
BULLER PLATEAUX CONTINUATION PROJECT

PROPOSED INFRASTRUCTURE

ASSESSMENT OF ENVIRONMENTAL EFFECTS – LIGHTING

Prepared for

Bathurst Resources Limited

INDEPENDENT ELECTRICAL & ILLUMINATION ENGINEERS

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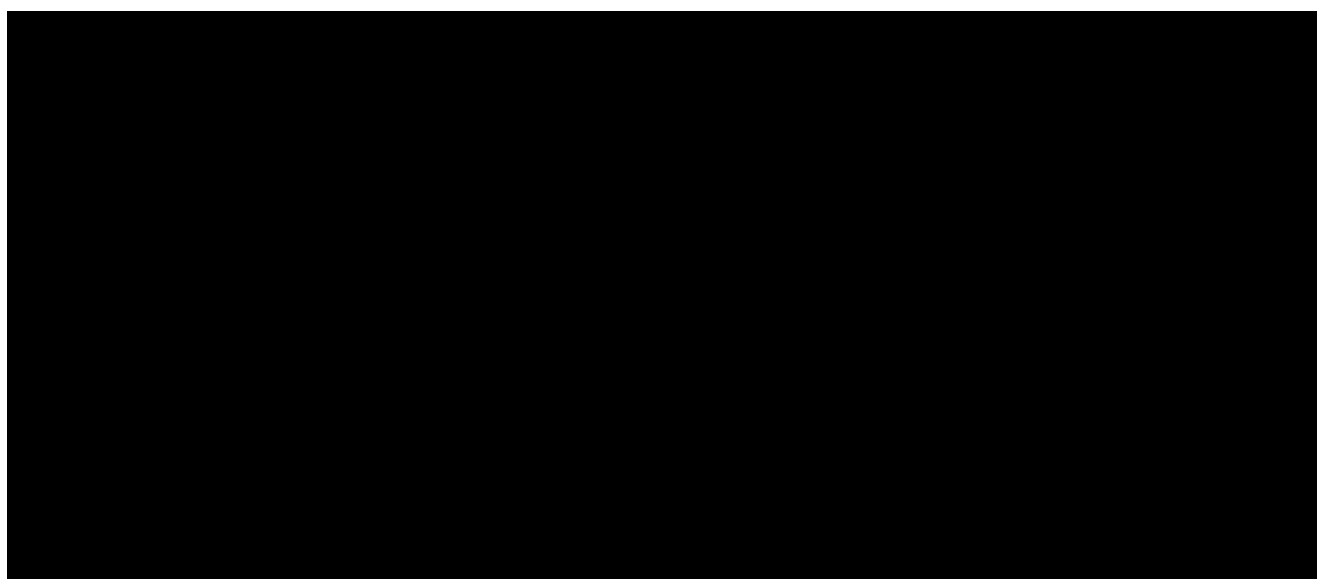
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EXECUTIVE SUMMARY

LDP Limited (**LDP**) has been engaged by Bathurst Resources Limited (**Bathurst**) to provide an assessment of lighting effects associated with the proposed infrastructure at the Buller Plateaux Continuation Project (**BPCP**).

This specific report relates to the following locations;

- The proposed mining operation at Mount Frederick South (**MFS**);
- The proposed mining operation at Escarpment Extended (**ESE**) on the Denniston Plateau;
- The proposed Upper Waimangaroa Haul Road (**UWHR**) linking ESE and MFS to the existing Stockton Mine Coal Handling and Processing Facility (CHPP); and
- The proposed additional mining operation areas at the northern end of the existing Stockton mine (**Stockton North**)

Collectively, I refer to all locations as the **Sites**.

Please refer to the report "24-0042-001A_BCPCP_Existing Infrastructure_Lighting Effects", for the assessment of lighting effects associated with the existing infrastructure which is part of the Buller Plateaux Continuation Project.

In summary;

- Fixed lighting will be well controlled. Higher intensity lights such as floodlights will be aimed down with zero upward tilt and lower intensity lights such as bulkhead type will be mounted near ground level and generally concealed from view by topography and vegetation.
- Mobile lighting will need to be tilted at a high angle to adequately light the work area and as such could potentially generate glare effects when seen from nearby residential locations. However, the conditions will mitigate this by aiming each MLT away from such locations.
- MFS: Lighting may be visible at MFS from Denniston and potentially also distant views from Westport to Waimangaroa. Effects may be moderate-high at Denniston and low elsewhere;
- ESE: Fixed infrastructure lighting at ESE will not be visible from any inhabited area beyond the Denniston Plateau. However, mobile lighting towers and vehicle mounted lights may be visible when situated near the present height of the western and southern edges.

There may be some visibility of fixed infrastructure lighting, mobile lighting towers and vehicle lights at ESE from Denniston, but the majority of the lighting will be concealed by topography and vegetation. Effects may be moderate at Denniston and low elsewhere ;

- UWHR: With minor exceptions, the UWHR will not be lit. It is also unlikely that lights on vehicles traversing the road would be visible from any residential location, with the potential exception [REDACTED] However, views, if any, would be distant. Effects may be low at Denniston and nil elsewhere.

- Stockton North: Lighting at Stockton North may have some visibility from Millerton, Granity, Ngakawau and Hector. Effects may be low-moderate at Millerton and low elsewhere.

The lighting will comply with the permitted activity requirements of the Operative Buller District Plan (**BDP**) and the Te Tai o Poutini Plan decisions version (**TTPP**).

Overall, I am of the opinion that any lighting effects will be;

- a. Denniston: Moderate-high, or more than minor
- b. Millerton: Low-moderate, or minor
- c. Elsewhere: Negligible-low, or less than minor

1.0 INTRODUCTION

Currently, the Sites have no artificial lighting and are therefore dark at night.

Under the BPCP, proposed operations for the Sites will be 24 hours/day, 7 days/week.

Mount Frederick South:

MFS will be accessed for removal of overburden, mining operations and future remediation, from the UWHR, with a haul road being constructed off the UWHR to reach up into the proposed MFS mine area. Mining in this area will largely be integrated with the Stockton and ESE operations, with minimal semi-permanent infrastructure located at the site (two small semi-permanent staff crib rooms, water management infrastructure and a coal transfer stockpile area).

A water treatment plant will be located at the lower end of the MFS mine access road near the UWHR junction and will have external lighting to provide safe access around the plant for operators during night-time. The water treatment plant will operate 24/7 during mining operations. Post-closure, water treatment infrastructure will be retained until rehabilitation is complete and water quality consistently meets required limits, with active WTP treatment initially and passive systems progressively established.

There will be no coal processing at MFS. MFS coal will be transported to Stockton, with only a modelled portion requiring CHPP processing and other coal going to ROM loadout for blending.

Mobile plant, vehicles and mobile lighting towers will be used as described later in this report.

When work is being undertaken at or near the present ground level, there will be some visibility of mobile lighting towers as well as mobile plant and vehicle lights. Potential viewing locations could include the residences on the Denniston Plateau to the south, and possibly minor distant views from Westport and areas north up to Waimangaroa.

████████████████████ would appear likely to have the greatest exposure to MFS, including visibility of the WTP, coal pad and UWHR intersection lighting.

Other than Denniston, given the viewing angle and separation distance, effects would be negligible to very low, further mitigated by the conditions I have proposed.

Effects to residents at Denniston would be moderate-high in my opinion.

Escarpment Extended:

The ESE Project sub-area includes the existing Escarpment Mine (which is currently under care and maintenance), and an extension of mining into adjacent areas. It also includes the proposed Escarpment Borrow Pit, which will be used to provide aggregate for the construction and establishment of ESE, the construction of the UWHR, and for any ongoing aggregate requirements.

ESE will have four primary infrastructure areas to support mining operations:

- Gatehouse/ Admin Office Area.
- Central Infrastructure Area.
- Coal Haulage Infrastructure Area.
- [REDACTED]

The Waimangaroa Storage Yard, located at the bottom of t[REDACTED] Denniston Road below the Denniston Plateau, is also included within the ESE Project sub-area. It is currently used for the storage of containers, and if the Project is approved, will be used as a laydown area for road construction works as required. Lighting is not proposed for the yard.

Access to ESE is currently provided by the existing public Denniston Road, but will be connected to the Stockton Project sub-area by the proposed Bathurst UWHR. Coal mined at ESE will be transported to the Stockton Project sub-area via the UWHR for sizing or washing, before being transported via the aerial ropeway to the Ngakawau Rail Loadout.

Lighting provisions are discussed in further detail later in the report, but in general terms, the following lighting provisions are anticipated:

- Pole mounted floodlights for access and area lighting with building mounted bulkhead lights for security and safe movement (24/7 use):
 - Gatehouse & administration area
 - Central infrastructure area (**CIA**)
 - Coal haulage infrastructure area (**CHIA**)
- Building and plant mounted bulkhead or similar lighting (Occasional use as required):
 - Bulk explosives plant

While ESE is initially being established, access for equipment and materials will be via the existing Denniston Road.

Once the mine is operating, the coal will be transported by truck to the CHPP at Stockton via the UWHR.

Permanent lighting will be well controlled with floodlights tilted down, such that the main beam is not directly visible from residential locations or directly in line with public roads.

The Site is mostly screened from view by buildings, topography and foliage. Residential locations and public roads on the Denniston Plateau will have some visibility of the lighting, but there will be no visibility of fixed infrastructure lighting from any inhabited location beyond the Denniston Plateau. There could be minor distant views of mobile lighting towers, mobile plant and vehicle lights, particularly when operating near the western and southern edges of the ESE.

Effects to residents at Denniston would be low-moderate in my opinion.

Upper Waimangaroa Haul Road:

The UWHR will be created to enable coal to be hauled from ESE and MFS to the CHPP. A small portion of the route is presently used as a maintenance access track by Transpower. However, that portion of the track will be widened and modified to make it fit for the proposed purpose.

The UWHR will be routed through a valley, well below the Denniston Plateau. As such it will be below typical view shafts and well screened by topography and vegetation.

The UWHR will generally not be lit. A single generator powered light is proposed for safety at the intersection for the MFS haul leg. In addition, while construction of the haul road is typically expected to be a daytime activity, there could be a need for some mobile tower lighting at times, particularly in winter months when the days are shorter.

Some fleeting visibility of vehicle lights on the haul tracks may be possible from residences located at the north-east extremities of the Denniston Plateau. However, any such effects would be negligible and further mitigated by the conditions I have proposed.

T [REDACTED] could appear to have the most significant view (and possibly the only view) of the Haul Road, including the MFS intersection and adjacent facilities.

There are no residences close to the UWHR and as such, headlight sweep effects, if any, will be negligible.

Stockton North

Stockton North will be accessed for removal of overburden, mining operations and future remediation, from within the existing Stockton mine. Mining in this area will be integrated with the Stockton operations, with no infrastructure located at the site.

No permanent lighting towers are proposed.

There will be no coal processing at Stockton North. All of the coal extracted will be taken by truck to the existing CHPP, within the Stockton site.

Mobile plant, vehicles and mobile lighting towers will be used as described later in this report.

There may be some visibility of mobile lighting towers as well as mobile plant and vehicle lights. Potential viewing locations could be residences at Hector, Ngakawau and Millerton.

However, given the viewing angle and separation distance, effects would be low-moderate at Millerton and low elsewhere.

Report Author

John Mckensey is the author of this report, acting on behalf of LDP. LDP is an independent Electrical and Illumination Engineering Consultancy, established in 1994. I hold the position of Executive Engineer and have over 40 years' experience in relation to lighting design and the assessment of effects of lighting.

I have the following qualifications and expertise: I hold a Bachelor of Engineering (Electrical), am a Member of the Illuminating Engineering Society of Australia and New Zealand Inc. (MIES) and hold a number of relevant affiliations including CMEngNZ, MIEAust, CPEng(Aust), NER, APEC Engineer, IntPE(Aust). I am a member of the Resource Management Law Society of NZ Inc and the International Dark-Sky Association.

I have received 19 awards for lighting design from the Illuminating Engineering Society and other learned bodies, including 3 International awards and 3 lighting design awards from the Royal Astronomical Society of New Zealand (for "efficient, effective and sustainable lighting design – protecting the night environment").

In addition to advising local government in relation Plan Changes (Auckland – AUP, Christchurch – DP updates, Hamilton – DP plan changes PC5 and PC9), I have provided evidence in the Environment Court for a number of resource consent applications.

I have provided advice regarding construction lighting effects for a range of resource consent applications including;

- Maramarua Coal Mine, Maramarua
- Rotowaro Coal Mine, Huntley
- AC36 Americas Cup, Auckland
- Hydroelectric Drainage Canal, Tekapo
- Junction Road Power Plant, Taranaki
- Mt Munro Wind Farm, Wairarapa
- Amberfield Subdivision, Hamilton
- Titanium Park Industrial Expansion, Waipa

I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023 and this report has been prepared in compliance with that Code, as if it was expert evidence presented in proceedings before the Environment Court. Unless I state otherwise, this report is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this report.

Caveat

To limit repetition, where this report makes a statement regarding effects, any such statement is the opinion of the author.

2.0 APPLICATION SCOPE

The purpose of the BPCP is to re-consent the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across the Stockton and Denniston Plateau (collectively referred to as the Buller Plateaux), including MFS and ESE via the proposed UWHR.

Further details have been provided in the Mitchell Daysh Assessment of Environmental Effects.

