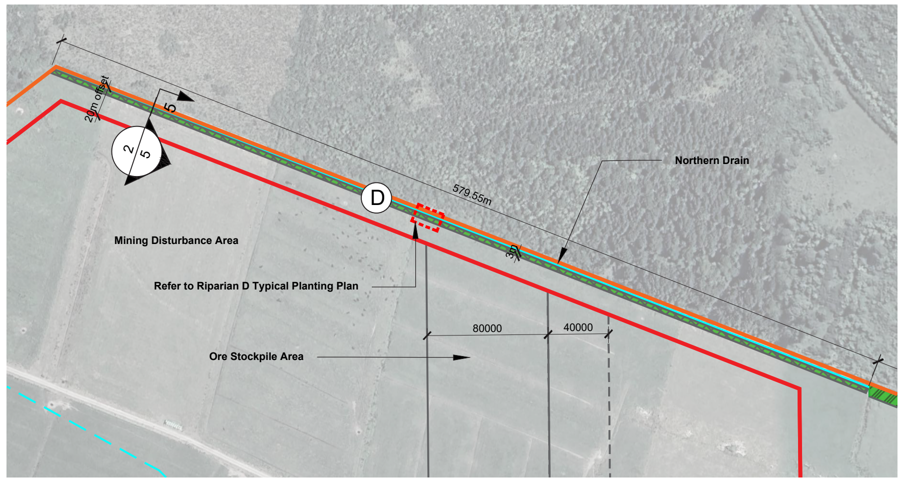
Plant species	Abbrev-iation	Mature Size h x w (m)	Plant Spacing (m)	Per Linear Metre	Mix %	Total Length East Side (m)	Total Number East Side	Total Length West Side (m)	Total Number West Side
Aristotelia serrata	As	6x3	1.5	LM	16.67	618.4	137	622.3	138
Coprosma propinqua	Cp	5x2.5	1.5	LM	8.33	618.4	69	622.3	69
Coprosma robusta	Cr	5x2.5	1.5	LM	8.33	618.4	69	622.3	69
Cordyline australis	Ca	6x2	1.5	LM	12.50	618.4	103	622.3	104
Melicytus ramiflorus	Mr	8x2.5	1.5	LM	16.67	618.4	137	622.3	138
Phormium tenax	Pht	3x2	1.5	LM	20.83	618.4	172	622.3	173
Pittosporum eugenioides	Pe	6x3	1.5	LM	8.33	618.4	69	622.3	69
Pittosporum tenuifolium	Pt	6x3	1.5	LM	8.33	618.4	69	622.3	69
			Total:		100		824		830

PLANTING LEGEND



BARRYTOWN MINERAL SANDS MINE	05.06 Riparian Type C_Collins Creek_ Typical Planting Plan	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

RIPARIAN TYPE D NORTHERN DRAIN



1 Key Plan
Scale: 1:5000

LEGEND

- Riparian Planting Type D - Planting along Northern Drain (3m wide) southern side
- North- Eastern Boundary Planting Screen (8m wide)
- Mining Disturbance Area
- Northern Drain
- Application Site

Tree and Planting Schedule

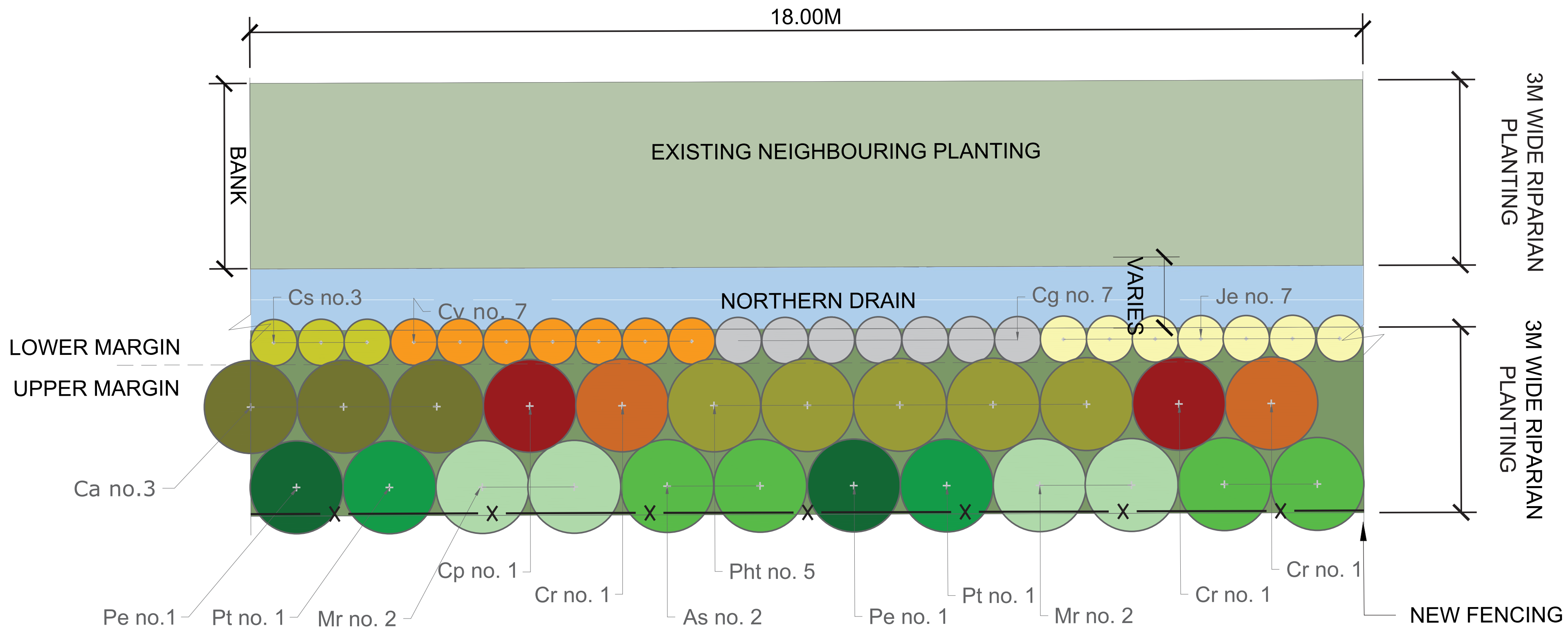
NORTHERN DRAIN - D - LOWER MARGIN (SINGLE ROW)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length South Side (m)	Total Number South Side
Carex germinata	Cg	1x1	0.75	LM	29.17	582.5	227
Carex secta	Cs	1.5x1.5	0.75	LM	12.50	582.5	97
Carex virgata	Cv	1x0.5	0.75	LM	29.17	582.5	227
Juncus edgariae	Je	1x1	0.75	LM	29.17	582.5	227
			Total:		100		777

NORTHERN DRAIN - D - UPPER MARGIN (DOUBLE ROWS)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length South Side (m)	Total Number South Side
Aristotelia serrata	As	6x3	1.5	LM	16.67	582.5	129
Coprosma propinqua	Cp	5x2.5	1.5	LM	8.33	582.5	65
Coprosma robusta	Cr	5x2.5	1.5	LM	8.33	582.5	65
Cordyline australis	Ca	6x2	1.5	LM	12.50	582.5	97
Melicytus ramiflorus	Mr	8x2.5	1.5	LM	16.67	582.5	129
Phormium tenax	Pht	3x2	1.5	LM	20.83	582.5	162
Pittosporum eugenioides	Pe	6x3	1.5	LM	8.33	582.5	65
Pittosporum tenuifolium	Pt	6x3	1.5	LM	8.33	582.5	65
			Total:		100		777

Riparian Type D: Northern Drain	
Activity	Planting and fencing the northern drain.
Location	Planting will run parallel with the northern boundary until the northern drain feeds into Rusty's Lagoon.
Details	3m of planting will occur along the southern side of the northern drain. Fencing will be located on the outer edge.
Desired Outcome	Planting will support stream health, encourage biodiversity, assist to rehabilitate natural character, and ensure the site meets statutory obligations.
Timeframe	Refer to Staging Plan.

