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BENDIGO OPHIR GOLD PROJECT

Assessment of Cosgroves Resource Consent Issue Exterior Lighting Report

Prepared for: Central Otago District Council

Revision: C

11 March 2026

Quality Assurance Statement

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Document Status

Revision	Date	Description
A	29/08/2025	Preliminary
B	04/03/2026	Updated to reflect Resource Consent Submission - DRAFT
C	11/03/2026	Updated to include assessment of recommended Resource Consent conditions

Distribution

Revision	Date	Issued to
A	29/08/2025	Anne Rodgers, CODC
B	04/03/2026	Anne Rodgers, CODC
C	11/03/2026	Anne Rodgers, CODC

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Executive Summary

Pedersen Read have undertaken an independent technical review of the Resource Consent Issue Exterior Lighting Report (September 2025, Rev E) prepared by Cosgroves for the Bendigo Ophir Gold Project (BOGP), on behalf of the Central Otago District Council.

Revision A of this assessment identified several matters requiring further clarification at pre-lodgement stage. This report assesses how the issues identified pre-lodgement have been addressed in the Resource Consent Issue version of the Exterior Lighting Report. A summary of the potential lighting issues identified pre-lodgement and how they have been subsequently addressed in the Resource Consent Issue Exterior Lighting Report is included in the below table:

Effect Category	**Summary of identified limitation (pre-lodgement)**	**Summary of effect – Resource Consent version**	**Assessment of Adequacy in Resource Consent Application**
Spill Light	No use of AS/NZS 4282 benchmark; assessment limited to basic compliance with District Plan	AS/NZS 4282:2023 adopted as the primary assessment standard. Detailed compliance modelling to be undertaken at detailed design stage. Compliance with District Plan spill limits anticipated.	Partially Addressed We recommend an additional mitigation regarding confirming the proposed environmental zone.
Glare	Not explicitly assessed; no mention of mitigation through aiming angles or shielding	Explicitly addressed through directional lighting strategy, use of optically controlled luminaires, shielding, and landform screening. Effects expected to reduce as pits deepen and landforms develop.	Adequately Addressed
Sky Glow	Considered only under Dark Sky Reserve guidelines; lacks empirical analysis	Zero upward waste light ratio (UWLR) luminaires proposed. Directional lighting and avoidance of unnecessary floodlighting described. Sky glow effects expected to be minimised subject to implementation.	Adequately Addressed
Construction Lighting	Generally omitted from consideration	Construction-phase lighting now explicitly addressed, including mobile lighting rigs and inward orientation. To be managed through Lighting Management Plan and consent conditions.	Adequately Addressed
Ecological Impact	No linkage to ecological studies or recognised wildlife lighting protocols	Lighting mitigation measures aligned with ecological management plans, including 3000K colour temperature (where practicable) and directional control away from sensitive habitats.	Adequately Addressed
Visual Amenity	Visibility of lighting from surrounding environs is omitted.	Night-time visibility considered in context of project staging, landform development, and visual simulations. Effects expected to vary by stage but capable of mitigation.	Adequately Addressed

As shown in the above table, the matters identified during the pre-lodgement review have been substantively addressed in the Resource Consent Issue lighting report. However, detailed lighting modelling has not yet been undertaken and will occur during the detailed design stage. Appropriate Resource Consent conditions are therefore required to ensure that the proposed lighting design and mitigation measures are implemented and verified.

In addition, this report reviews the proposed Resource Consent conditions relating to lighting as provided by the applicant. The adequacy of these conditions is assessed against the mitigation measures identified in this report, and a set of recommended amendments to the consent conditions is provided to ensure that the lighting mitigation measures relied upon in the assessment are clearly secured through enforceable provisions.

Subject to the implementation of the recommended consent condition amendments outlined in this report, residual lighting effects are assessed to be less than minor to minor, depending on staging and implementation.

On that basis, no outstanding lighting matters of concern are identified at the Resource Consent Stage.

Contents

Appendices

Tables

Figures

1. Introduction

Pedersen Read have reviewed the proposed Exterior Lighting for the Bendigo Ophir Gold Project (BOGP) at various stages of the Resource Consent application.

- Revision A (29/08/2025) of this report reviewed the application pre-lodgement and identified areas of concern with the application.
- Revision B (04/03/2026) of this report assessed how the issues identified pre lodgement have been addressed in the lodged Resource Consent application.
- Revision C (this report) provides an additional evaluation of the proposed Resource Consent conditions.

This assessment has been undertaken by Kate Macdonald of Pedersen Read Limited, consulting electrical engineers.

Kate holds a Bachelor of Engineering (Hons), Electrical and Electronic, and is a Chartered Professional Engineer (CPEng) and Chartered Member of Engineering New Zealand (CMEngNZ).

The review has been carried out through examination of the submitted Resource Consent lighting documentation, with specific reference to the concerns identified during the pre-lodgement review.