2.1 Project Description

Bathurst have prepared a detailed project Description. This is available as a separate document titled "Buller Coal Plateaux Continuation Project – Project Description".

3.0 EXISTING LIGHTING ENVIRONMENT

The existing environment comprising and surrounding the Sites (shown in Figure 1) is described in detail in the Mitchell Daysh AEE.

MFS: There is sparse inhabitation to the south (Denniston Plateau). Otherwise, the surrounding land is uninhabited.

ESE: There is sparse inhabitation at Denniston, immediately north and north-east of ESE. Otherwise, the surrounding land is uninhabited.

UWHR: The land surrounding the UWHR route is uninhabited.

Each of the above sites presently appear dark at night.

Stockton North: The land south of the site is the current Stockton Mine, including existing industrial lighting. The land to the north is uninhabited bush, with Millerton settlement approximately 1km beyond. The fixed lighting within the existing Stockton mine is not visible from any inhabited space beyond the site. Hence, Stockton North currently appears dark at night.

There is no public road lighting within or near the Sites. Since MFS, ESE and the Haul Road are presently unlit, the Sites are currently considered to be dark.

3.1 Site Visit

The author undertook a site visit on Tuesday 21/01/2025 of the Stockton Mine and surrounding areas both day and night and then on Wednesday 22/01/2025 to the Denniston Plateau, to appreciate existing and potential lighting effects.

The weather was fine and clear.

Further details and observations are included in section 6.1 of this report.

3.2 Analysis

Further to my site visit, I provide some observations regarding the environment below.



Figure 1. The Sites and Surrounds

The Sites covered in this report include the following areas identified in general terms in figure 1:

- Stockton North (Red star);
- MFS (Green star);
- ESE (Orange star); and
- The UWHR (Yellow star).

The existing Stockton CHPP is shown as a blue star in figure 1. The Haul Road will run through a valley to the east, connecting the ESE and MFS to the CHPP.

An overall image of the proposed new areas (hatched in red) is shown in Figure 2.

Stockton North is shown in Figure 3, MFS is shown in Figure 4, ESE is shown in Figures 5 and 6 and the Haul Road is shown in Figures 7-9. The existing Waimangaroa Yard is shown in Figure 10.

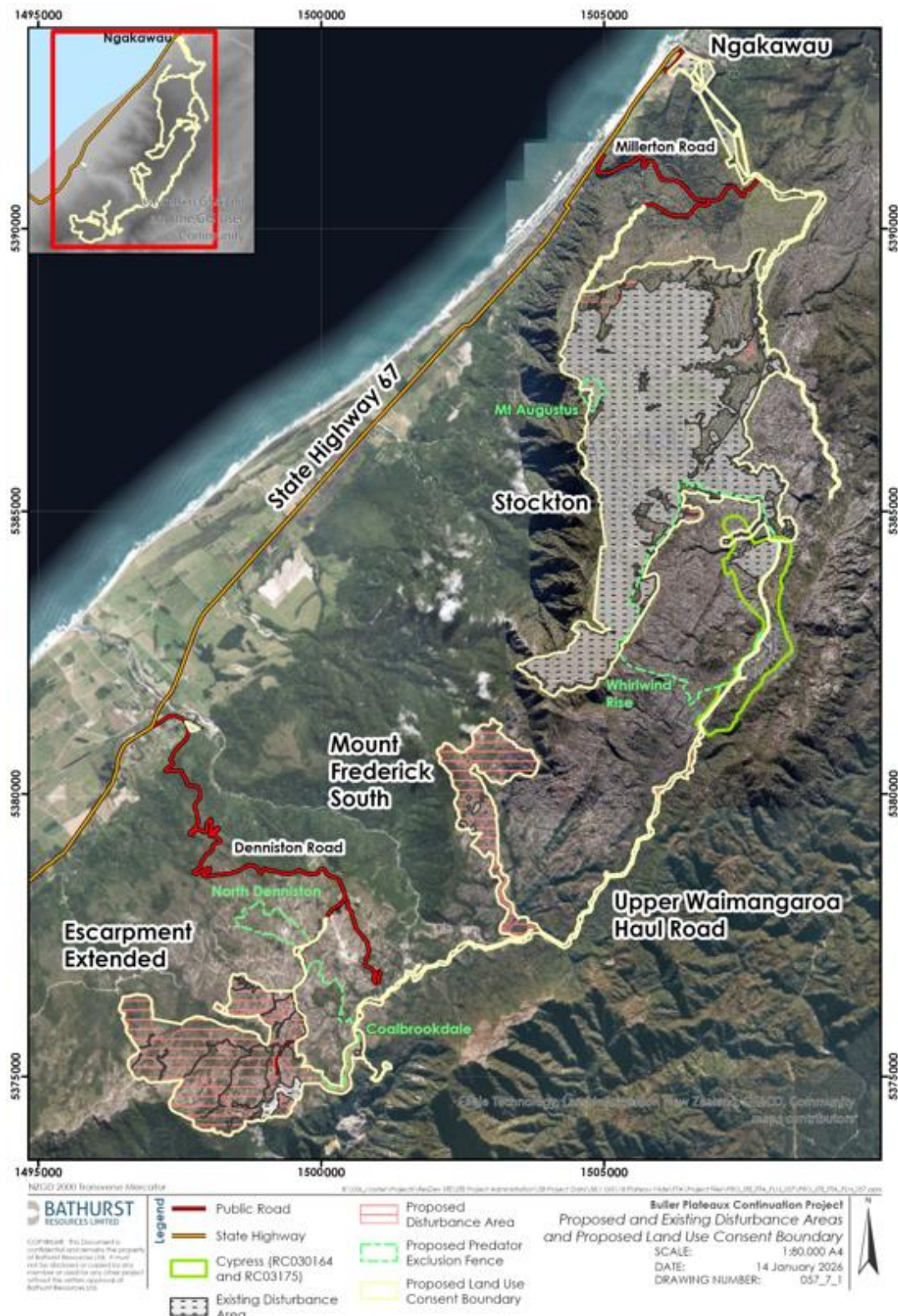


Figure 2. Overall – New Areas (red hatch)

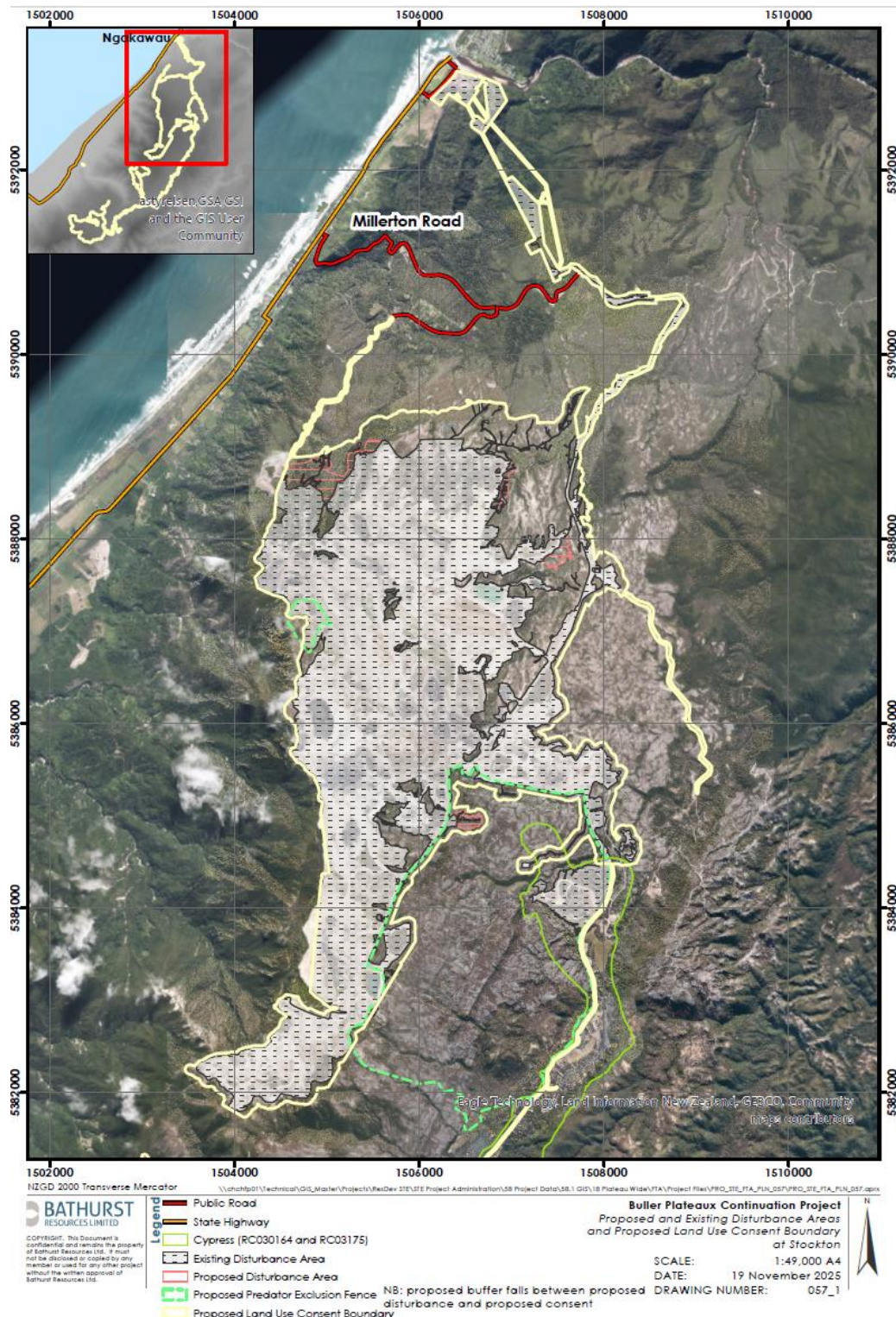


Figure 3. Stockton North (red hatch)