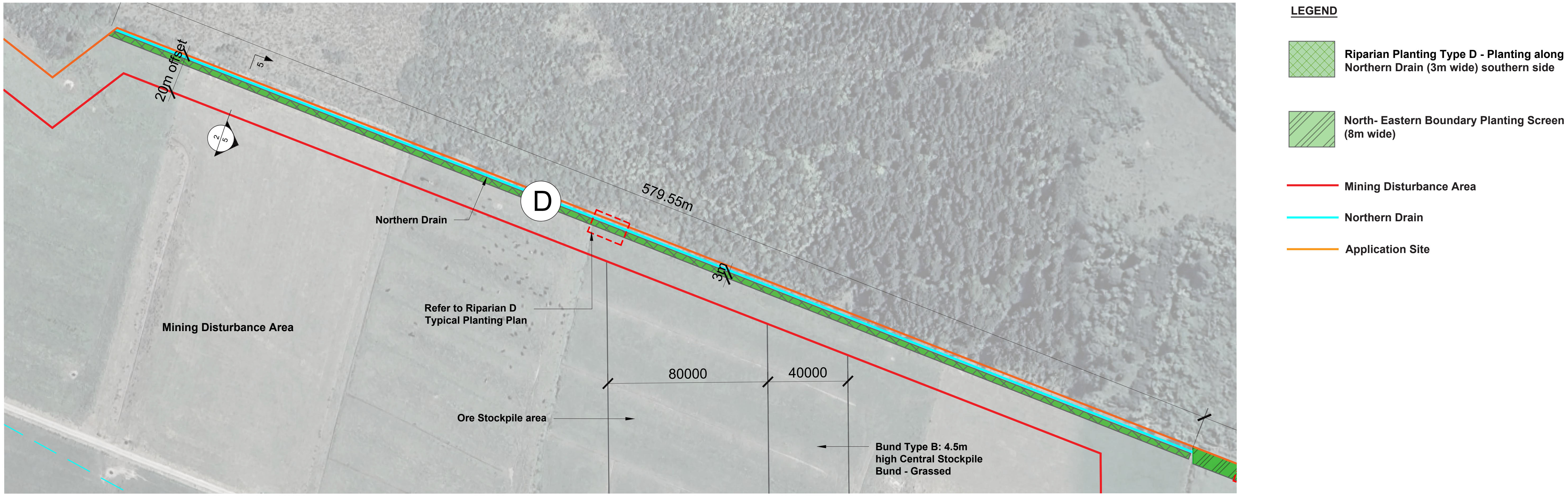
PLANTING LEGEND

- ***Aristotelia serrata***
- ***Pittosporum eugenioides***
- ***Melicytus ramiflorus***
- ***Pittosporum tenuifolium***
- ***Coprosma robusta***
- ***Coprosma propinqua***
- ***Cordyline australis***
- ***Phormium tenax***
- ***Carex secta***
- ***Carex germinata***
- ***Juncus edgariae***
- ***Carex virgata***

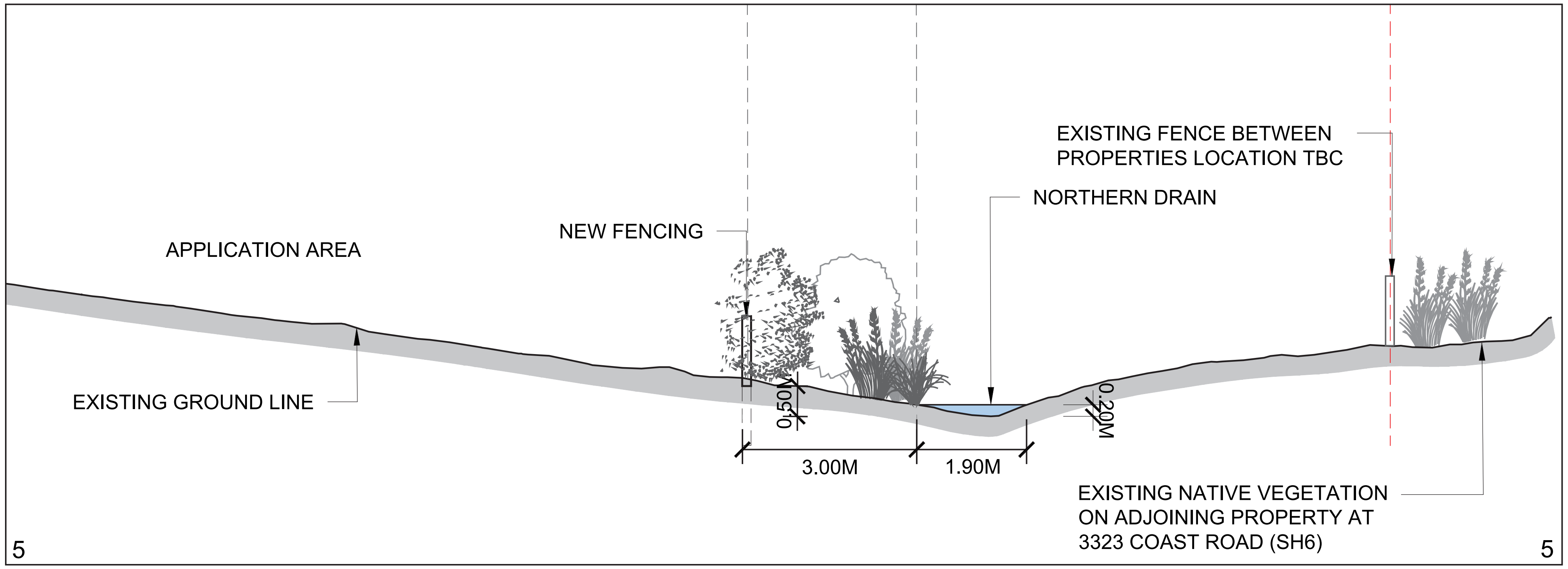


2 Section 5-5_Riparian Type D_Typical Planting Plan_ Northern Drain
Scale: 1:100

Note: The planting plan is illustrative of an 18m section. Within Planting Area D, it is intended that this section will be repeated along the southern side of the Northern Drain.



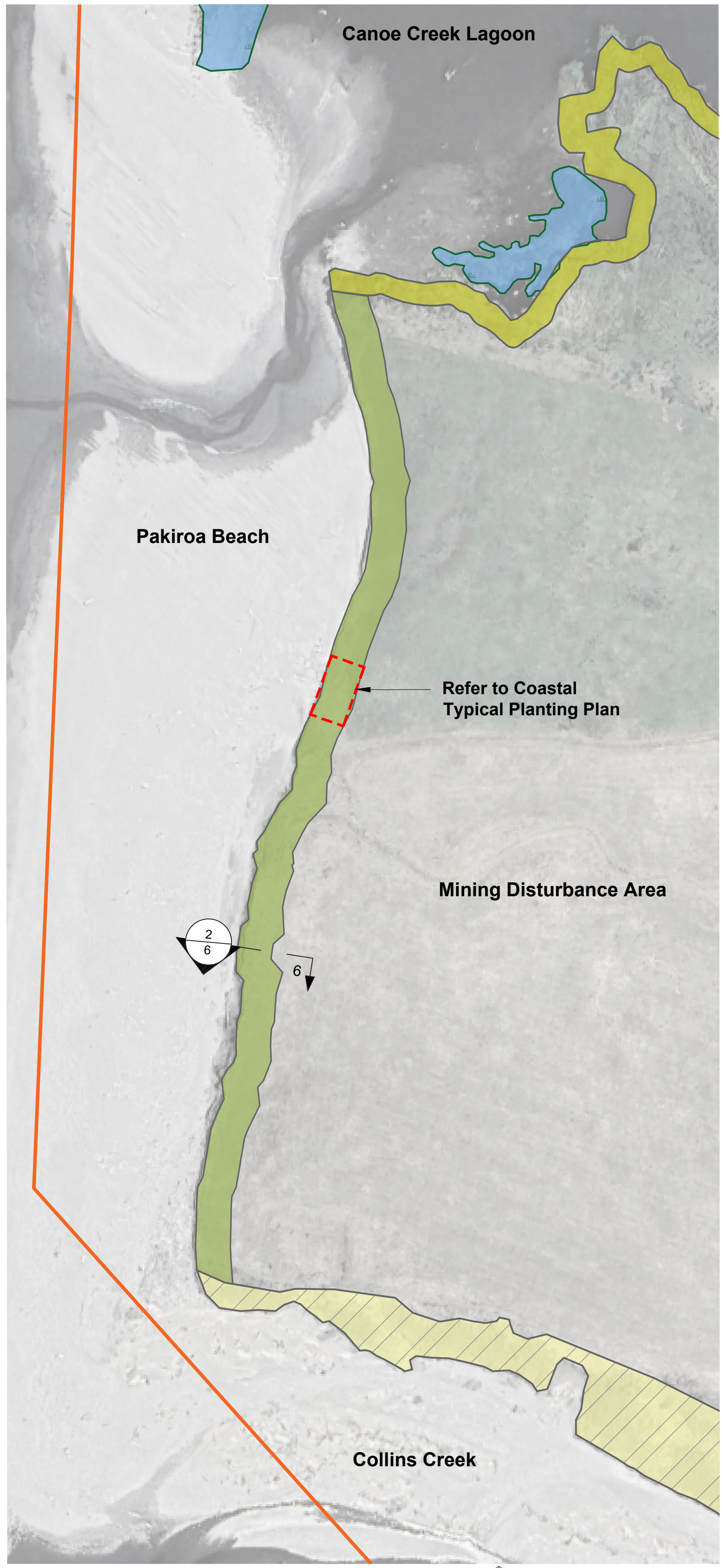
1 Planting Key Plan
Scale: 1:2000



2 Section 5-5_Riparian Type D Planting Plan_Northern Drain Typical
Scale: 1:100

BARRYTOWN MINERAL SANDS MINE	06.02 Riparian Type D_Typical Cross Section	PROJECT NUMBER 2003	REVISION DRAFT	SCALE AS SHOWN	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