A site visit to the proposed mine location was undertaken by Andrew Read on 31 July 2025. The visit included inspection of the mine site and surrounding landscape to inform understanding of the site context and visibility.

In addition to reviewing the updated lighting assessment documentation, this report also evaluates the proposed Resource Consent conditions relating to lighting submitted by the applicant. The adequacy of these conditions is assessed against the mitigation measures identified in this report, and recommended amendments are provided where necessary to ensure that lighting effects are appropriately managed through enforceable consent provisions.

2. Assessment Scope and Methodology

2.1 Background

Pedersen Read was initially engaged to review the Exterior Lighting Report prepared by Cosgroves (May 2025, ref CQ24020) as part of the pre-lodgement review of the Bendigo Ophir Gold Project fast-track application.

Following preliminary review, Pedersen Read provided feedback and technical queries to Central Otago District Council (CODC), which were subsequently raised with the applicant as part of the pre-lodgement completeness review. In response, Cosgroves issued a design memorandum dated 25 July 2025 addressing the matters raised.

Revision A of this assessment considered the pre-lodgement Exterior Lighting Report and associated design memorandum.

The current Revision C report (this report) builds on the revision B assessment of the Exterior Lighting Report submitted as part of the Resource Consent application (September 2025) and also includes an assessment of the proposed Resource Consent conditions. The purpose of this revision is to evaluate how the matters identified during pre-lodgement review have been addressed within the Resource Consent documentation and how the proposed Resource Consent conditions capture the intent of the application.

2.2 Assessment Methodology

This assessment has been undertaken through technical review of the updated Exterior Lighting Report submitted as part of the Resource Consent application (September 2025), together with associated documentation relevant to lighting effects.

The methodology for this review has involved:

- Consideration of the matters identified during the pre-lodgement review (Revision A of this report) and evaluation of how the identified concerns have been addressed within the Resource Consent documentation.
- Review of the proposed lighting strategy.
- Assessment of the alignment of the updated Cosgroves report with recognised industry standards and best practice guidance.
- Assessment of the proposed Resource Consent conditions provided by the applicant.
- Consideration of the site context informed by the July 2025 site visit by Andrew Read.

Key references include:

- AS/NZS 4282:2023 – Control of the Obtrusive Effects of Outdoor Lighting.
- National Light Pollution Guidelines for Wildlife (Australia, 2023).
- Local and regional planning frameworks (e.g., Central Otago District Plan).
- The Boffa Miskell Landscape, Natural Character and Visual Effects Assessment (for context regarding visibility and staging).
- The proposed Resource Consent conditions provided by the applicant.

Refer to Appendix B Bibliography for the list of documents and activities that have formed this review.

3. Review of Updated Resource Consent Exterior Lighting Report (September 2025)

3.1 Overview

Pedersen Read has reviewed the updated Exterior Lighting Report – Resource Consent Issue (September 2025, Rev E) prepared by Cosgroves for the Bendigo Ophir Gold Project (BOGP). This review considers the extent to which matters identified during the pre-lodgement review have been addressed.

The updated report includes additional material relating to adoption of AS/NZS 4282:2023, construction-phase lighting, mobile and vehicular lighting, visibility and amenity effects, and ecological considerations.

3.2 Adoption of AS/NZS 4282:2023

The updated report confirms that AS/NZS 4282:2023 will be used to inform lighting design and assessment of obtrusive effects. This addresses the pre-lodgement concern that the earlier report relied primarily on District Plan spill limits.

At this stage the report describes intended methodology rather than completed modelling. Demonstration of compliance will occur during detailed design and should be secured through enforceable consent conditions.

The Resource Consent Exterior Lighting Report indicates that the lighting designer has adopted Environmental Zone A2 (low district brightness) for the purposes of the lighting assessment. However, given the remote location of the BOGP site and the absence of existing artificial lighting in the surrounding environs, the area could reasonably be interpreted as Environmental Zone A1 (Dark) under AS/NZS 4282:2023.

The absence of existing artificial lighting, the remote location of the site within the Dunstan Ranges, and the surrounding predominantly natural landscape character are all consistent with the description of Environmental Zone A1 under AS/NZS 4282:2023.

The applicable environmental zone has implications for the allowable limits on obtrusive lighting parameters such as spill light, glare and upward light ratio.

Given this uncertainty, it is recommended that a Resource Consent condition require confirmation of the applicable AS/NZS 4282:2023 environmental zone by CODC prior to the commencement of detailed lighting design, with the final lighting design requiring to comply with the confirmed environmental zone.

3.3 Construction Phase Lighting

The updated report explicitly addresses construction-phase lighting, including use of customised mobile lighting rigs, inward orientation, and limiting lighting to active areas. Subject to implementation through a Lighting Management Plan (LMP), construction lighting effects are considered capable of being appropriately managed.

This addresses the pre-lodgement concern that the earlier report did not adequately address construction-phase lighting effects.

3.4 Visibility and Amenity Effects

The updated report includes a dedicated section addressing visibility and amenity effects, with reference to project staging and landform development. Mitigation measures include zero upward waste light ratio (UWLR) luminaires, directional lighting, and use of controls in non-operational areas.