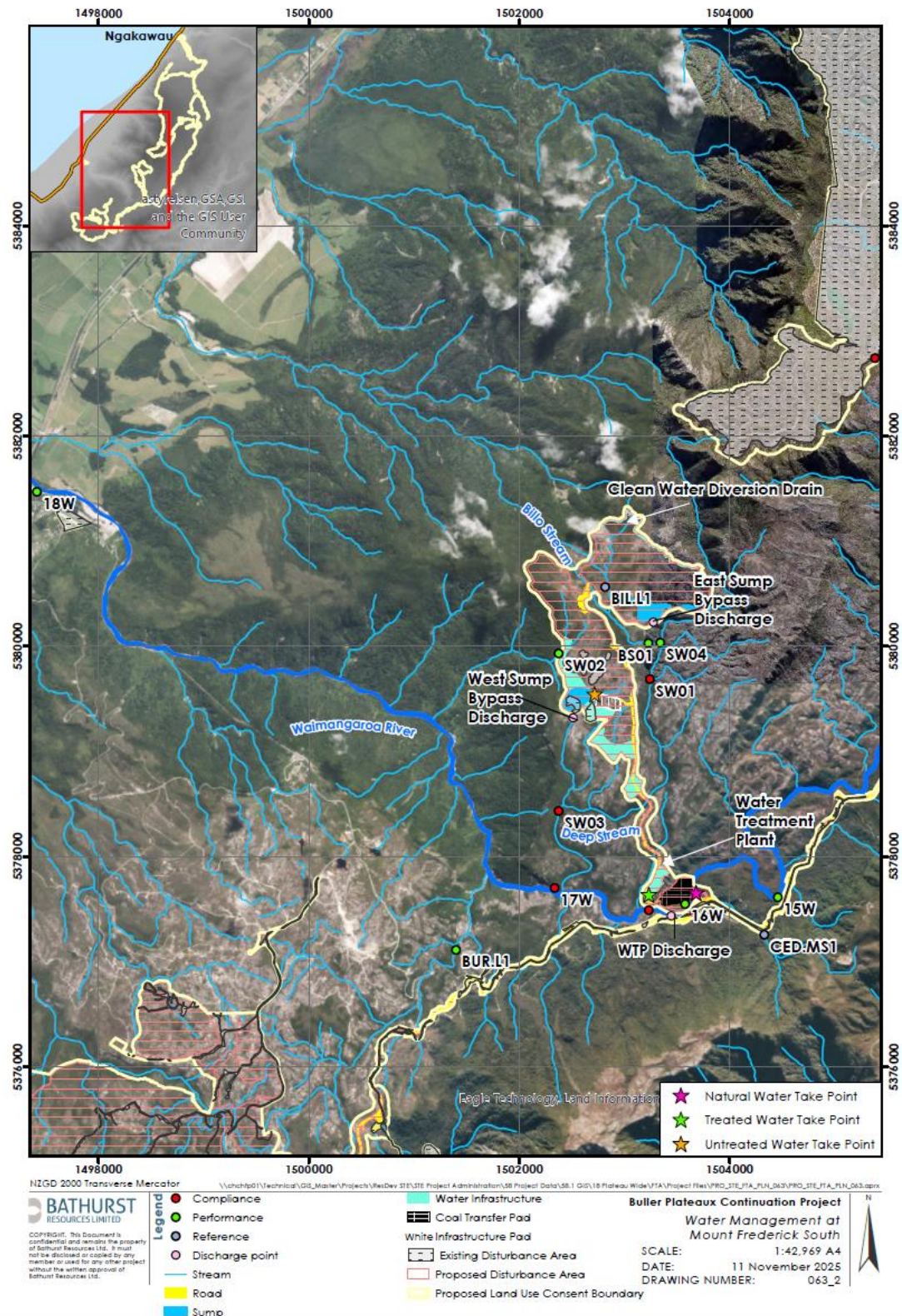


Figure 4. MFS

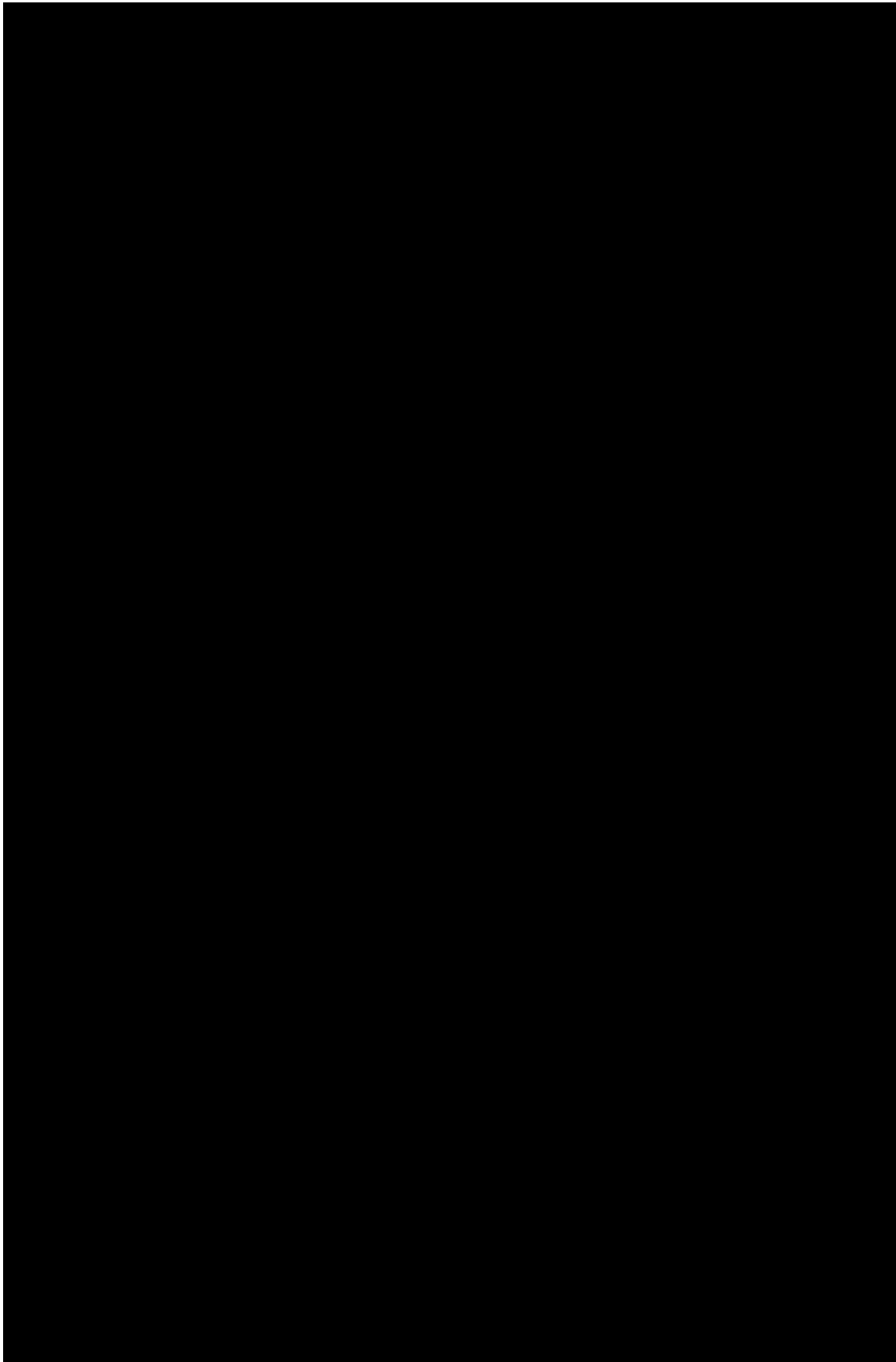


Figure 6 shows the ESE Infrastructure in greater detail.

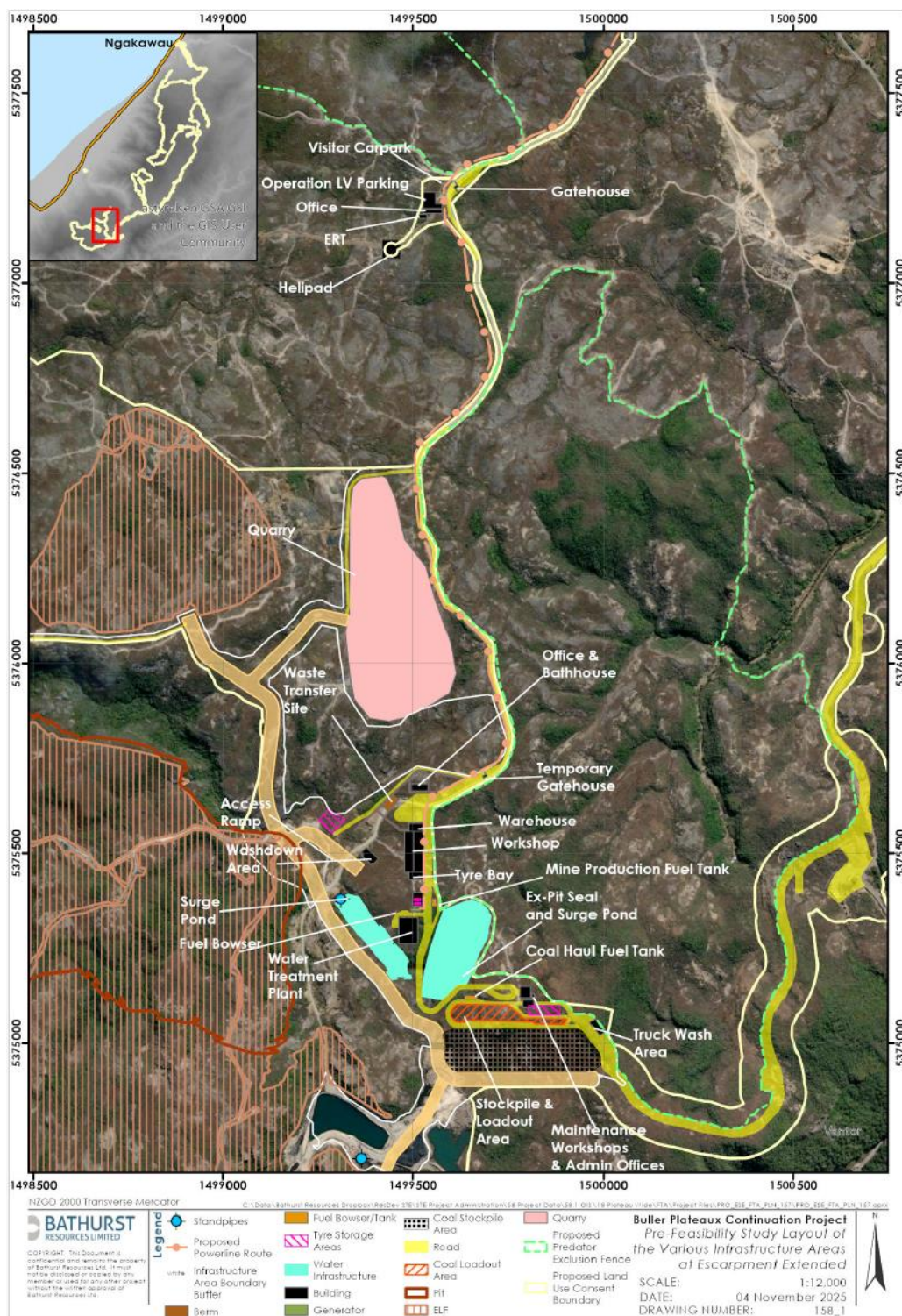
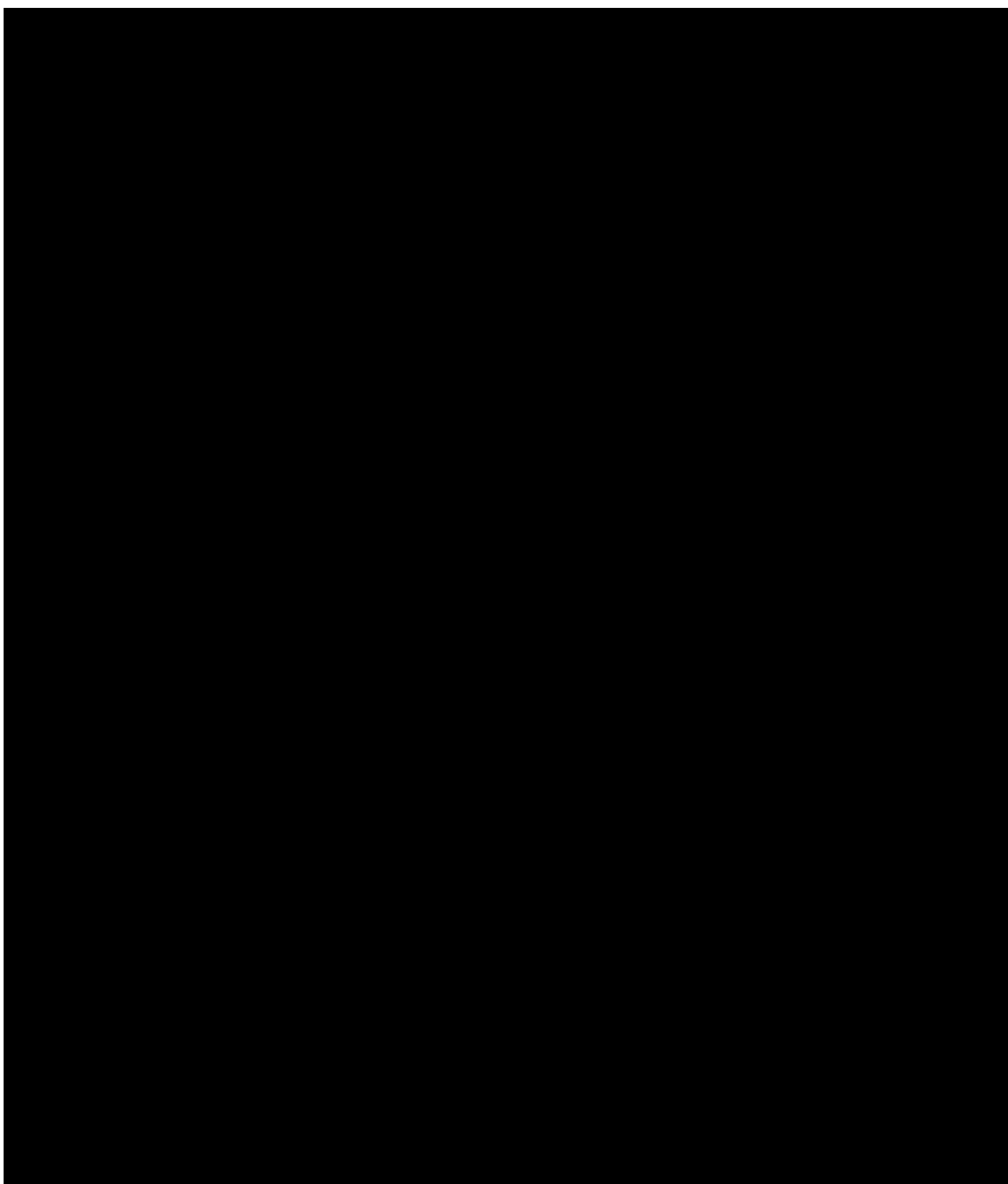