COASTAL MITIGATION



1 Planting Sheet Arrangement
Scale: 1:2000

LEGEND

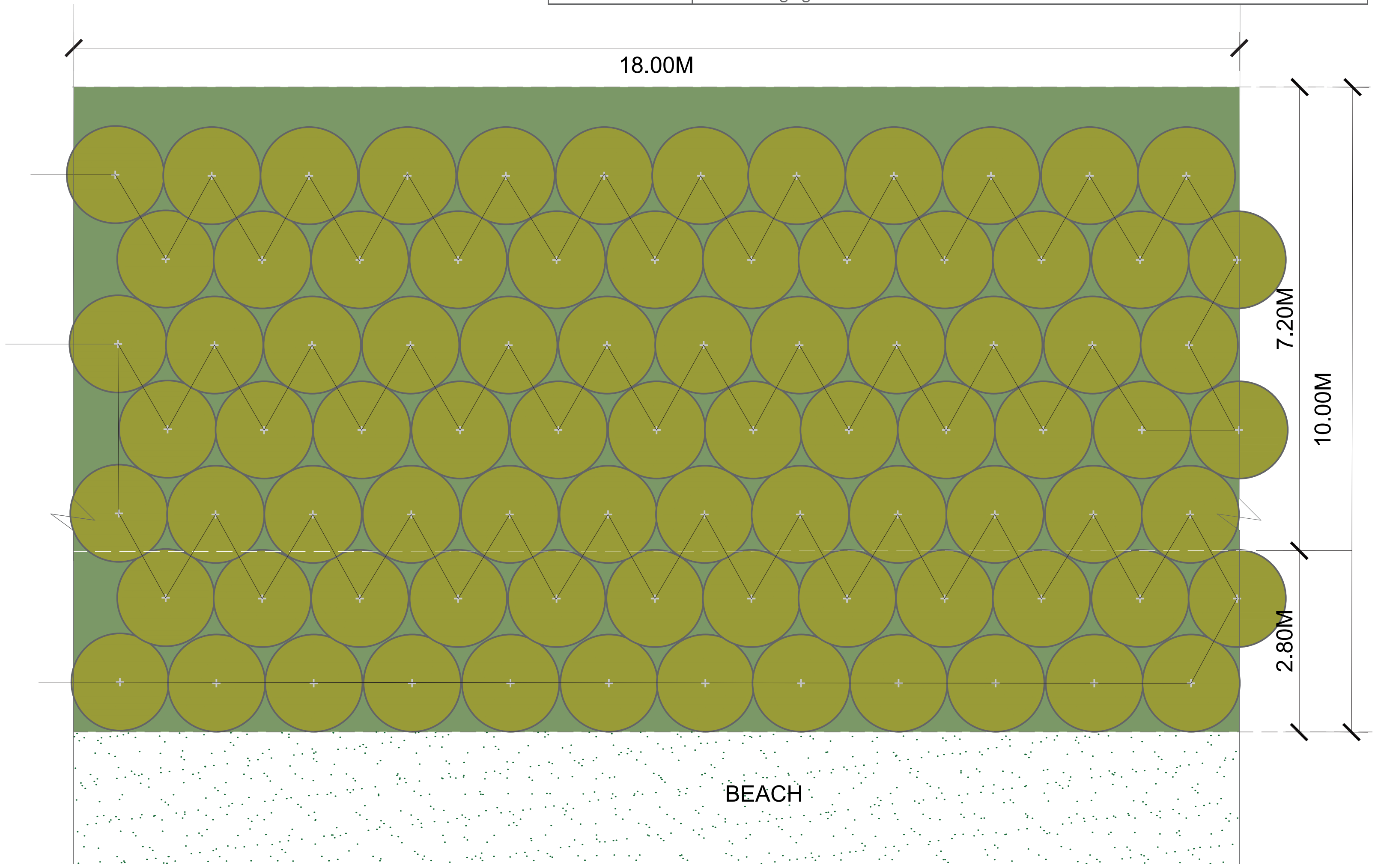
- Wetland Mitigation Planting (6m wide)
- Coastal Mitigation Planting (10m wide)
- Existing Wetland Planting
- Existing Riparian Planting
- Application Site
- *Phormium tenax*

Note: The planting plan is illustrative of an 18m section. Within The Coastal Planting Area, it is intended that this section will be repeated along the entire length.

Tree and Planting Schedule

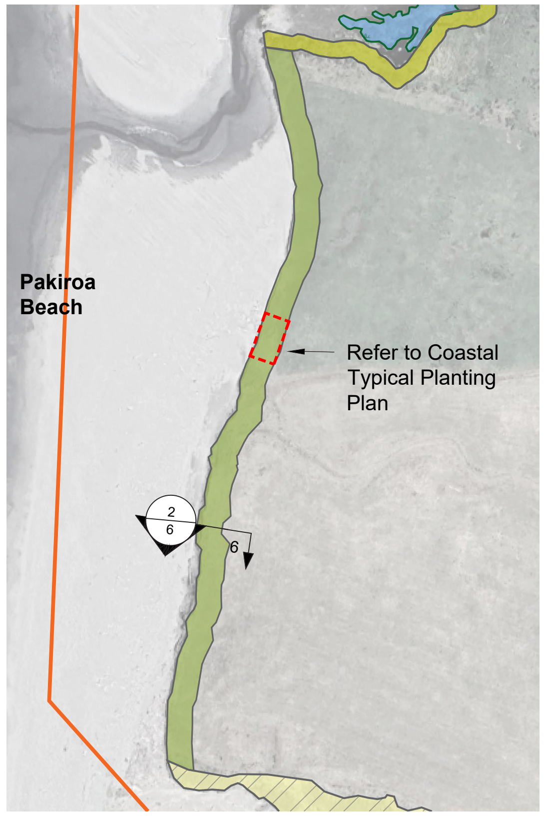
Coastal Planting (7 ROWS)							
Plant species	**Abbrev-iation**	**Mature Size h x w (m)**	**Spacing (m)**	**Per Linear Metre**	**Mix %**	**Total Length (m)**	**Total Number**
Phormium tenax	Pht	3x2	1.5	LM	100.00	298.9	1395
			Total:		100		1395

Coastal Planting	
Activity	Planting along the south-west coastline.
Location	The south-west coastal edge where pasture gives way to foreshore.
Details	10m wide planting in dense rows using flax (or similar species).
Desired Outcome	New planting along both the wetland and coastal edge will provide the opportunity for restoration and rehabilitation of natural character (as per NZCPS Policy 14). It will contribute by: (a)Creating and enhancing indigenous habitats and ecosystems of the wetlands, using local genetic stock where practicable. (b)Encouraging natural regeneration of indigenous species by fencing off the planting areas and having effective weed and animal pest management. (c)Restoring the intertidal margin by having an increased width of buffer planting. (d)In the long-term encouraging the Clean Water Facility wetland extension to merge with the existing landscape and much larger Canoe Creek Lagoon. **Planting will be reviewed and adjusted on site as necessary at the time of planting. This will respond to the changing coastal environment to ensure optimal plant location.**
Timeframe	Refer to Staging Plan.



2 Coastal Typical Planting Plan
Scale: 1:100

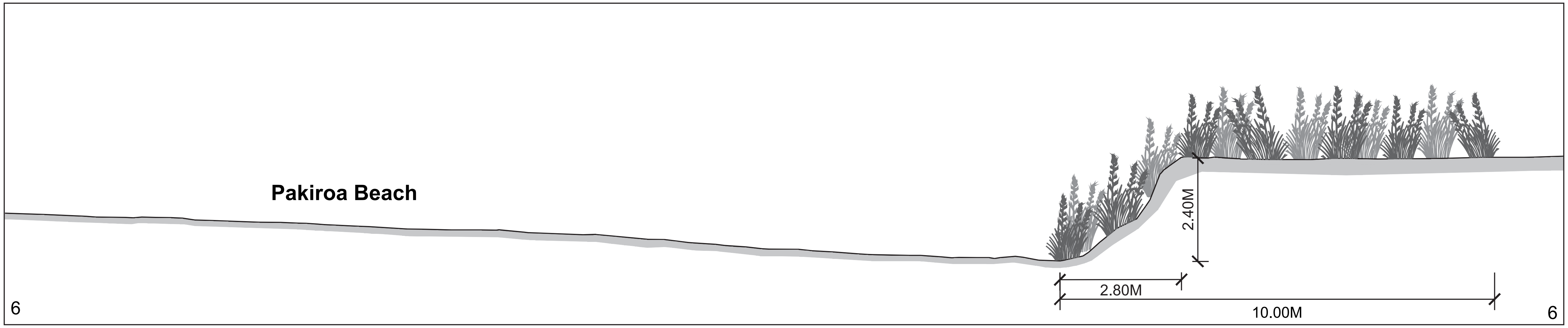
BARRYTOWN MINERAL SANDS MINE	07.01 Coastal_Typical Planting Plan	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 15/12/2023



LEGEND

- Wetland Mitigation Planting (6m wide)
- Coastal Mitigation Planting (10m wide)
- Existing Wetland Planting
- Existing Riparian Planting
- Application Site
- *Phormium tenax*

1 Key Plan
Scale: 1:3000



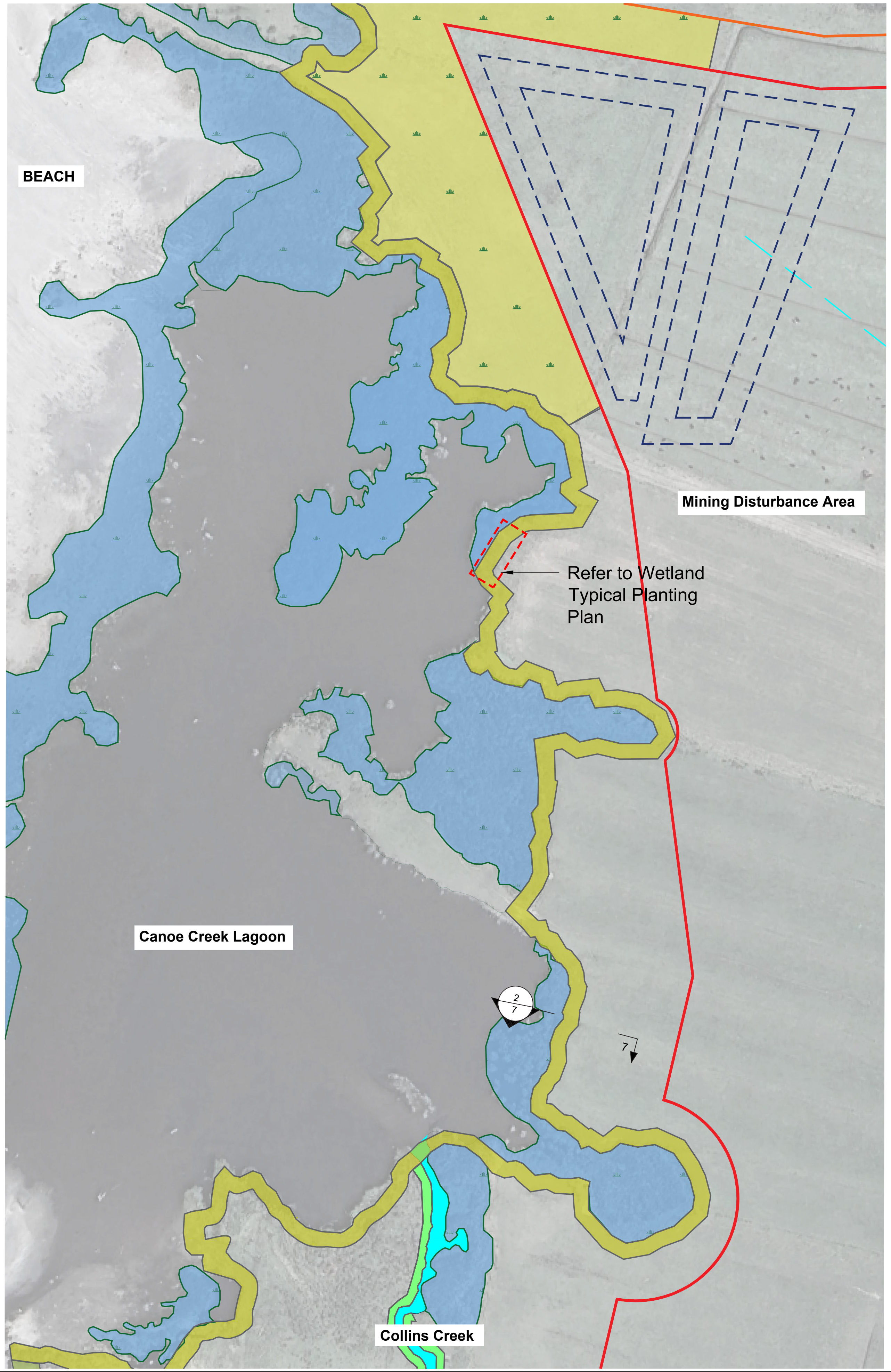
2 Section 6-6_Coastal Planting PlanTypical
Scale: 1:100

WETLAND MITIGATION

LEGEND

- Clean Water Facility (CWF) Planting
- Wetland Mitigation Planting (6m wide)
- Existing Wetland Planting
- Mining Disturbance Area
- Application Site
- CWF to be planted on identified edges. To be used for water management during mining, and converted to wetlands at project completion.

Wetland Planting	
Activity	Planting along the edge of coastal lagoon and the north-western edge of the Clean Water
Location	The perimeter of the Canoe Creek Lagoon and the edge of the Clean Water Facility, between
Details	6m wide planting adjacent to the wetland.
Desired Outcome	New planting along both the wetland and coastal edge will provide the opportunity for restoration and rehabilitation of natural character (as per NZCPS Policy 14). It will contribute by: (a)Creating and enhancing indigenous habitats and ecosystems of the wetlands, using local genetic stock where practicable. (b)Encouraging natural regeneration of indigenous species by fencing off the planting areas and having effective weed and animal pest management. (c)Restoring the intertidal margin by having an increased width of buffer planting. (d)In the long-term encouraging the Clean Water Facility wetland extension to merge with the existing landscape and much larger Canoe Creek Lagoon. **Planting will be reviewed and adjusted on site as necessary at the time of planting. This will respond to the changing coastal environment to ensure optimal plant location.**
Timeframe	Refer to Staging Plan.

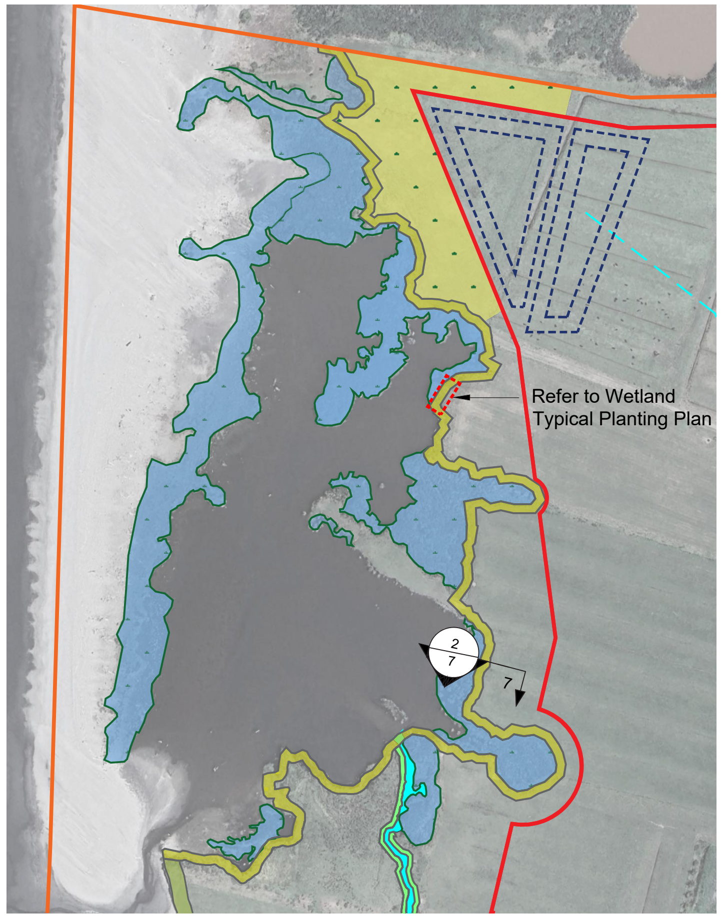


1 Planting Sheet Arrangement
Scale: 1:2000

BARRYTOWN MINERAL SANDS MINE

08.01 Wetland Mitigation Planting Plan

PROJECT NUMBER	REVISION	SCALE	DESIGN: GHLA,WMS,HP	DATE
2003	DRAFT	1:2000@A3 1:1000@A1	DRAWN: EH,EM APPVD: NC	8/12/2023



LEGEND

- Clean Water Facility (CWF) Planting
- Wetland Mitigation Planting (6m wide)
- Existing Wetland Planting
- Mining Disturbance Area
- Application Site
- CWF to be planted on identified edges. To be used for water management during mining, and converted to wetlands at project completion.