Figure 6. ESE – Details



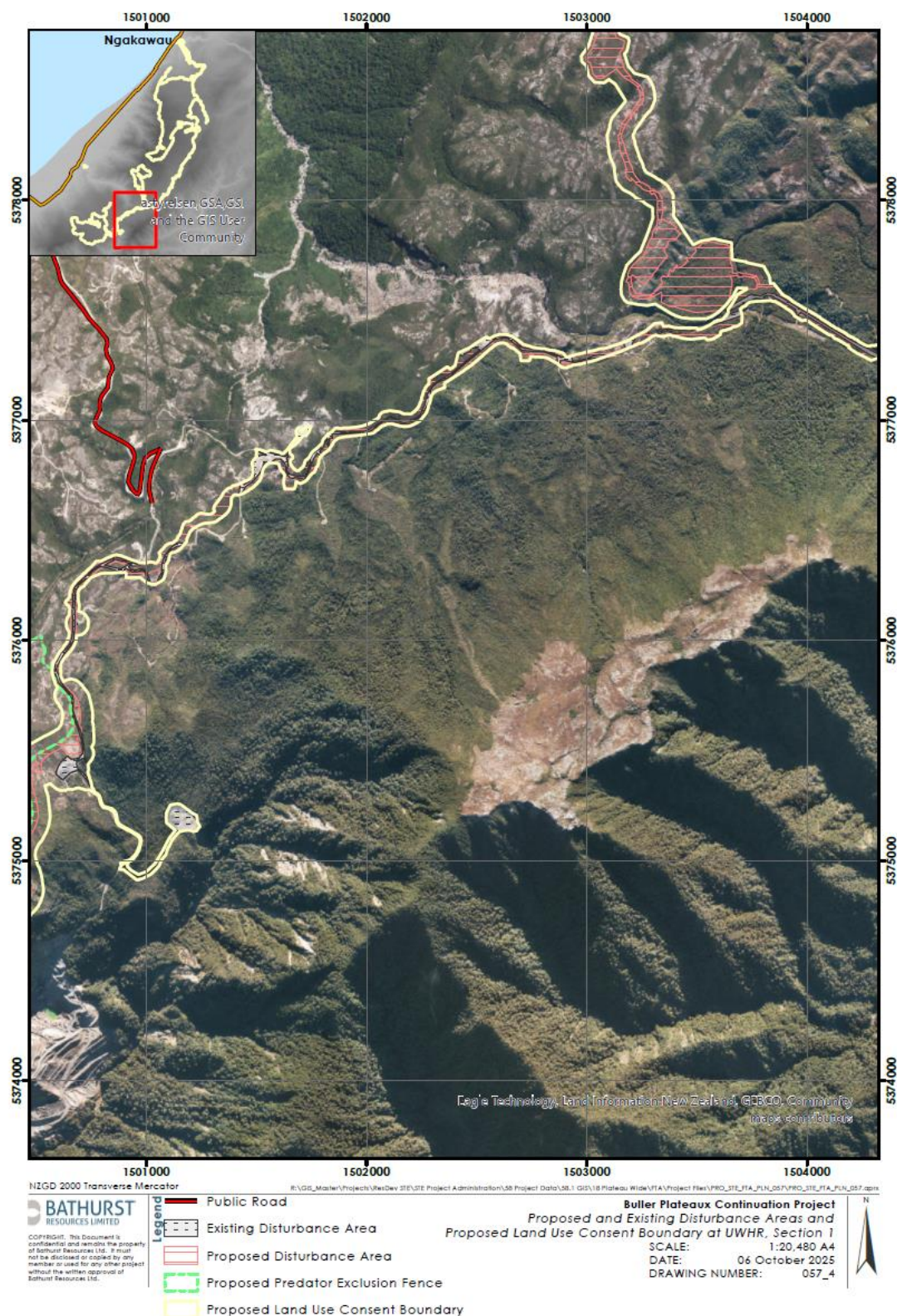


Figure 8. UWHR – ESE to MFS

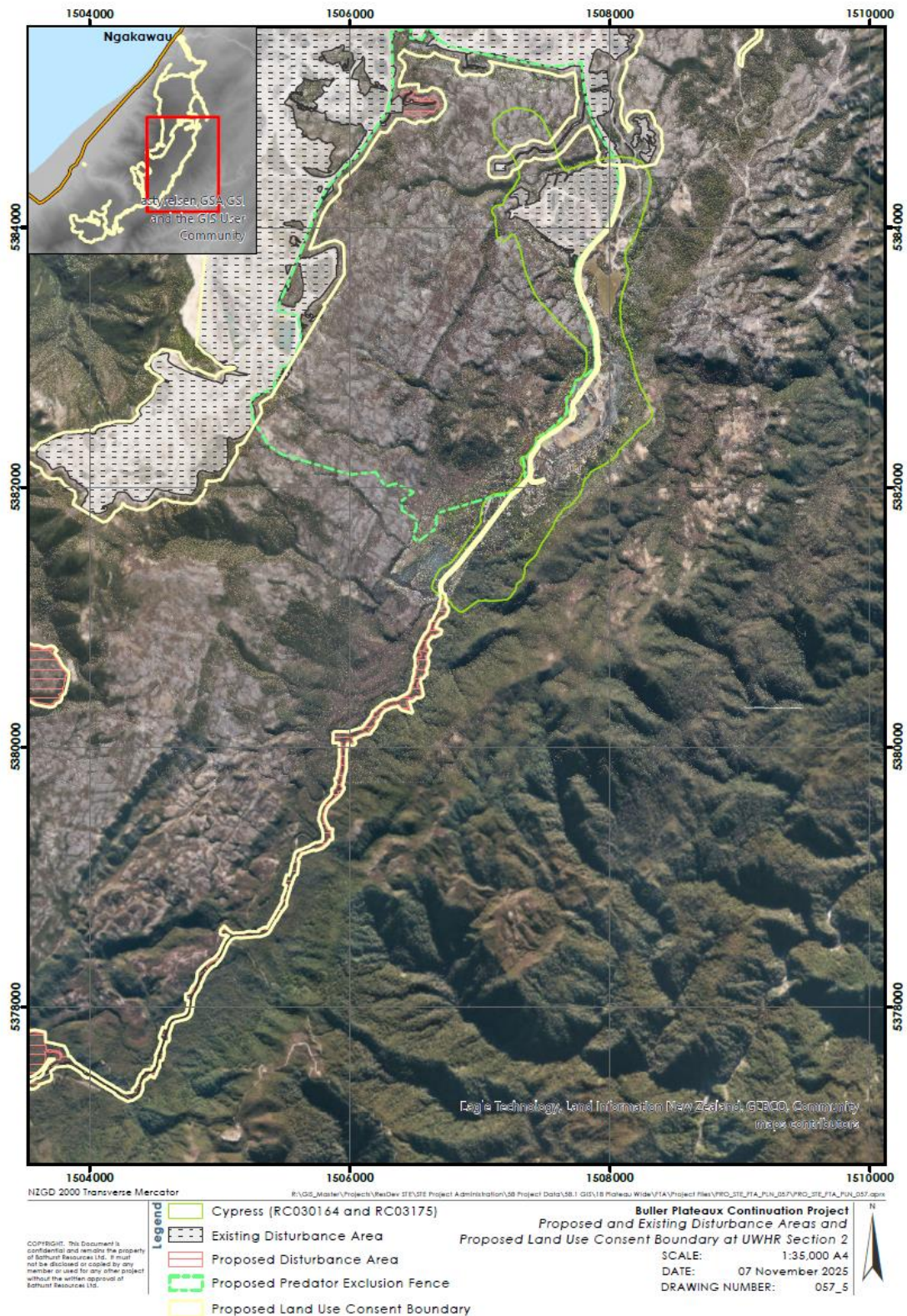


Figure 9. UWHR – MFS to Stockton

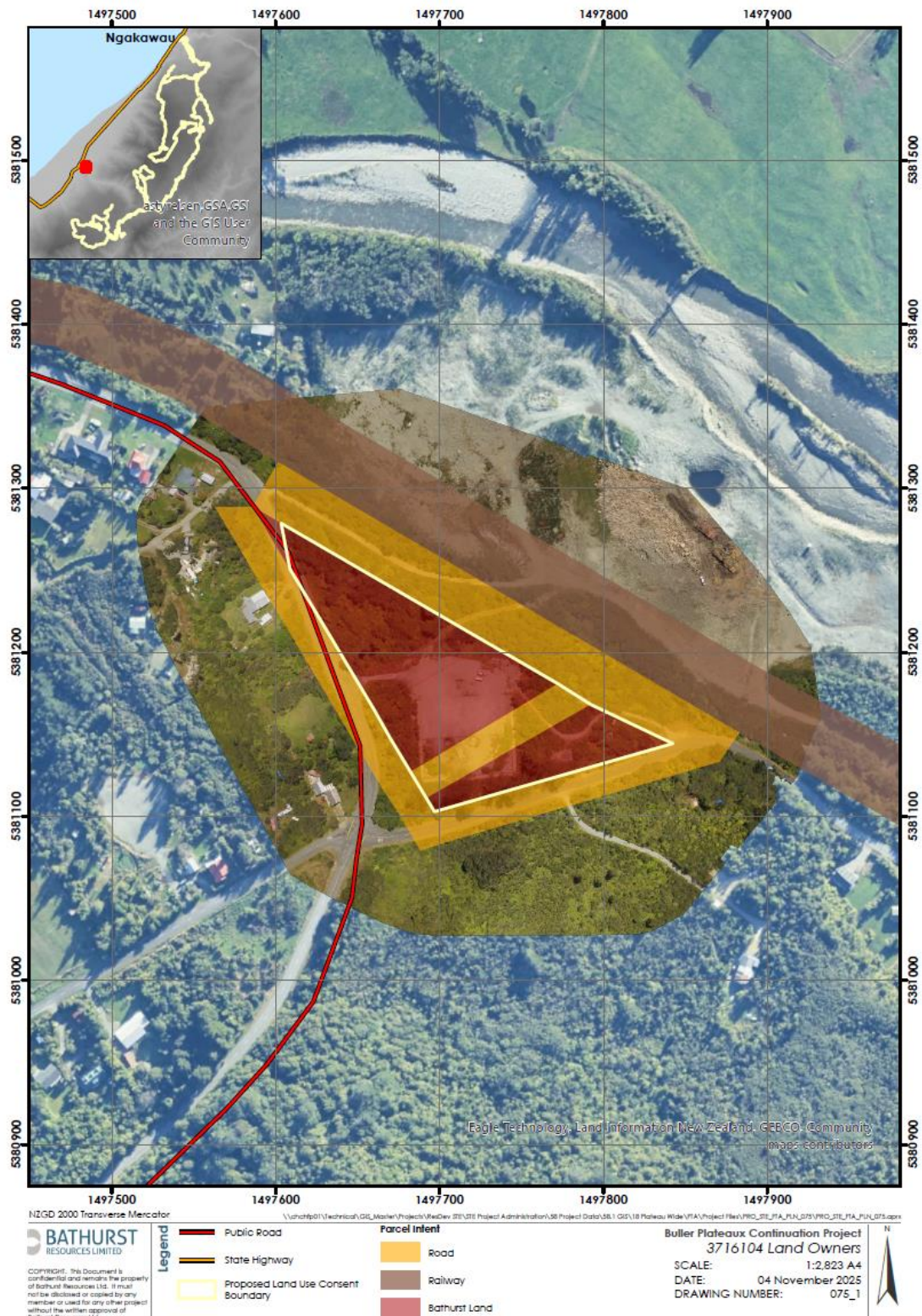


Figure 10. Waimangaroa Yard (Existing disturbance area)

The Sites are located on land zoned as Rural.

A proposal has also been notified in the TTPP to create a “Buller Coalfield Special Purpose Zone” (BCZ) which, if created, would encompass the Sites. Under this proposal, some parts of the site will be zoned as Open Space. While the TTPP is now operative in part, the BCZ chapter is under appeal. This is discussed in further detail in the MDA Planning report.

Observations relating to the relative location of nearby land with a residential use, are described in Table 1.

ITEM	SITE	CLOSEST RESIDENTIAL USE	OBSERVATIONS
1.1	MFS		
1.1.1		██████████ ██████████	Located south-west of MFS. ██████████ ██████████ ██████████ The majority of the MFS lighting (mobile and fixed) may be visible from properties at Denniston.
1.1.2		██████████ ██████████)	Located west of MFS. ██████████ ██████████. There will likely be distant views of the MFS mobile lighting from some residences. Fixed lighting is unlikely to be visible.
1.2	ESE		
1.2.1		██████████ ██████████	Located immediately north to north-east of ESE. ██████████ ██████████ ██████████ ██████████ The principal residential views appear to typically be directed away from ESE and are generally screened by topography and vegetation from proposed lighting within ESE.

			However, some visibility of lighting may occur.
1.3	UWHR		
1.3.1		██████████ ██████████	Located south-east of the UWHR, on elevated land and heavily screened by topography and vegetation. ████████████████████ ████████████████████████████ ████████████████████████ ████████████████████████████ ██████████
1.4	Stockton North		
1.4.1		██████████████████ ██████████	Located 1km north of Stockton North at lower elevation and generally screened by existing vegetation from potential lighting at Stockton North. There may be visibility of lighting from some properties, particularly to the south of Millerton.

Table 1. Closest Residential Use

Figures 15 & 16, on pages 38 & 39 respectively, show the cross-section paths considered. Table 4 on page 40 defines the end points of each path, being the potential light source and the receiving environment. Clarifying the terms used above;

- Denniston: Residential area 1
- Waimangaroa: Residential area 2
- Millerton: Residential area 3

Table 1 addresses fixed lighting effects. Mobile lighting effects will be less obtrusive in terms of light spill and glare provided the conditions I propose are adopted. However, the amenity of residents at Denniston may be affected by the night-time mobile lighting. Views from Denniston of the MFS and ESE that are presently dark, will potentially now be illuminated at times and the lighting, particularly related to mobile plant and vehicles, will be dynamic rather than static.

Using the guidelines provided in AS/NZS 4282:2023 (Control of the obtrusive effects of outdoor lighting), the ambient light conditions at the Sites, when operational, could best be described as shown in Table 2.

ITEM	LOCATION	ENVIRONMENTAL ZONE (per AS/NZS 4282:2023)	AMBIENT LIGHT CONDITIONS
2.1	Sites		
2.1.1	MFS	A4	High district brightness (Industrial lighting)
2.1.2	ESE	A4	High district brightness (Industrial lighting)
2.1.3	UWHR	A1	Dark
2.2	Surrounds		
2.2.1	Residential Area 1 (Denniston)	A2	Low district brightness (Sparsely inhabited, dense vegetation & no road lighting)
2.2.2	Residential Area 3 (Millerton)	A2	Low district brightness (Greater urban density than Denniston, but no street lighting and heavily vegetated)
2.3	Distant Views		
2.3.1	Residential Area 2 Waimangaroa	A2	Low district brightness (Sparsely inhabited, & no road lighting)

Table 2. Ambient light conditions

The definition of the environmental zones is described in Table 3.1 of AS/NZS 4282:2023, repeated below as Table 3 for reference.