1 Zoom Plan
Scale: 1:5000

Tree and Planting Schedule

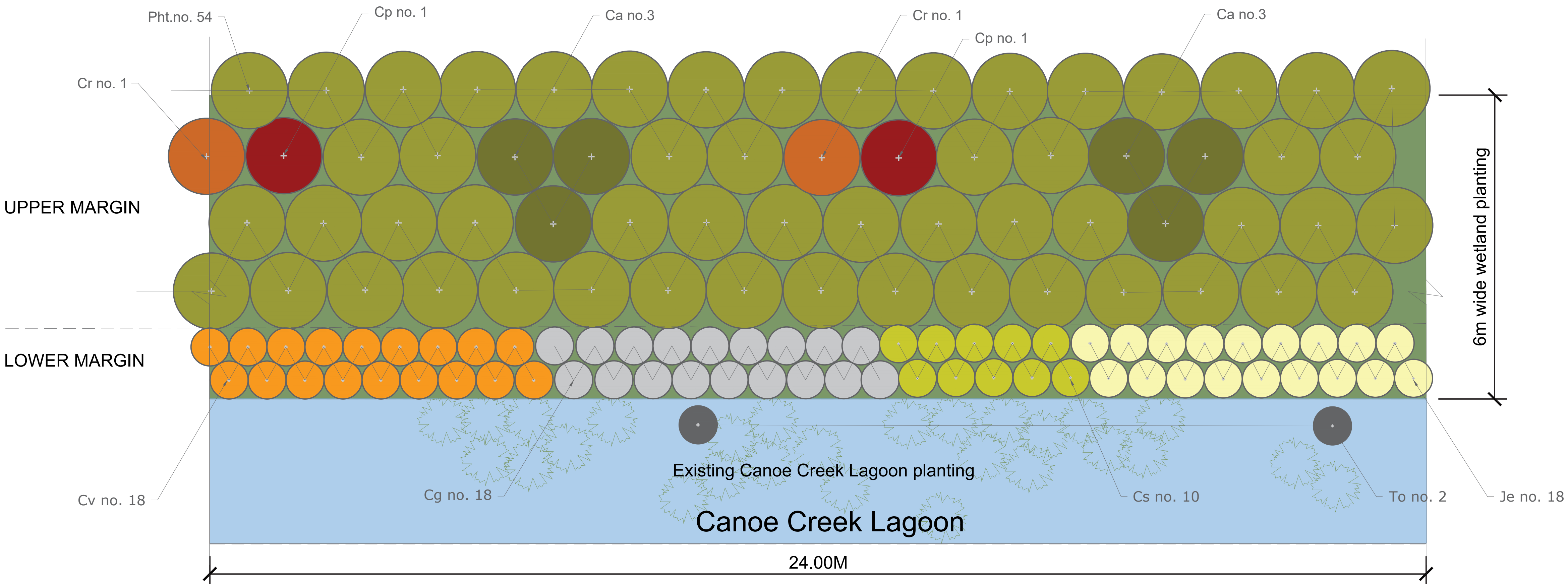
Wetland Planting - LOWER MARGIN (DOUBLE ROW)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length (m)	Total Number
Carex germinata	Cg	1x1	0.75	LM	28.13	1249.8	938
Carex secta	Cs	1.5x1.5	0.75	LM	15.15	1249.8	505
Carex virgata	Cv	1x0.5	0.75	LM	28.13	1249.8	938
Juncus edgariae	Je	1x1	0.75	LM	28.13	1249.8	938
Typha orientalis	To	2.3x1.5	0.75	LM	3.13	1249.8	104
			Total:		103		3422

Wetland Planting - UPPER MARGIN (4 ROWS)							
Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Per Linear Metre	Mix %	Total Length (m)	Total Number
Coprosma propinqua	Cp	5x2.5	1.5	LM	3.10	1249.8	103
Coprosma robusta	Cr	5x2.5	1.5	LM	3.10	1249.8	103
Cordyline australis	Ca	6x2	1.5	LM	9.38	1249.8	313
Phormium tenax	Pht	3x2	1.5	LM	84.38	1249.8	2812
			Total:		100		3331

Note: The planting plan is illustrative of a 24m section. It is intended that this will be repeated along the full length of the wetland.

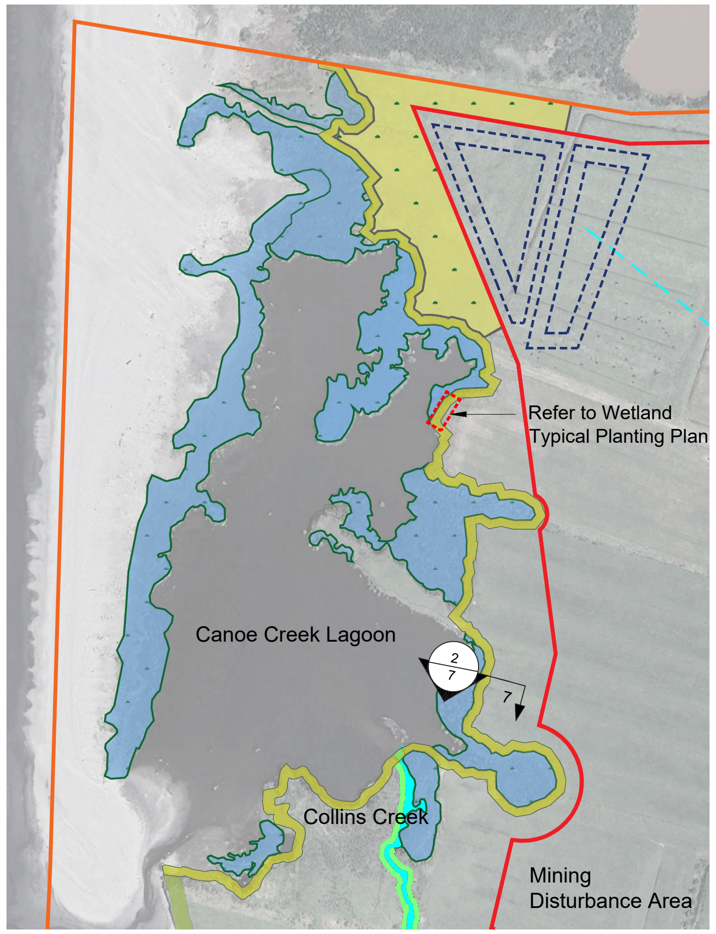
PLANTING LEGEND

- *Coprosma robusta*
- *Coprosma propinqua*
- *Cordyline australis*
- *Phormium tenax*
- *Carex secta*
- *Carex germinata*
- *Juncus edgariae*
- *Typha orientalis*
- *Carex virgata*
- Existing lagoon planting



2 Wetland Typical Planting Plan
Scale: 1:100

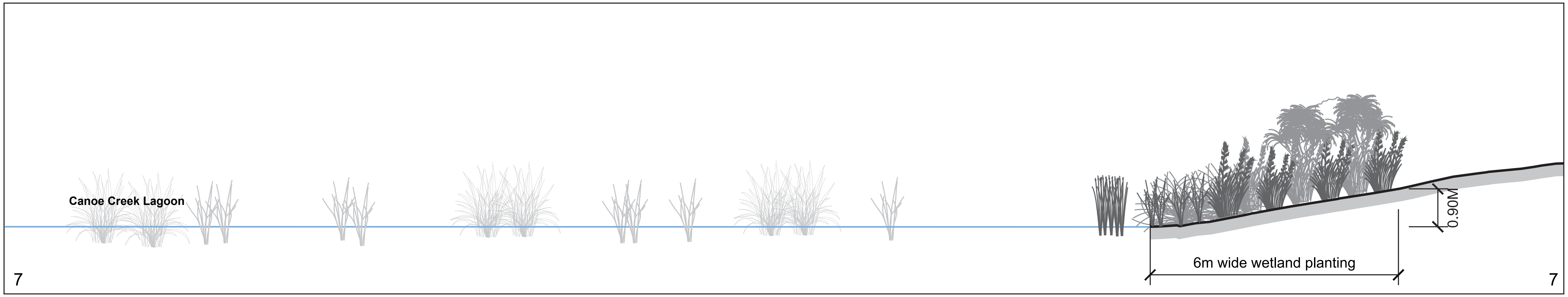
BARRYTOWN MINERAL SANDS MINE	08.02 Wetland _Typical Planting Plan	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN @A3	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023



1 Key Plan
Scale: 1:5000

LEGEND

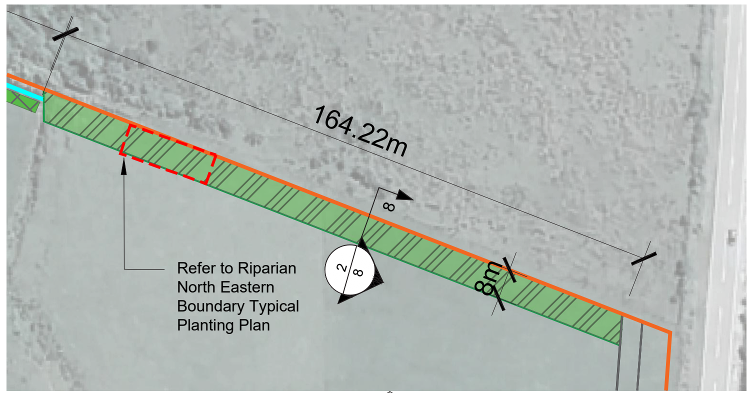
- Clean Water Facility (CWF) Planting
- Wetland Mitigation Planting (6m wide)
- Existing Wetland Planting
- Mining Disturbance Area
- Application Site
- CWF to be planted on identified edges. To be used for water management during mining, and converted to wetlands at project completion.



2 Section 7-7_Wetland Planting Plan_Typical
Scale: 1:100

BARRYTOWN MINERAL SANDS MINE	08.03 Wetland_Typical Planting Plan	PROJECT NUMBER	REVISION	SCALE	DESIGN: GHLA,WMS,HP	DATE
		2003	B	AS SHOWN@A3	DRAWN: EH,EM APPVD: NC	15/12/2023

NORTH EASTERN BOUNDARY



1 Key Plan
Scale: 1:2000

LEGEND

North- Eastern Boundary Planting Screen (8m wide)

Mining Disturbance Area

Northern Drain

Application Site

PLANTING LEGEND

Aristotelia serrata

Pittosporum eugenioides

Melicytus ramiflorus

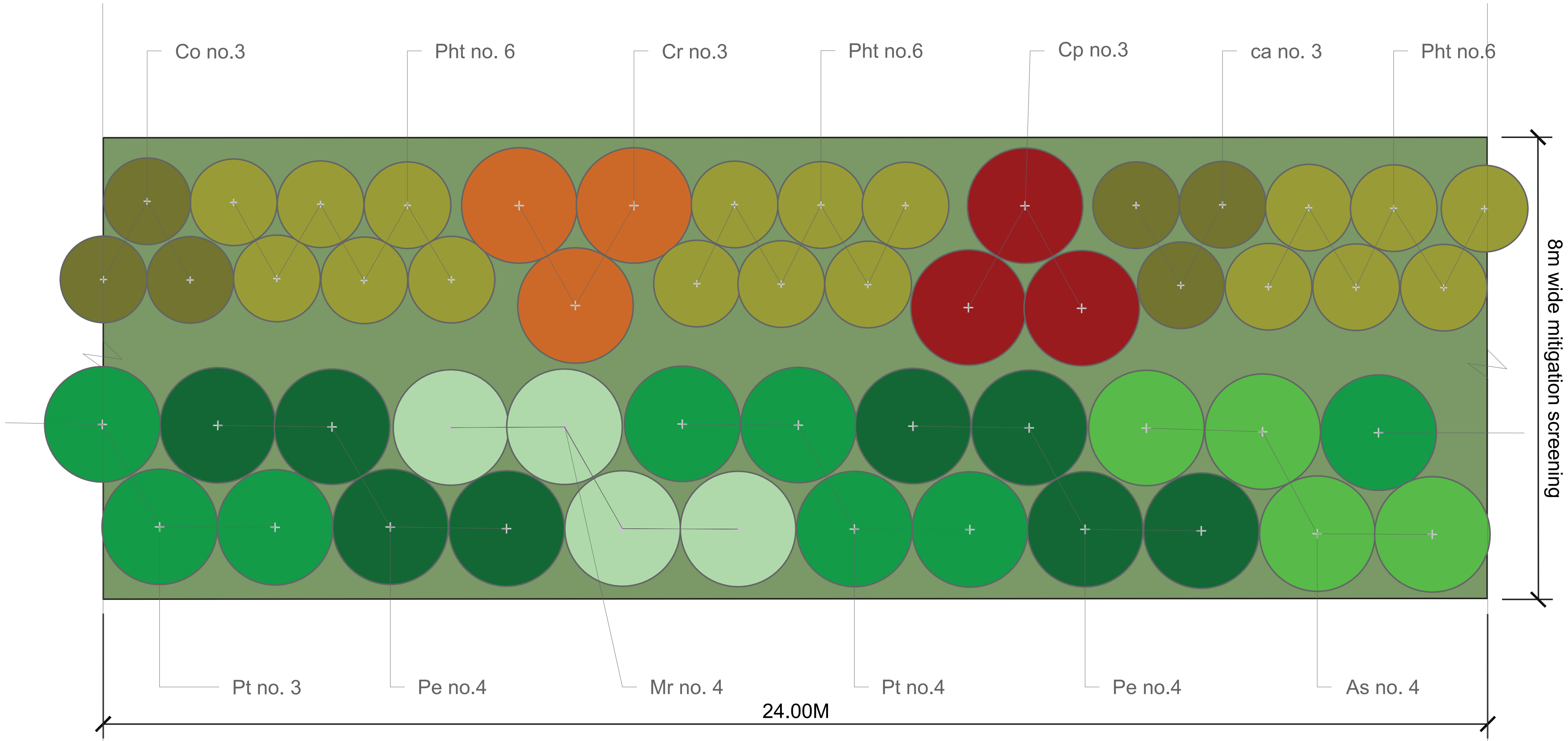
Pittosporum tenuifolium

Coprosma robusta

Coprosma propinqua

Cordyline australis

Phormium tenax

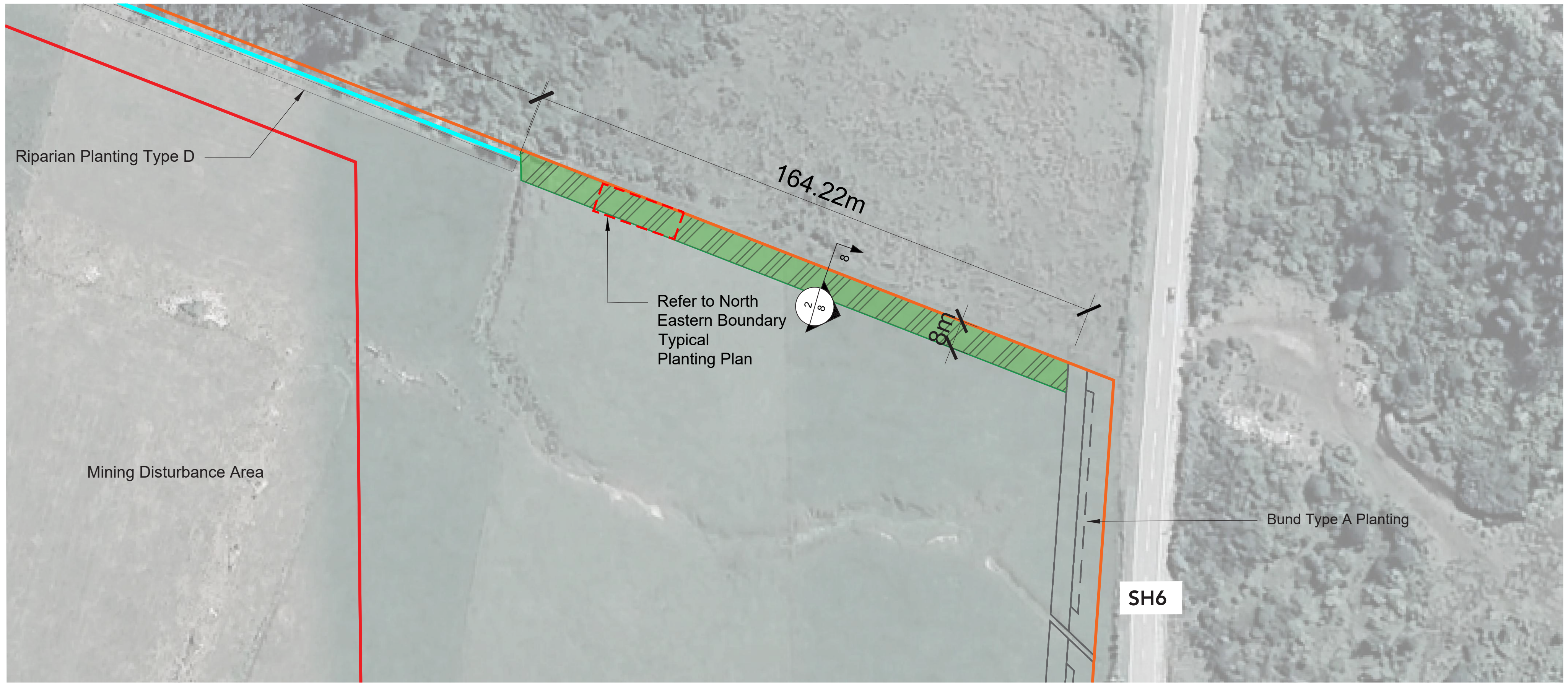


2 North-Eastern Boundary Typical Planting Plan
Scale: 1:100

Note: The planting plan is illustrative of an 24m section. Within The North Eastern Boundary Planting Area, it is intended that this section will be repeated along the entire length.