Environmental Zones	Ambient Light Conditions	Descriptions/Examples
A0	Intrinsically Dark	UNESCO Starlight Reserve IDA: Dark Sky Parks, Reserves or Sanctuaries Major optical observatories Other accreditations of dark sky places for example astro-tourism, heritage value, astronomical importance, wildlife/ecosystem protection Lighting for safe access may be required
A1	Dark	Relatively uninhabited rural areas (including terrestrial, marine, aquatic and coastal areas)
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas Generally roadways without streetlighting through suburban, rural or semi-rural areas other than intersections
A3	Medium district brightness	Suburban areas in towns and cities Generally roadways with streetlighting through suburban, rural or semi-rural areas
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas Industrial and port areas Transport Interchanges
TV	High district brightness	Vicinity of major sport and event stadiums during TV broadcasts
NOTE: Zones A0 and A1 would normally have a minimum area of 50 ha (0.5 km ²). There may be smaller environmentally sensitive areas.		

Table 3. Environmental zones (per AS/NZS 4282 Table 3.1)

4.0 LIGHTING

There is presently no existing lighting at the Sites.

The proposed lighting at the Sites is described below.

4.1 General

The lighting will be like that currently in use at the Stockton mine for similar activities. I have shown relevant examples of typical lighting present at Stockton in Figure 11 as indicative of the expected lighting for the new infrastructure.

Permanent Lighting

I refer to permanent infrastructure lighting as **Fixed Lighting**.

Examples of permanent infrastructure lighting are shown in Figure 11. This lighting will be mounted on columns, buildings and structures and will be present for the operational life of the mine.





11B. Typical Main Gate



11C. Typical HV parking (left image) & LV parking (right image)
(Note: Typical office building shown on the right)



11D. Typical stockpile lighting



11E. Typical Workshop/Handling Facilities

Figure 11. Permanent Lighting Examples

Mobile Lighting Towers

Mobile lighting towers will be used as required at night at work faces and principal mine road bends and intersections for safety. Examples of the mobile lighting equipment are shown in Figure 12.

When erected, each lighting tower is typically up to 11.5m high.





Figure 12. Mobile Lighting Tower Examples

Mobile Plant and Vehicles

Mobile plant and vehicles will be equipped with headlights, safety lights and work lights. Examples of the machines are shown in Figure 13.





Figure 13. Mobile Plant and Vehicle Examples

I refer to mobile lighting towers and lighting attached to mobile plant and vehicles, collectively as **Mobile Lighting**.

Night-time Lighting

Examples of the lighting detailed above are shown in Figure 14.



14A: Mobile lighting tower – rear and side view



14B: Mobile lighting tower – coverage



14C: Typical extraction activities



14D. Typical stockpile lighting



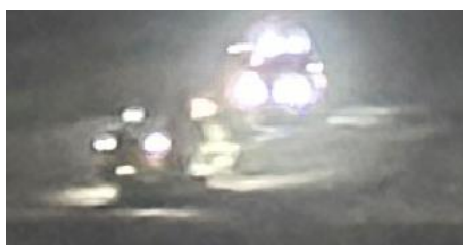
14E. Typical office lighting



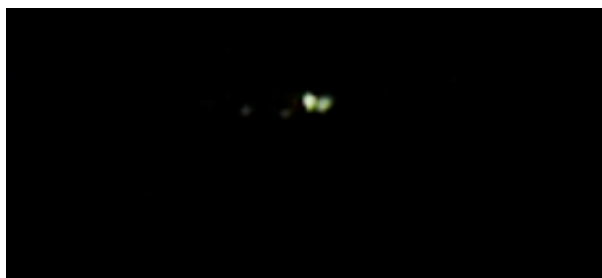
14F. Water cart



14G. Excavator



14H. Haulage



14I. Main gate



14J. Typical workshop/handling facilities

Figure 14. Night-time lighting examples

4.2 MFS

Permanent lighting may include;

- Stockpile: Pole lights.
 - Similar to figures: Daytime – 11D. Night-time – 14D.
- WTP: Pole & bulkhead lights.
 - Similar to figures: Daytime – 11C. Night-time – 14E.
- Crib: Bulkhead & minor area lights.
 - Similar to figures: Daytime – 11A. Night-time – 14E.

Mobile lighting may include;

- ELF & PIT: Mining operations (plant, vehicles and mobile lighting towers);
 - See figures: Daytime – 12 & 13. Night-time – 14A to 14C, 14F to 14H.

4.3 ESE

Permanent lighting may include;

- Gate & Admin: Pole & bulkhead lights.
 - Similar to figures: Daytime – 11B & 11C. Night-time – 14E.
- CIA: Pole & bulkhead lights.
 - Similar to figures: Daytime – 11A & 11E. Night-time – 14E & 14J.
- CHIA: Pole lights.
 - Similar to figures: Daytime – 11D & 11E. Night-time – 14D & 14J.
- Explosives: Bulkhead lights.
 - As for CIA, but much smaller in scale.
- Yard: No lighting is proposed for the Waimangaroa Yard

Mobile lighting may include;

- ELF & PIT: Mining (plant, vehicles and mobile lighting towers);
 - See figures: Daytime – 12 & 13. Night-time – 14A to 14C, 14F to 14H.

4.4 UWHR

There will be no permanent lighting other than a single generator power light at the MFS haul intersection for safety.

Mobile lighting may include;

- Haulage (Vehicles): See figures: Daytime – 13. Night-time – 14F & 14H.
- While construction of the UWHR is expected to be a daytime activity, there may be a need for mobile tower lighting in winter months when days are shorter.

4.5 Stockton North

There will be no permanent lighting.

Mobile lighting may include;

- ELF & PIT: Mining operations (plant, vehicles and mobile lighting towers);
➤ See figures: Daytime – 12 & 13. Night-time – 14A to 14C, 14F to 14H.

4.6 Construction lighting

While the construction of buildings and permanent structures is envisaged to be a daytime activity, there could potentially be night-time work.

Where that is required, construction lighting may include;

- Crane boom lighting
- Construction vehicle navigation, safety and working lighting
- Mobile lighting towers to highlight the work area
- Temporary festoon or similar lighting within buildings and/or structures to support localised construction and fit-out work

The visibility of any such construction lighting would be consistent with that described for the permanent lighting, as discussed separately in the report, and could potentially relate to the following elements;

- Stockton North: Nil (no fixed infrastructure proposed)
- UWHR: Nil (no fixed infrastructure proposed). [Note: "Nil" applies only to fixed construction-related infrastructure lighting. A possible temporary UWHR mobile lighting tower is addressed under Section 4.4 and subject to the proposed mobile lighting tower controls.]
- Waimangaroa Yard: Nil (no fixed infrastructure proposed)
- MFS: Water treatment Plant
- ESE:
 - Gatehouse & Administration
 - Central Infrastructure Area
 - Coal Hall Infrastructure Area

○ [REDACTED]

4.7 De-construction lighting

At the end of the operational life of the Sites, the infrastructure will be dismantled and removed. As for construction, this is expected to be a daytime activity, but there could potentially be night-time work.

The type of lighting, locations and expected visibility will be similar to that described for Construction.

4.8 Indicative lighting effects

Clarifying the effects mentioned in this report, indicative arrangements and nominal associated lighting effects are summarised below.

I have undertaken conservative modelling for the envisaged fixed lighting mounted on columns, buildings and structures. The indicative results are shown in Table 6.

- **General principles:**

The nominal illuminance (spill light) at the window of a dwelling from a point source can be calculated by the formula;

$$E = I/d^2 \text{ (E=Illuminance, I=Luminous Intensity, d=distance)}$$

With the identified viewing distances from residences and public roads being no less than 1km, the light source will effectively appear as a single point source.

Luminous Intensity is expressed as candelas (**cd**).

For context;

- An LED roadway light can typically be in the order of 2,000cd for a 25 watt residential road light or 9,000cd for a 100 watt highway light.
- The luminous intensity of a vehicle headlight on low beam is approximately 30,000cd.
- Starlight on a clear evening produces approximately 0.0001 lux.
- Typical moonlight with a full moon on a clear night is approximately 0.3-0.5 lux, but can range up to 1 lux.

- **Column mounted lights:**

The tallest and most powerful floodlight proposed would be 400W LED at a mounting height of 12m. These are proposed to be an asymmetric style floodlight installed with zero upward tilt.

I have analysed a typical floodlight with these characteristics, conservatively assuming it is directed towards a residence. Given that effects are cumulative, I have also conservatively assumed that there could be up to 20 such lights at 526W each.

- **Building mounted lights:**

While there may be some floodlights attached to buildings, any such lights will be installed with zero tilt. Hence, they will produce spill light effects no greater than those indicated in Table 6.

The majority of lights attached to buildings will be much smaller wattage – nominally up to 50W LED and typically up to 4m above ground. I have analysed a typical linear style luminaire (also referred to as an ‘under veranda’ or ‘bulkhead’ style), conservatively assuming 50 such lights at 57W each. These lights can have a variety of different shapes (e.g. could be round instead of rectangular, etc), but the lighting effect will be the same.

- **Fixed lighting effects:**

I have considered potential worst-case effects apparent from studying cross sections generated in Google Earth in conjunction with site observations and my understanding of proposed landform changes during the life of the project.

The cross-section paths considered are shown in Figures 15 and 16, with related features and observations as detailed in Table 4. Table 5 defines the features of the luminaires considered for the model and Table 6 shows the results of the modelling.



Figure 15. Cross-section paths considered – ESE & MFS

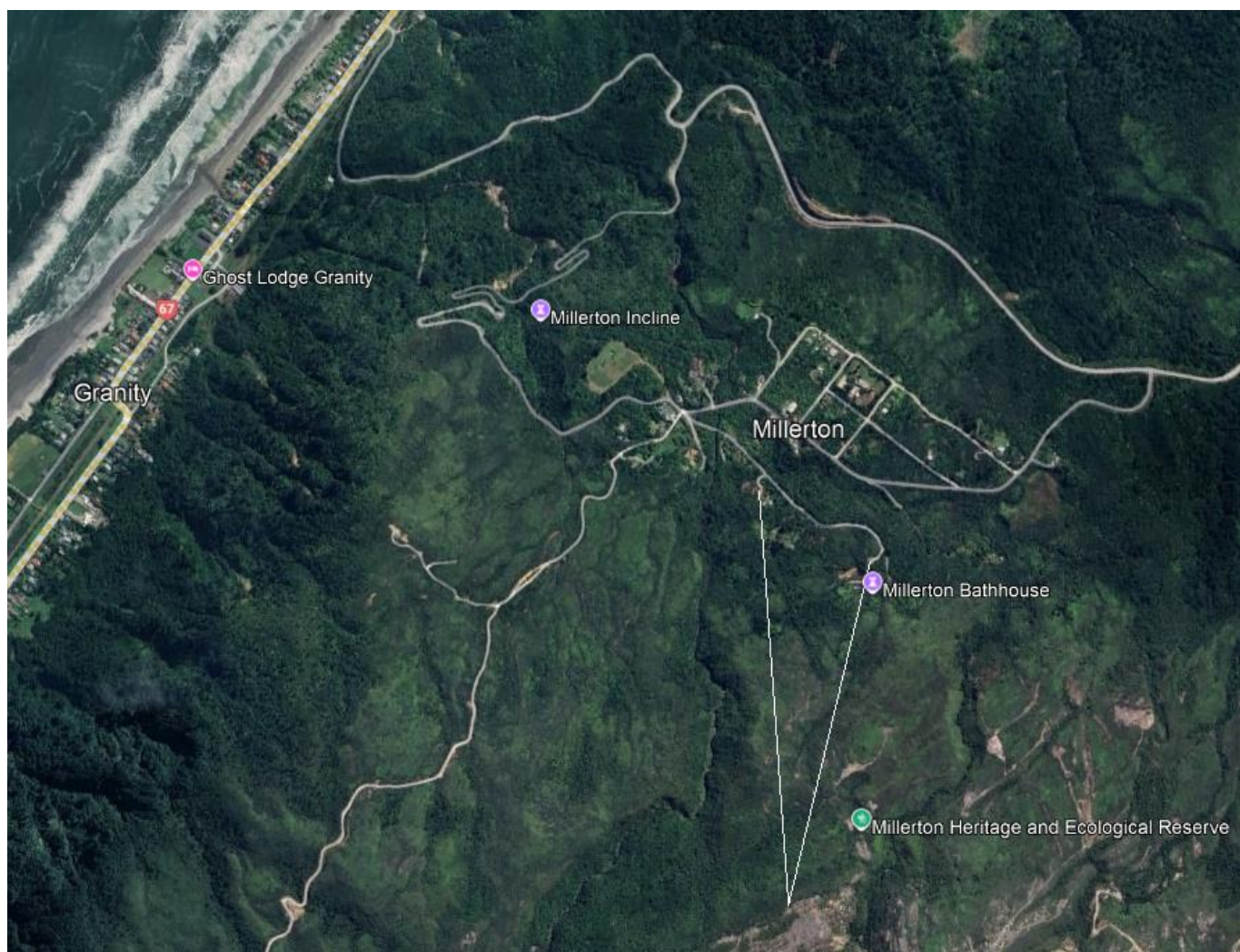


Figure 16. Cross-section paths considered – Stockton North

PATH	FROM	TO	HEIGHT CHANGE (m)	DISTANCE (m)	VERTICAL ANGLE (°)	LIGHTING VISIBLE		FIXED LIGHTING			MOBILE LIGHTING	
						FIXED	MOBILE	FIXED 12M POLE FLOOD LIGHTS	FIXED 8M POLE FLOOD LIGHTS	FIXED BULKHEAD LIGHTS	MOBILE 10M FLOOD LIGHTS	VEHICLE LIGHTS
P1	Westport	ESE - CHI	610	17,000	88	No	N/A					
P2	Westport	MFS - ELF	811	19,600	88	N/A	Possible				Yes	Yes
P3	Waimangaroa	MFS - ELF	824	5,800	82	N/A	Unlikely				Yes	Yes
P4	Waimangaroa	MFS - ELF - South	690	7,200	85	N/A	Possible				Yes	Yes
P5	Denniston - West	ESE - Gate	70	1,500	87	Possible	N/A		Yes	Yes		Yes
P6	Denniston - East	ESE - Gate	22	1,100	89	No	N/A					
P7	Denniston Rd - East	ESE - CIA	230	1,000	77	No	N/A					
P8	Denniston	MFS - ELF	197	3,600	87	N/A	Possible				Yes	Yes
P9	Denniston - West	ESE - ELF - West	26	4,000	90	N/A	Unlikely				Yes	Yes
P10	Denniston - East	ESE - CIA	-13	2,300	90	No	N/A					
P11	Denniston	UWHR	-80	2,900	92	N/A	Possible					Yes
P12	Denniston	MFS - ELF - South	71	2,900	89	N/A	Possible				Yes	Yes
P13	Denniston Rd - East	ESE - CHI	45	2,200	89	Unlikely	N/A	Yes		Yes		Yes
P14	Denniston - East	ESE - CHI	2	2,900	90	Unlikely	N/A	Yes		Yes		Yes
P15	Denniston	ESE - ELF - South	158	4,700	88	N/A	Possible				Yes	Yes
P16	Waimangaroa	ESE - ELF - West	596	4,900	83	N/A	Possible				Yes	Yes
P17	Waimangaroa	ESE - ELF - South	748	7,000	84	N/A	Possible				Yes	Yes
P18	Westport	ESE - ELF - West	566	12,700	87	N/A	Unlikely				Yes	Yes
P19	Fairdown	ESE - ELF - West	598	5,100	83	N/A	Possible				Yes	Yes
P20	Fairdown	ESE - ELF - South	777	7,200	84	N/A	No					
P21	Birchfield	ESE - ELF - West	601	9,600	86	N/A	Possible				Yes	Yes
P22	Birchfield	ESE - ELF - South	759	11,600	86	N/A	Possible				Yes	Yes
P23	Birchfield	ESE - CHI	641	10,900	87	No	N/A					
P24	Birchfield	MFS - ELF	819	5,800	82	N/A	Possible				Yes	Yes
P25	Fairdown	MFS - ELF	848	11,000	86	N/A	Unlikely				Yes	Yes
P26	Denniston	MFS - WTP & Stockp	-82	2,900	92	Possible	N/A		Yes	Yes	Yes	Yes
P27	Millerton	Stockton North - EL	250	1,000	76	N/A	Possible				Yes	Yes
P28	Napier St	Stockton North - EL	226	900	76	N/A	Possible				Yes	Yes

Table 4. Cross-section observations

TYPE (Nominal)	QUANTITY	LUMENS	PEAK INTENSITY (cd)	PEAK ANGLE (°)	STYLE
500W FLOOD (526W)	1	75,000	56,272	64	
60W BULKHEAD (57W)	1	8,000	2625	22.5	
NOTES:		1. Flood - Aimed down, zero tilt			
		2. Bulkhead - Wall mount - aimed at 90 degrees			

Table 5. Modelled lighting characteristics

PATH	FROM	TO	HEIGHT CHANGE (m)	DISTANCE (m)	VERTICAL ANGLE (°)	LIGHTING VISIBLE		INTENSITY AT ANGLE (cd)		SPILL LIGHT (lux)			GLARE (cd)		
						FIXED	MOBILE	1x500W FLOOD	1x60W BULKHEAD	20x500W FLOOD	50x60W BULKHEAD	TOTAL	1x500W FLOOD	1x60W BULKHEAD	WORST
P1	Westport	ESE - CHI	610	17,000	88	No	N/A								
P2	Westport	MFS - ELF	811	19,600	88	N/A	Possible	10,020	2,600						
P3	Waimangaroa	MFS - ELF	824	5,800	82	N/A	Unlikely	10,460	2,580						
P4	Waimangaroa	MFS - ELF - South	690	7,200	85	N/A	Possible	10,165	2,595						
P5	Denniston - West	ESE - Gate	70	1,500	87	Possible	N/A	10,020	2,600	0.0011	0.0560	0.0571	199	327	327
P6	Denniston - East	ESE - Gate	22	1,100	89	No	N/A								
P7	Denniston Rd - East	ESE - CIA	230	1,000	77	No	N/A								
P8	Denniston	MFS - ELF	197	3,600	87	N/A	Possible	10,015	2,600						
P9	Denniston - West	ESE - ELF - West	26	4,000	90	N/A	Unlikely	0	2,555						
P10	Denniston - East	ESE - CIA	-13	2,300	90	No	N/A								
P11	Denniston	UWHR	-80	2,900	92	N/A	Possible	0	2,600						
P12	Denniston	MFS - ELF - South	71	2,900	89	N/A	Possible	10,030	2,590						
P13	Denniston Rd - East	ESE - CHI	45	2,200	89	Unlikely	N/A	10,030	2,590	0.0003	0.0263	0.0266	160	266	266
P14	Denniston - East	ESE - CHI	2	2,900	90	Unlikely	N/A	0	2,555	0.0000	0.0000	0.0000	0	266	266
P15	Denniston	ESE - ELF - South	158	4,700	88	N/A	Possible	10,020	2,600						
P16	Waimangaroa	ESE - ELF - West	596	4,900	83	N/A	Possible	10,335	2,580						
P17	Waimangaroa	ESE - ELF - South	748	7,000	84	N/A	Possible	10,270	2,590						
P18	Westport	ESE - ELF - West	566	12,700	87	N/A	Unlikely	10,015	2,600						
P19	Fairdown	ESE - ELF - West	598	5,100	83	N/A	Possible	10,335	2,580						
P20	Fairdown	ESE - ELF - South	777	7,200	84	N/A	No								
P21	Birchfield	ESE - ELF - West	601	9,600	86	N/A	Possible	10,085	2,600						
P22	Birchfield	ESE - ELF - South	759	11,600	86	N/A	Possible	10,085	2,600						
P23	Birchfield	ESE - CHI	641	10,900	87	No	N/A								
P24	Birchfield	MFS - ELF	819	5,800	82	N/A	Possible	10,460	2,580						
P25	Fairdown	MFS - ELF	848	11,000	86	N/A	Unlikely	10,085	2,600						
P26	Denniston	MFS - WTP & Stockpile	-82	2,900	92	Possible	N/A	0	2,600	0.0000	0.0000	0.0000	0	179	179
P27	Millerton	Stockton North - ELF	250	1,000	76	N/A	Possible	11,155	2,535						
P28	Napier St	Stockton North - ELF	226	900	76	N/A	Possible	11,155	2,535						

Table 6. Indicative fixed lighting effects

The maximum potential effects are highlighted in pink.

Locations highlighted in green will have no view of any lighting, fixed or mobile, at the locations indicated. As such, spill light and glare will be avoided.

The locations highlighted in salmon have no visibility of the fixed lighting and therefore spill light and glare will be avoided.

Denniston is the only inhabited location with potential visibility of the proposed fixed lighting mounted on columns, buildings and structures. Those effects are summarised below.

- Light spill: Approximately 0.1 lux (i.e. similar to moonlight)
- Glare:
 - Denniston West: Approximately 330cd
 - Denniston East: Approximately 270cd

District Plan limits are discussed in Section 5, but 0.1 lux is well within the 10lux limit.

Glare effects may be higher than recommended. AS/NZS 4282 recommends up to 1,000cd for environmental zone A2 (defined as sparsely inhabited rural and semi-rural areas, generally without street lighting). Hence, glare from fixed lighting will also be well within the recommended 1,000cd limit.

- **Mobile lighting towers:**

Mobile lighting towers are typically adjustable up to 11.5m high. I have conservatively assumed 12m. The floodlights on these vary in light output and quantity, But the greatest light output I have seen to date includes 4 x 350W LED. Again, I have conservatively assumed this for the analysis.

The floodlights are typically wide beam, but flat panel. Hence, they project no light behind the floodlight – i.e. backwards, through to side-on (i.e. with 0 degrees being straight in front to the lights, backwards is 180 degrees and side-on is 90 degrees).

The lights will be aimed down towards the space that requires lighting. That may be towards a residence, directly away or somewhere in between, depending on where the working surface is located.

I have modelled a worst-case theoretical scenario, considering the possibility of 2 such towers, each with 4 floodlights, both be aimed directly towards a residence at 1km distance, then the light spill could potentially be up to 0.6 lux. While this scenario is unlikely to occur in practice, the resulting light spill would be well within the District Plan 10 lux limit.

When lighting a working face, I have observed that the tilt angle is typically set at around 80 degrees. While any such light facing away from a residence will produce nil-negligible effects to the residence, any such light aimed towards a residence could generate luminous intensity (i.e. glare) towards a residence up to approximately 60,000cd. However, the conditions I propose will mitigate this risk to result in luminous intensity less than 1,000cd, as recommended in AS/NZS 4282 for this type of environment.

Threshold Increment (i.e. glare to motorists) would be well within the 20% limit recommended by AS/NZS 4282. I have calculated that TI would be 0% provided that any MLT is directed at 90 degrees (i.e. across the view) or greater (i.e. further away). The conditions I have proposed will achieve this result.

- **Night sky views**

I understand that some visitors choose to visit the Denniston Plateau on occasions to star gaze. Since, with the minor exception of residential lighting at the few residences present, this is currently a dark space, the introduction of any artificial lighting will potentially reduce night sky visibility.

Considering the location and nature of the sites, there will be locations on the Denniston Plateau where a visitor may star gaze without directly seeing any of the proposed lighting.

The introduction of the proposed lighting will likely reduce visibility, mainly due to atmospheric scattering of lighting at the sites. Quantifying the effects in terms of numerical values is not possible given the variables such as mobile lighting.

However, as a lighting specialist and amateur astronomer, I am of the opinion that it would be possible to find readily accessible locations on the Plateau where the reduction in night

sky visibility due to the introduction of the proposed artificial lighting, may be limited to approximately 1-2 magnitudes in terms of visibility of astronomic phenomena.

Hence, any such effects would be very low-low in my opinion.

- **Analysis of lighting effects:**

As indicated above, lighting effects will satisfy the limits in the District Plan and the recommendations in AS/NZS 4282.

Also, for residential locations other than those Denniston and Millerton, the separation distances are such that any visible lighting will present as a very small percentage of the night-time view. As such, in my opinion, it would generate negligible-very low effects on night-time views and associated amenity.

However, while topography and/or vegetation may adequately screen the residents' views at Denniston and Millerton, it is possible that this may not be the case in some instances. Should a resident be exposed to views of the lighting at either location, it could present a significant change from their present experience of complete darkness at night. The intrusion could occupy a significant portion of a resident's night-time view, particularly at Denniston in relation to the MFS.

In such an event, I would consider the change to constitute a moderate-high effects at Denniston and a low-moderate effect at Millerton.

In all other respects, I would consider effects to be no more than low.

5.0 STATUTORY REQUIREMENTS

Compliance has been assessed against both the Operative Buller District Plan (**BDP**) and the Te Tai o Poutini Plan decisions version (**TTPP**).

5.1 BDP

The current lighting provisions applicable at the Sites are those presented in Section 7.9 of the BDP.

The relevant parts of section 7.9 of the BDP are shown in Table 7, with an analysis in terms of compliance.

PROVISION	COMPLIANCE
7.9.4. Glare and light spill	
7.9.4.1. All exterior lighting shall be designed, installed and maintained so that:	
7.9.4.1.1. Light emitted does not cause a distraction or glare which could create a traffic hazard on any road, or interfere with the correct operation of navigational aids;	1. MFS: There will be no visibility of any light that could generate noticeable glare on any public road. Fixed lighting will be controlled to avoid glare. Mobile lighting may appear bright when viewed face-on, but mobile light locations will be small in number and located at such a distance that effects will be adequately managed, particularly with the conditions I propose. I have determined from indicative modelling that glare to motorists from any such lighting will be within the 20% TI limit (i.e. glare to motorists) recommended by AS/NZS 4282. [REDACTED] [REDACTED] There are no nearby navigable waterways or airstrips. 2. ESE: There will be no visibility of any light that could generate noticeable glare on any public road beyond the Denniston Plateau. On the Plateau, Denniston Road is at least 1km distant from any proposed lighting. I have determined from indicative modelling that glare to motorists from any such lighting will be within the 20% TI limit recommended by AS/NZS 4282.