Tree and Planting Schedule

North Eastern Boundary Planting (4 ROWS)							
Plant species	**Abbrev-iation**	**Mature Size h x w (m)**	**Spacing (m)**	**Per Linear Metre**	**Mix %**	**Total Length (m)**	**Total Number**
Aristotelia serrata	As	6x3	2	LM	7.40	163.46	24
Coprosma propinqua	Cp	5x2.5	2	LM	5.55	163.46	18
Coprosma robusta	Cr	5x2.5	2	LM	5.55	163.46	18
Cordyline australis	Ca	6x2	1.5	LM	11.11	163.46	48
Melicytus ramiflorus	Mr	8x2.5	2	LM	7.40	163.46	24
Phormium tenax	Pht	3x2	1.5	LM	33.33	163.46	145
Pittosporum eugenioides	Pe	6x3	2	LM	14.80	163.46	48
Pittosporum tenuifolium	Pt	6x3	2	LM	14.80	163.46	48
			Total:		100		375

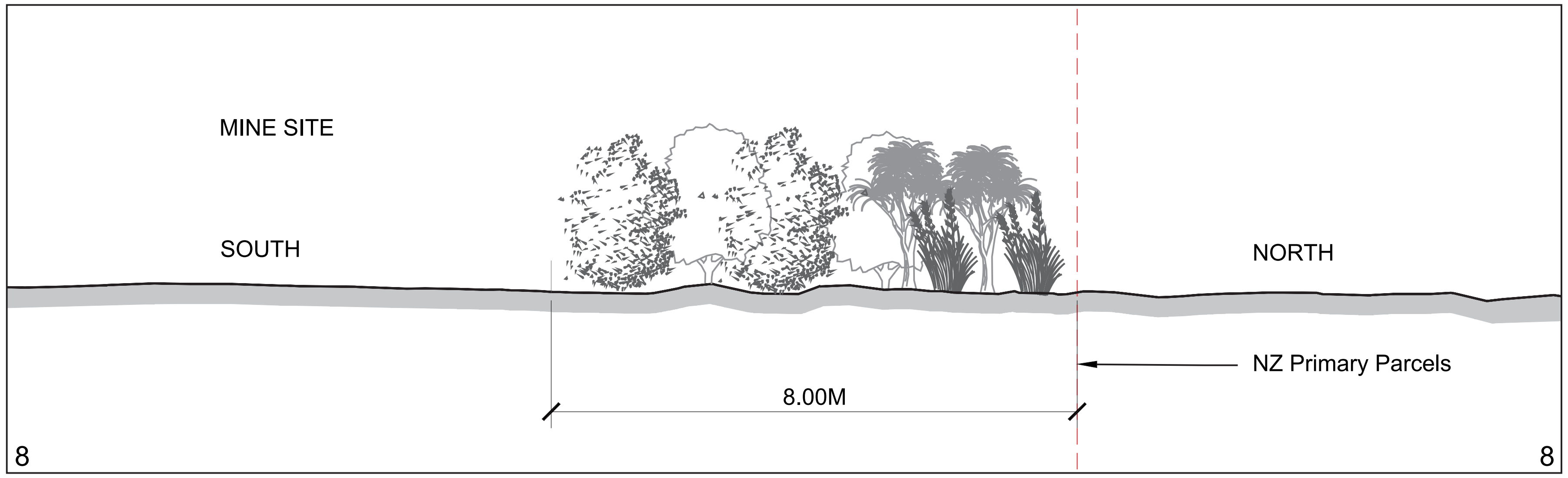


LEGEND

- North- Eastern Boundary Planting Screen (8m wide)
- Mining Disturbance Area
- Northern Drain
- Application Site

1 Planting Sheet Arrangement
Scale: 1:1000

Riparian Type D: Northern Drain	
Activity	Planting and fencing the northern drain.
Location	Planting will run parallel with the northern boundary until the northern drain feeds into Rusty's Lagoon.
Details	3m of planting will occur along the southern side of the northern drain. Fencing will be located on the outer edge.
Desired Outcome	Planting will support stream health, encourage biodiversity, and ensure the site meets statutory obligations.
Timeframe	Refer to Staging Plan.



2 Section 8-8_North-Eastern Boundary Planting Plan_Typical
Scale: 1:100

BARRYTOWN MINERAL SANDS MINE	09.02 North Eastern Boundary_ Typical Cross Section	PROJECT NUMBER 2003	REVISION B	SCALE AS SHOWN @A3	DESIGN: GHLA,WMS,HP DRAWN: EH,EM APPVD: NC	DATE 19/12/2023

PLANT SCHEDULES - CLEAN WATER FACILITY, FUTURE WETLAND AND ENRICHMENT PLANTING

Future Wetland Lower Margin Edge Planting (Pond 4)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Density plants/m2	Mix %	Bed Area (m2)	Total Number
Carex germinata	Cg	1x1	0.75	2.1	**28**	300	172
Carex secta	Cs	1.5x1.5	0.75	2.1	**28**	300	172
Carex virgata	Cv	1x0.5	0.75	2.1	**28**	300	172
Juncus edgariae	Je	1x1	0.75	2.1	**16**	300	99
			Total:		100		443

Future Wetland Upper Margin Edge Planting (Pond 4)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Density plants/m2	Mix %	Bed Area (m2)	Total Number
Coprosma propinqua	Cp	5x2.5	1.5	0.5	**10**	700	36
Coprosma robusta	Cr	5x2.5	1.5	0.5	**10**	700	36
Cordyline australis	Ca	6x2	1.5	0.5	**10**	700	36
Phormium tenax	Pht	3x2	1.5	0.5	**70**	700	251
			Total:		100		359

Future Wetland Shallow Water (Pond 4)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Density plants/m2	Mix %	Bed Area (m2)	Total Number
Typha orientalis	To	2.3x1.5	0.75	2.1	**1.5**	**5000**	154
			Total:		100		154

Enrichment Planting (Riparian and Wetland areas)

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Density plants/m2	Mix %	2.5% of plant total	Total Number
Dacrycarpus dacrydioides	Dd	5x50	1.5	0.5	**40**	**484**	194
Laurelia novae-zelandiae	Ln	4x20	1.5	0.5	**20**	**484**	97
Metrosideros robusta	Mer	6x20	1.5	0.5	**40**	**484**	194
			Total:		100.0		484

Clean Water Facility Edge Planting

Plant species	Abbrev-iation	Mature Size h x w (m)	Spacing (m)	Density plants/m2	Mix %	Bed Area (m2)	Total Number
Coprosma propinqua	Cp	5x2.5	1.5	0.5	**20**	**9244**	949
Coprosma robusta	Cr	5x2.5	1.5	0.5	**15**	**9244**	712
Cordyline australis	Ca	6x2	1.5	0.5	**10**	**9244**	474
Phormium tenax	Pht	3x2	1.5	0.5	**55**	**9244**	2609
			Total:		100.00		4744

OVERALL PLANT SCHEDULES

Entire Site Planting														
Plant species	Abbreviation	Bund A Eastern Bund	Bund B Stockpile Bund	Riparian A Collins Creek	Riparian B Collins Creek	Riparian C Collins Creek	Riparian D North Eastern Drain	Coastal Planting	Wetland Planting (6m wide)	North Eastern Boundary	Clean Water Fill Edge	Future Wetland Area	Enrichment - Riparian and Wetand	Total Number of Each Species
Aristotelia serrata	As	50	62	141	141	275	129			24				822
Carex germinata	Cg			246	248	484	227		938			172		2315
Carex secta	Cs			105	106	207	97		505			172		1192
Carex virgata	Cv			246	248	484	227		938			172		2315
Coprosma propinqua	Cp	38		70	70	138	65		103	18	949	36		1487
Coprosma robusta	Cr	38		70	70	138	65		103	18	712	36		1250
Cordyline australis	Ca	75		105	106	207	97		313	48	474	36		1461
Dacrycarpus dacrydioides	Dd												194	194
Juncus edgariae	Je			246	248	484	227		938			99		2242
Laurelia novae-zelandiae	Ln												97	97
Melicytus ramiflorus	Mr	50	62	141	141	275	129			24				822
Metrosideros robusta	Mer												194	194
Phormium tenax	Pht	225		176	176	345	162	1395	2812	145	2609	251		8296
Pittosporum eugenioides	Pe	100	125	70	70	138	65			48				616
Pittosporum tenuifolium	Pt	100	125	70	70	138	65			48				616
Typha orientalis	To								104			154		258
	Total per planting area	676	374	1686	1694	3313	1555	1395	6754	373	4744	1128	485	
													Total:	24177

Plant species	Size	Total Number of Each Species
Aristotelia serrata	1m+	822
Carex germinata	1L	2315
Carex secta	1L	1192
Carex virgata	1L	2315
Coprosma propinqua	1L	1487
Coprosma robusta	1L	1250
Cordyline australis	1L	1461
Dacrycarpus dacrydioides	1L	194
Juncus edgariae	1L	2242
Laurelia novae-zelandiae	1L	97
Melicytus ramiflorus	1m+	822
Metrosideros robuster	1m+	194
Phormium tenax	1L	8296
Pittosporum eugenioides	1m+	616
Pittosporum tenuifolium	1m+	616
Typha orientalis	1L	258
Total:		24177

Schedule 6

Tai Poutini
RESOURCES

Planting Covenant Area

Produced for: TiGa
by Luke McNeish(TPRL) on 15/03/2024

0 50 100 m
1:3000 @ A3

Projection: WSG84 / NZTM2000
Background Imagery: Google Earth
Data Sources: LINZ, Client and/or TPRL Data

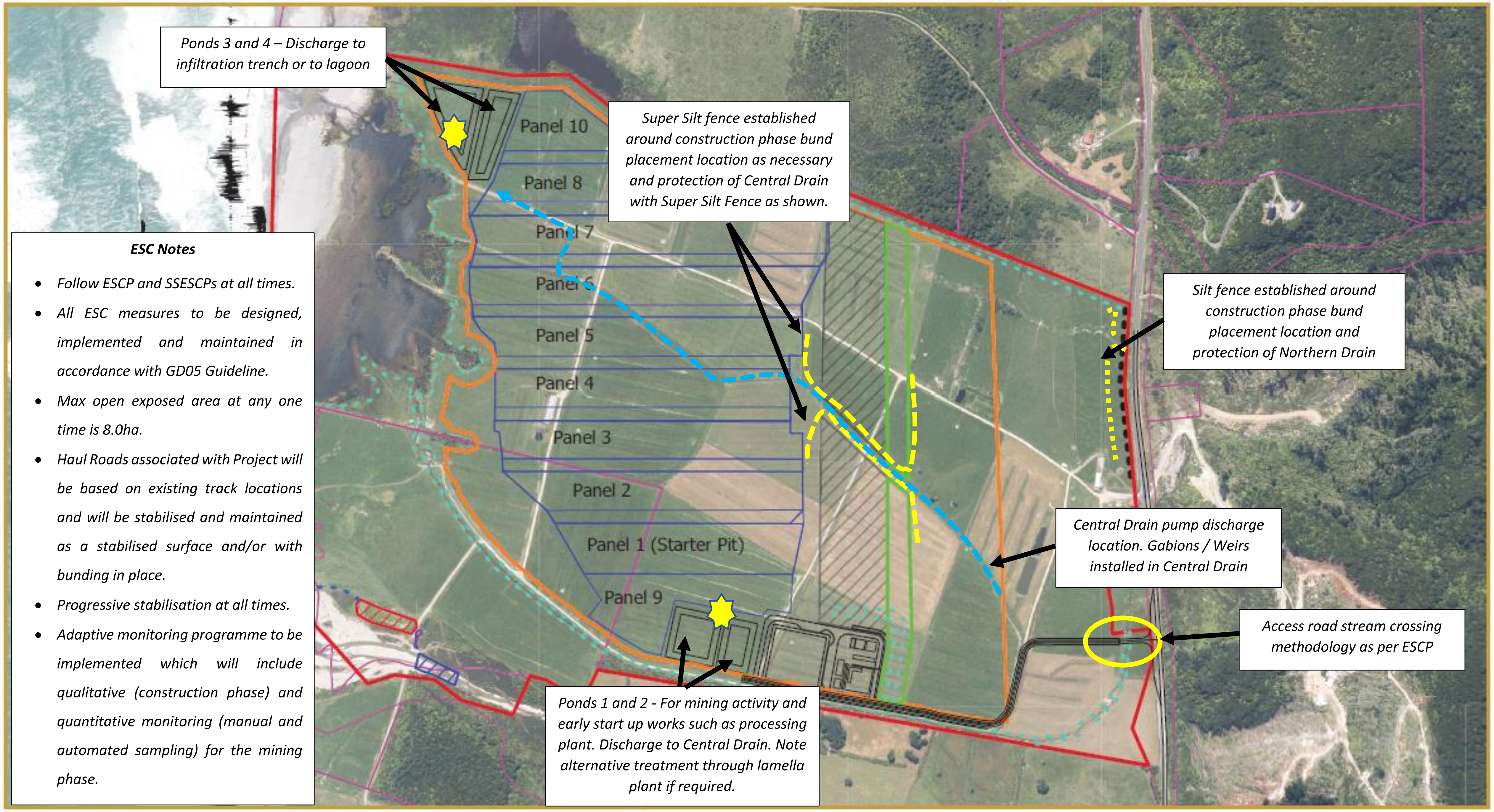
Legend:

- Clean Water Facilty Pre Mining Planting (0.81 Ha)
- Proposed Covenant Area (2.95 Ha)
- Mining Disturbance Area
- Wetland Extension Post Mining Planting (1.99Ha)
- Coastal Lagoon Edge Planting (0.15 Ha)

Note: Planting will be undertaken as outlined in the Glasson Huxtable Landscape Mitigation Planting Plan dated January 2024, and the Wetland and Riparian Planting Plan.

Schedule 7

Barrytown ESCP Overview Concept Plan



Tai Poutini RESOURCES

TiGa Consent Application
Amended Map

This map/plan has been produced by Tai Poutini Resources Ltd for the purpose of providing information as part of the agreed upon scope and services with the client. This graphic is solely for the client. Any use or reliance on any information within by a third party without prior approval by the client is at their own risk. At the time of production, all information is assumed accurate. Tai Poutini Resources Ltd holds no accountability for any liability or action arising from any incomplete or inaccurate information within this map/plan.

Produced for: TiGa
by Luke McNeish on 12/06/2023

0 125 250 375 m

1:8,000 @ A3

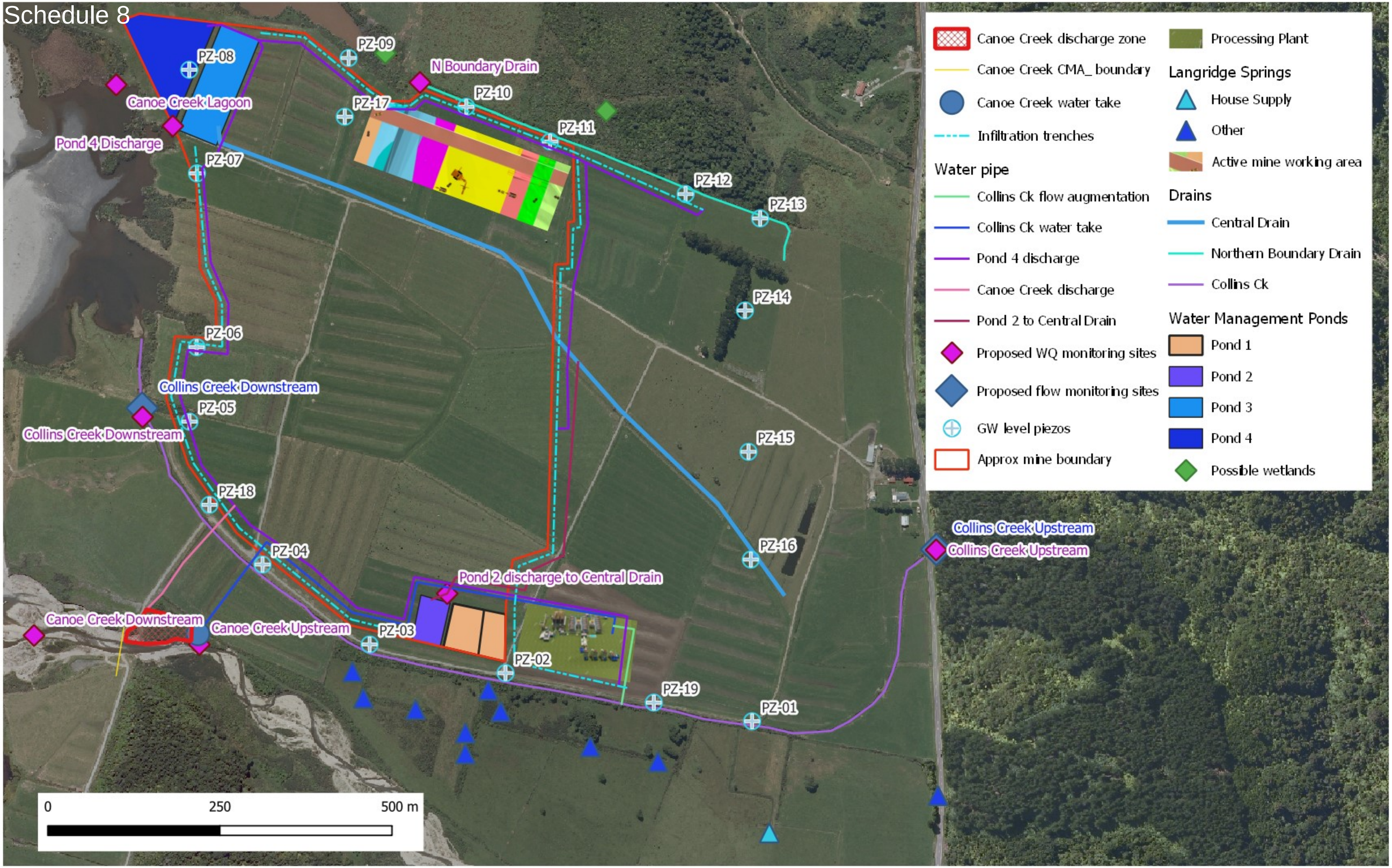
Projection: WSG84 / NZTM2000
Background Imagery: ESRI Satellite
Data Sources: LINZ, Client and or TPRL Data

Legend:

- Planting
- TiGa Application Area 21022023
- Bund
- Gallery Water Take
- Watertake Location
- Premining ore stockpile
- Mining Disturbance Area
- Mine Infrastructure
- Overflow Channel
- Water Infiltration Area
- Mining Strips
- Bund and Planting
- Property Boundaries
- Automated Sampling Locations

Note: Refer to Landscape Mitigation Plan for detailed Information on Bunds and Planting.

Schedule 8



KSL Kōmanawa Solutions Ltd

Project name:	**Barrytown Mineral Sands**
Date:	**Date: 05/03/2023**
Client:	**Tiga Minerals and Metals**