	There are no nearby navigable waterways or airstrips. 3. UWHR: No lighting is proposed 4. Stockton North: There will be no visibility of any light that could generate noticeable glare on any public road. The nearest public road, Napier Road, is at least 1km distant from any proposed lighting. I have determined from indicative modelling that glare to motorists from any such lighting will be within the 20% TI limit recommended by AS/NZS 4282. There are no nearby navigable waterways or airstrips. 5. Analysis: In my opinion, the lighting will not create any significant distraction, glare or interfere with navigational aids 6. Compliance: Complies
<i>7.9.4.1.2. There is no adverse effect on residents or activities adjacent to the area being illuminated.</i>	Since any lighting will have some effect, I understand that the intent of this clause is to ensure that there is no significant adverse effect (i.e. a more than minor effect). On that basis; 1. MFS: The closest residences are those at Denniston, at least 2km distant from MFS. The separation distance will ensure that light spill at Denniston residences from MFS activities will be indistinguishable from natural ambient lighting. Glare and associated amenity (i.e. night time views) effects from mobile lighting and possibly fixed lighting may be noticeable to some residents, although it appears likely that topography and vegetation should adequately screen such effects. 2. ESE: The closest residences are those at Denniston, at least 1km distant from any fixed lighting. The separation distance will ensure that light spill at Denniston from ESE activities will be indistinguishable from natural ambient lighting. Glare and associated amenity effects could arise, similar to those noted for MFS. 3. UWHR: No lighting is proposed, other than 1 light at Haul Rd MFS intersection (aimed

	down so the light source is not directly visible). 4. Stockton North: No fixed lighting is proposed. Mobile lighting may potentially be visible from Millerton, which is at least 1km distant, as could be the case for the ELF & PIT at MFS as seen from Denniston, albeit likely smaller in visible extents. However, the conditions I propose will satisfactorily mitigate such effects. 5. Analysis: In my opinion, the lighting may result in moderate-high, or more than minor adverse effects at Denniston, but be low-moderate, or minor elsewhere. 6. Compliance: Complies, with potential exceptions at Denniston
<i>7.9.4.2. Any activity shall ensure that no greater than a 10 lux spill (horizontal or vertical) of light shall enter any adjoining property, measured 2.0 metres inside the boundary of the adjoining site.</i>	As noted above, the light spill at any residence (including any location 2.0m inside the adjoining boundary), will be similar to natural ambient lighting. I have modelled the fixed lighting and determined that the maximum light spill would be approximately 0.1 lux. While mobile lighting, by its variable nature, cannot be accurately quantified, I have undertaken conservative modelling and estimate that spill light will not exceed 0.1 lux (i.e. well within the 10 lux limit). 1. MFS: Light spill will be indistinguishable from natural ambient lighting 2. ESE: Light spill will be indistinguishable from natural ambient lighting 3. UWHR: No lighting is proposed, other than 1 light at Haul Rd MFS intersection (aimed down so the light source is not directly visible). Light spill will be indistinguishable from natural ambient lighting 4. Stockton North: Light spill will be indistinguishable from natural ambient lighting 5. Analysis: Light spill will be less than 10 lux 6. Compliance: Complies

Table 7. BDP Compliance

5.2 TTPP

The proposed lighting provisions applicable at the Sites are those presented in Section LIGHT R1, R3 and R4 of the TTPP. While the TTPP is now operative in part, the LIGHT chapter is under appeal.

The relevant parts of LIGHT R1, R3 and R4 of the TTPP are shown in Table 8, with an analysis in terms of compliance.

PROVISION	COMPLIANCE
LIGHT R1	All Zones: General Permitted Activity Standards
All activities must comply with the following relevant standards: 1. Lighting limits must be measured and assessed in accordance with AS/NZS 4282 Control of the Obtrusive Effects of Outdoor Lighting. 2. For measurement of light levels in NOSZ – Natural Open Space Zone, SETZ – PREC 3 – Settlement Zone – Coastal Settlement Precinct, and in All Zones where the site falls within the Outstanding Coastal Natural Character Overlay, the calculation shall be taken at the property boundary. 3. All exterior lighting shall be directed towards the area within the site that is intended to be illuminated.	1. The lighting has been assessed in accordance with the recommendations in AS/NZS4282:2023. 2. None of the sites are within NOSZ SETZ PREC 3, nor the Outstanding Coastal Natural Character Overlay. 3. All exterior lighting is directed downwards towards where it is required Complies
LIGHT R3	Artificial Outdoor Lighting in all RESZ - Residential Zones, all SETZ - Settlement Zone except the SETZ - PREC 3 - Coastal Settlement Precinct, NCZ Neighbourhood Centre Zone, OSZ - Open Space Zone, and SARZ - Sport and Recreation Zone
<i>1. Outdoor artificial lighting must not exceed the following vertical levels measured at the boundary of the property:</i> <i>i. 7.00am – 10.00pm: 10 Lux; and</i> <i>ii. 10.00pm – 7.00am: 2 Lux;</i>	Some parts of the site will be OSZ. However, since all areas will comply with the more stringent requirements of LIGHT R4, they will also comply with LIGHT R3 Complies
LIGHT R4	Artificial Outdoor Lighting in the GRUZ - General Rural Zone, RLZ - Rural Lifestyle Zone, MPZ - Māori Purpose

	Zone, FUZ - Future Urban Zone, BCZ - Buller Coalfield Zone and MINZ - Mineral Extraction Zone
1. Outdoor artificial lighting must not exceed the following vertical levels measured at the boundary of the property: i. 7.00am – 10.00pm: 5 Lux; and ii. 10.00pm – 7.00am: 1 Lux;	1. All areas: The spill light at any adjoining property boundary or window will be no more than 0.1 lux at any time. Complies

Table 8. TTPP Compliance

5.3 Compliance

In summary, subject to adopting the conditions proposed in this report, the lighting will be compliant with the Permitted Activity requirements in both the Operative Buller District Plan and the Te Tai o Poutini Plan decisions version.

5.4 AS/NZS 4282:2023

Neither the BDP nor the TTPP appear to require compliance with the recommended obtrusive light limits in AS/NZS 4282:2023 (Control of the obtrusive effects of outdoor lighting) (**AS/NZS 4282**). However, the standard is mentioned. Hence, for completeness, I have also assessed compliance in relation to AS/NZS 4282;

- Table 3.1 - Environment Zone: As noted earlier in Table 2, the lighting categories applicable to the sites where lighting is proposed range from A2 to A4. A2 ("low district brightness") is the most stringent of these and for simplicity has conservatively been used for this assessment. The UWHR is category A1, but only 1 light is proposed at the MFS intersection for safe access.
- Table 3.2 – Light technical parameters:
 - Light spill: Not relevant as addressed above under TTPP LIGHT R3 and R4
 - Threshold increment (TI) (i.e. glare to motorists): Recommended $\leq 20\%$. This can only be calculated as it is not measurable. However, from my experience and representative calculations undertaken, I have undertaken a number of representative worst case calculations for the proposed lighting and all have returned a TI of 0%.
 - Upward Light Ratio: Recommended $\leq 1\%$. This limit applies in aggregate to all lighting in an installation. I observed that the majority of lighting is tilted down with little upward tilt. In my opinion, the lighting will comply with this requirement.
- Table 3.3 – Maximum luminous intensity: Recommended $\leq 1,000$ candelas (cd) during curfew hours (i.e. the most stringent). This can only be calculated as it is not practical to site measure. The most prevalent form of lighting will be mobile lighting towers which will be moved regularly as required throughout the sites and then aimed as required. It is therefore not possible to calculate every potential configuration that may occur. However, I have considered the

potential dispositions and am of the opinion that the lighting will comply with the 1,000cd limit, provided the conditions proposed in this report are adopted.

4. Table 3.4 – Maximum luminance of surfaces: Not applicable. This table relates to lighting of signs and highlighting building facades, none of which is relevant in this instance.

Hence, while compliance with the recommended obtrusive light limits in AS/NZS 4282 does not appear to be required by either the BDP or the TTPP, in my opinion the recommended limits will be satisfied.

6.0 ENVIRONMENTAL EFFECTS

I have considered the potential effects of the lighting required as part of the Project with respect to potential sensitive receivers (**Observers**).

Observers could include:

- Occupants of residential dwellings with direct visibility of the Sites (**Residents**)
- Motorists on public roads (**Motorists**)
- Nocturnal biota (**Biota**)
- Visitors (**Stargazers**)

This section of my report addresses the potential effects of lighting on Observers, including:

- relevant site observations;
- categories of potential effects; and
- an assessment of the effects.

The Quality Planning website proposes a scale¹ as below for the determination of adverse effects. I have added an abbreviated expression in square brackets to simplify the reference to each category for brevity;

- **Nil Effects [Nil]**
No effects at all.
- **Less than Minor Adverse Effects [Less than minor]**
Adverse effects that are discernible day-to-day effects, but too small to adversely affect other persons.
- **Minor Adverse Effects [Minor]**
Adverse effects that are noticeable but will not cause any significant adverse impacts.
- **More than Minor Adverse Effects [More than minor]**
Adverse effects that are noticeable that may cause an adverse impact but could be potentially mitigated or remedied.
- **Significant Adverse Effects that could be remedied or mitigated [Significant]**
An effect that is noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied.
- **Unacceptable Adverse Effects [Unacceptable]**
Extensive adverse effects that cannot be avoided, remedied or mitigated.

Working within the context of the above definitions, I have correlated these planning terms with my view of technical effects, to provide a technical effect rating as shown in Table 9.

¹ Quality Planning – Determining the extent of adverse effects
(<https://www.qualityplanning.org.nz/node/837>)

EFFECT RATING	PLANNING DETERMINATION
Very high	Significant
High	Significant
Moderate-high	More than minor
Moderate	More than minor
Low-moderate	Minor
Low	Less than minor
Negligible-very low	Less than minor

Table 9. Technical vs planning effects terminology

As noted in the BRL Project Description, operations will occur 24/7. Operational fixed lighting on buildings and static lighting columns will be on all night to ensure safe use, orientation, early recognition of obstructions, hazards and people and for safe movement of staff.

Sensor lighting has been considered but is not viewed as a suitable approach for these reasons. The fixed lighting duration will change throughout the year as the length of night varies – approximately 15 hours in mid-winter to 9 hours in mid-summer.

Vehicles and mobile plant with associated navigation, work and safety lighting will operate throughout the night, moving through the site as required to suit the nature of their activities. Mobile lighting towers will operate throughout the night – typically at current excavation locations and at significant bends/intersections of roads within the site.

6.1 Site Visit Observations

I undertook daytime observations of the existing Stockton mine site, the Denniston Plateau (including the Escarpment extents, local roads & residential areas) and the area near sea level between Westport and Ngakawau on 21-22/01/2025. I also visited all areas other than Denniston on the evening of 21/01/2025 to appreciate existing lighting effects.

There is currently no night-time mining activity visible from Denniston. While I viewed the southern point of commencement of the Haul Road, the remainder was neither practical to access, nor relevant as there is no existing lighting. Similarly, there is no existing lighting at MFS and access was impractical. Hence, these areas were not visited.

I make reference to dim moonlight below. Moonlight can vary from Nil (i.e. a moonless night) typically up to 0.5-1 lux (i.e. full moon). As examples, for locations at 2km from the Sites, I estimate a maximum of 0.1 lux. As distance increases, spill light decreases.

In particular, for the proposed lighting at the Sites, I observed;

- MFS:
 - Residents at Denniston may have views of fixed and mobile lighting. Fixed lighting will not be visible beyond the Denniston Plateau. Mobile lighting may be visible from more distant locations including Westport and locations further north through to Waimangaroa.
 - The lighting will be at least 2km distant from any residence, ensuring that light spill will be similar to dim natural ambient light (i.e. moonlight & starlight).
 - Glare from mobile lighting may be experienced and night-time views may be affected.
 - Effects will be moderate-high in my opinion.
- ESE:
 - On the Denniston Plateau, lighting will also mostly be concealed by topography with respect to local residences and those residences typically appear to have their dominant view away from the Escarpment and/or are screened by topography and/or vegetation. However, there could be some views of fixed lighting from locations in Denniston.
 - Mobile lighting, especially when present at higher elevations near the ELF & PIT perimeter, could be visible from Denniston and from some more distant locations including Westport and locations further north through to Waimangaroa.
 - At Denniston, some glare from mobile lighting may be experienced and night-time views may be affected, albeit both to a lesser degree than effects anticipated from MFS.
 - The lighting will be at least 1km distant from any residence, ensuring that light spill will be similar to dim natural ambient light (i.e. moonlight & starlight).
 - The separation distances and restricted visibility due to topography, together with the conditions I have proposed, will ensure that any effects will be low-moderate in my opinion.
- UWHR:
 - The proposed route is through a valley, well below Denniston and thereby below typical views from residences. The route will also mostly be concealed from view by topography and vegetation.
 - While there is a small chance that vehicles on the Haul Road might be visible in some locations from some residences in Denniston, the angle of view would ensure that if this occurs, any effects will be very low in my opinion.
 - T [REDACTED]
[REDACTED]
[REDACTED]
 - The UWHR is not visible from any residential location beyond the Denniston Plateau.
- Stockton North:

- There could be limited visibility of mobile lighting from some residences at Millerton. The dense vegetation surrounding many residences may be sufficient to screen any such views but some may still have a view.
- The lighting will be at least 1km distant from any residence, ensuring that light spill will be similar to dim natural ambient light (i.e. moonlight & starlight).
- Glare from mobile lighting may be experienced, particularly if mobile lighting towers are located near the northern edge, and night-time views may be affected to a moderate degree.
- There could also potentially be distant views of the lighting from coastal areas such as Granity, Ngakawau and Hector, some 2-4km distant, with Granity being the closest at 2km. Light spill will be similar to dim natural ambient light (i.e. moonlight & starlight).
- The separation distances and restricted visibility due to topography and vegetation, together with the conditions I have proposed, will ensure that any effects will be low-moderate in my opinion.
- General:
 - When looking from darker locations near Westport, a very faint skyglow was evident above Stockton. A similar effect may be seen above ESE and or MFS.

6.2 Residents

While not all types of obtrusive light effects will necessarily affect Residents, the following potential effects have been considered;

1. **Sky glow:** Light scattered in the atmosphere reducing visibility of the night sky;
2. **Light spill:** Direct light trespass, as measured in lux, typically at the window of a dwelling;
3. **Glare:** Brightness of a light source when viewed in contrast to the immediate surrounds;
4. **Amenity:** Views of the night sky; and
5. **Health:** Sleep disturbance & seizures.

Light spill is governed by the requirements of the BDP and potentially the TTPP. Glare and sky glow are recommended by a standard (AS/NZS 4282:2023). Amenity and health effects are good practice elements assessed by expert opinion.

Sky Glow

Sky glow is typically noticed as the glow visible above an artificial lighting installation at night when viewed from a distance, as a result of direct and reflected upward light from artificial lighting, striking particles in the atmosphere and scattering the light.

The sky glow from the Site lighting will be negligible.

Hence, sky glow effects on Residents will be negligible, or less than minor.

Light Spill

The nominal illuminance (spill light) at the window of a dwelling from a point source can be calculated by the formula;

$$E = I/d^2 \text{ (E=Illuminance, I=Luminous Intensity, d=distance)}$$

In other words, spill light reduces geometrically with distance from the light source.

I have modelled potential spill light effects as discussed elsewhere in this report and believe that spill light will be less than 0.1 lux.

Spill light at locations other than the Denniston Plateau will be less than starlight (i.e. nominally less than 0.001 lux).

Hence, in my opinion, light spill effects to Residents will be negligible to low, or less than minor.

Glare

Glare (luminous intensity) will vary with viewing angle but not distance.

As viewed during my site visit, effects from current mining activities at Stockton were negligible to low. In my opinion, effects from MFS and ESE would be similar for residents beyond the Denniston Plateau.

Visibility of lighting at MFS and ESE will be greater for Denniston residents. The MFS in particular may also occupy a significant portion of night-time views.

While it is true that the numerical value of luminous intensity does not vary with distance, the actual effect of the apparent brightness does lessen as distance increases, since the light source occupies a progressively smaller part of the view.

A comparison could be made with our Sun. It is a star, with a similar size and order of brightness as many others we see in the night sky. However, our Sun is much closer than the other stars and thereby too bright to look at directly. Whereas other more distant stars are comfortable to view.

Mobile lighting towers will typically be aimed toward the working area, rather than towards distant residences, so effects will be lessened. Lights attached to mobile plant and vehicles tend to be transient in nature as they move with the plant/vehicle.

In my opinion, glare effects to Residents at Denniston may be moderate-high, at Millerton Low-moderate and elsewhere low-very low.

Amenity

When considering enjoyment of views of the night sky, the existing lighting environment is typically the limiting factor.

There will be very little or no perceptible change to night sky viewing beyond the Plateaux. At Denniston, there could be some loss of night sky visibility, particularly when facing directly towards the MFS or ESE lighting. Similarly at Millerton, when facing Stockton North.

In my opinion, amenity effects to Residents will be;

- a. Denniston & Millerton: Low to moderate, or no more than minor
- b. Elsewhere: Negligible, or less than minor

Health

Excess light at night can negatively affect sleep. However, there will be minimal lighting visible from residential locations as described above, no permanent persistent flashing lights and the lighting complies with the BDP and TTPP light spill provisions.

Denniston residents may potentially experience some sleep disturbance from glare effects and possibly from distant views of flashing safety lighting as plant and vehicles move within the MFS and ESE. However, should the resident choose to screen the night-time view with blinds, curtains or the like, then any such effects would be mitigated. This may also be possible at Millerton, although less likely in my opinion.

In my opinion, the effects on health to Residents will be negligible, or less than minor. However, in the case of residents at Denniston and Millerton, screening as described to mitigate sleep disturbance may be helpful.

Summary of effects of Residents

In my opinion, lighting effects to residential locations could be moderate-high.

6.3 Motorists

While not all types of obtrusive light effects will necessarily affect Motorists, the following potential effects have been considered:

1. **Glare:** The relative brightness of a light source in the driver's field of view and the potential of this to affect vision; and
2. **Distraction:** The potential for a flashing light to distract the driver's attention.

Glare

An analysis of glare effects to motorists is like that for Residents. The effect will lessen with distance due to the reduction in the size of the light source in the motorist's view.

Provided the conditions I propose are adopted, lighting effects to public road users will be satisfactorily mitigated.

Glare to motorists is evaluated by the term Threshold Increment (**TI**). AS/NZS 4282:2023 recommends a maximum TI of 20%. TI is primarily related to the visibility of the main beam of each luminaire, for fixed lighting other than minor security/access lighting, the luminaires will be aimed down and not directly visible from the road. Hence, the TI will be near or at 0%.

As previously mentioned, mobile lighting will typically be aimed at the workplace rather than roads. Nonetheless, the separation distance and mitigation afforded by the conditions I propose, are such that TI will be well below the recommended 20% limit.

In my opinion, glare effects to Motorists will be negligible, or less than minor.

Distraction

Flashing lights can be distracting to a motorist. This would be particularly so in an otherwise dark environment.

Mobile plant and equipment that will be used at the Sites will use flashing safety warning lights, but they will be mostly concealed from view from public roads by topography and vegetation. Should any become visible, the separation distances, will ensure that any effects are negligible.

Hence, in my opinion, distraction effects to Motorists will be negligible, or less than minor.

Summary of effects on motorists

In my opinion, effects to motorists will be negligible, or less than minor.

6.4 Biota

I have liaised with Ecological Solutions Ltd and understand that they are of the view that, when considering lighting effects on fauna, resident nocturnal birds such as rōroa (Great spotted kiwi) and ruru (morepork), as well as passing seabirds, along with bats and night active insects, could be most affected. I agree with that view.

Ecological Solutions Limited (2025a)² have concluded that there are no bats using the Project Area.

They have advised:

- With respect to seabirds, no seabird grounding or other affected seabird has ever been recorded at Stockton Mine, strongly indicating the current lighting management is sufficient to avoid effects on seabirds.
- Radio-tracking has revealed that resident rōroa adjust their home ranges in response to vegetation clearance and are very unlikely to be affected by fixed lighting or lighting within active pits.
- Ruru are likely to be similarly displaced, but may be attracted to lights for feeding on insects which are also attracted to light. This does not necessarily constitute an adverse effect.
- Mobile lighting (on vehicles) does pose a particular risk to rōroa crossing roads, and the effects of that are mitigated by managing speed limits and sight distances

² Ecological Solutions Limited. 2025a. Buller Plateaux Continuation Project - Terrestrial Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited. November 2025. Ecological Solutions Limited, Kāeo. 101pp plus appendices.

(Ecological Solutions Limited 2025b)³. Rōroa are regularly recorded crossing roads at Stockton Mine and only two fatalities have ever been recorded. Effects on invertebrates have not been quantified anywhere in New Zealand to our knowledge, but management actions intended to minimise effects on other fauna (including use of lighting in the appropriate spectrum, directional focus and shielding of lighting, only using lighting where and when required and the like) is also expected to reduce effects on insects.

- Lighting effects are expected to be negligible.

I have considered the above with respect to lighting effects and agree with that view.

In addition, I have reviewed the Aquatic Ecology report prepared by Earth Sciences New Zealand⁴
They have advised:

- Artificial lighting at night disrupts the natural light-dark patterns of ecosystems and documented effects of artificial light on freshwater ecosystems include impacts on plant growth and composition as well as diverse changes to movement and behaviour patterns of fish and macroinvertebrates (e.g., Greenwood 2024). Light is an attractant for adult aquatic (and terrestrial) winged insects and may also disrupt nocturnal behaviours of aquatic organisms, such as migration and feeding patterns, if the lighting is located close to a waterway.
- Light disturbance should be actively managed to minimise adverse effects, using recognised standards and plan provisions that address the impacts of artificial lighting on wildlife and natural character. The proposed Buller District Plan—including the Te Tai o Poutini Plan—provides region specific policies and rules to reduce artificial light impacts on the West Coast. In general, the impacts of light at night can be reduced by having lights on only when necessary, at the lowest safe illumination and at a maximal distance from waterways or wetlands. Where possible lights should be directed away from waterways or screened to not directly illuminate the water surface. Short wavelength light (e.g., ultraviolet or blue light) penetrates water further than longer wavelengths (e.g., orange or red) and has been linked with many ecological effects. Using lights with limited blue light (warmer colours and lower kelvin temperature colour ratings) are recommended and also required under the proposed District Plan.
- Recommended effects management: Artificial lighting structures should be designed, where practicable, to reduce attractiveness to adult winged insects.

³ Ecological Solutions Limited. 2025b. Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review. Unpublished report prepared for Bathurst Resources Limited. November 2025. Ecological Solutions Limited, Kāeo. 36pp.

⁴ Earth Sciences New Zealand. 2026055CH. Buller Plateaux Continuation Project – Assessment of Environmental Effects: Aquatic Ecology. Unpublished report prepared for Bathurst Resources Limited. March 2026. Earth Sciences New Zealand, Christchurch. 144pp.

In response, I agree with the above views and note as follows:

- In relation to coverage area of the project, there will be only a small portion where fixed lighting is present. By virtue of the proposed conditions, the fixed lighting will:
 - o Be the minimum required for safe access and operation;
 - o Have a nominal colour temperature no greater than 2700K; and
 - o Be directed down, with no upward tilt and selected to ensure no more than 1% direct upward light is emitted, or
 - o Be selected to ensure that the maximum luminous intensity from any luminaire, in any direction, does not exceed 1,000 candelas.
- MLTs will be used as required, typically to illuminate work faces. It is impractical to place limitations on their use with respect to Aquatic Ecology in general and adult winged insects in particular. However, there will only be a small portion of the coverage area of the project where MLTs will be in use at any time and rarely in the vicinity of waterways or wetlands.

Hence, with respect to Aquatic Ecology, it is my view that the proposed lighting will be consistent with the above recommendations as far as practical and that any effects will be negligible-low.

6.5 Visitors

The introduction of the proposed lighting will likely reduce visibility of the night sky for people visiting the Plateaux intending to star gaze, mainly due to atmospheric scattering of lighting at the sites. Quantifying the effects in terms of numerical values is not possible given the variables such as mobile lighting.

However, as a lighting specialist and amateur astronomer, I am of the opinion that it would be possible to find readily accessible locations on the Plateau where the reduction in night sky visibility due to the introduction of the proposed artificial lighting, may be limited to approximately 1-2 magnitudes in terms of visibility of astronomic phenomena.

Hence, any such effects would be very low-low in my opinion.

6.6 Overall Summary of effects

In my opinion, effects from the lighting will be;

- a. Denniston: Moderate-high, or more than minor
- b. Millerton: Low-moderate, or minor
- c. Elsewhere: Negligible-low, or less than minor

7.0 MITIGATION MEASURES

7.1 Proposed conditions

To satisfactorily manage lighting effects from the BPCP, I recommend the following conditions be included if consent is granted;

LIGHTING

1. *Establish a Lighting Management Plan (LMP) that includes the following requirements;*
 - a) *Mobile lighting towers: A mobile lighting tower (MLT) shall;*
 - i. *Be no taller than 12m,*
 - ii. *Not be aimed directly towards any residence or public road nearby the sites as follows;*
 - *At both the Escarpment and Mount Frederick South relative to residents and public roads on the Denniston Plateau, and*
 - *At Stockton North relative to residences and public roads within Millerton*
 - b) *Fixed Lighting: Where fixed lighting (i.e. lighting mounted on buildings, static structures, lighting columns or the like) is visible from any residential property or public road, it shall;*
 - i. *Be the minimum required for safe access and operation;*
 - ii. *Have a nominal colour temperature no greater than 2700K; and*
 - iii. *Be directed down, with no upward tilt and selected to ensure no more than 1% direct upward light is emitted, or*
 - iv. *Be selected to ensure that the maximum luminous intensity from any luminaire, in any direction, does not exceed 1,000 candelas.*
 - c) *Vehicle lighting:*
 - i. *Vehicles using the UWHR and operating within the Sites must use dipped headlights whenever it is safe to do so*
 - ii. *Vehicles using public roads on the Denniston Plateau must use dipped headlights whenever it is safe to do so, and*
 - iii. *Vehicle mounted flashing safety lighting shall not be used on public roads.*

8.0 CONCLUSION

Overall, provided the conditions I propose are implemented, it is my opinion that lighting effects will be;

- | | |
|---------------|------------------------------------|
| a. Denniston: | Moderate-high, or more than minor |
| b. Millerton: | Low-moderate, or minor |
| c. Elsewhere: | Negligible-low, or less than minor |