This addresses the pre-lodgement concern that the earlier report did not address the public visibility of night-time lighting of the site.

3.5 Ecological Considerations

The updated report references ecological management plans and includes mitigation measures such as 3,000K colour temperature (or lower where practicable), directional lighting away from sensitive habitats, and minimisation of unnecessary overnight lighting.

This addresses the pre-lodgement concern that there was a lack of coordination between the proposed lighting strategy and the ecological assessments.

3.6 Summary of review

The Resource Consent version of the lighting report addresses the technical concerns raised during the pre-lodgement review. Subject to detailed modelling and enforceable consent conditions, lighting effects are capable of being appropriately managed.

3.7 Summary of Effects

The below table summarises the potential lighting issues identified pre-lodgement, and how these issues have been addressed in the Resource Consent version of the Exterior Lighting Report prepared by Cosgroves.

Effect Category	Summary of identified limitation (pre-lodgement)	Summary of effect – Resource Consent version	Assessment of Adequacy in Resource Consent Application
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Table 1 - Summary of Effects

4. Situation

The BOGP is a proposed open cast mine, located in the Dunstan ranges, approximately 20km south of Cromwell. The Dunstan Ranges are visually dominant in the Central Otago landscape, presenting a highly natural and remote character. They contrast sharply with the irrigated farmland and viticultural areas of the Clutha Basin below.

The BOGP proposed mine site is located on Thomson Gorge Road, which is nearby to the following Department of Conservation (DOC) Public Reserves and Conservation Land:

- Bendigo Historic Reserve,
- Bendigo Scenic Reserve,
- Bendigo Conservation Area,
- Ardgour Conservation Area,
- Neinei i kura Conservation Area, and
- Dry Creek Conservation Area.

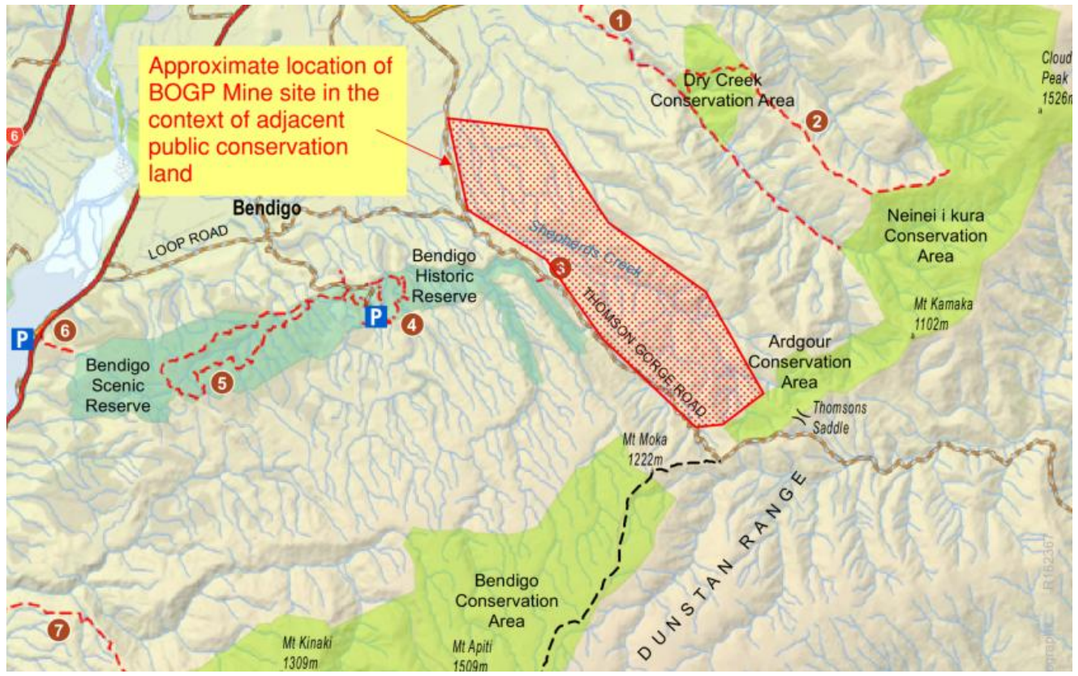

Figure 1 - BOGP site in context of DOC Reserves and Conservation Areas

4.1 Visibility of BOGP

The Boffa Miskell Landscape, Natural Character and Visual Effects Assessment report describes the visibility of the mine from various local vantage points.

Specific points to note regarding the visibility of various parts of the site are as follows:

- The main process plant will be at the bottom of the Shepherd's Creek. This location is surrounded by hills, even at the bottom of the valley where the river dog legs through the hills. The main plant should therefore be completely hidden from direct view outside of the site.
- The site admin and camp area is on flat ground to the front of the site and will be visible from outside of the site but not from far away as it will be behind an existing escarpment. Some local properties will be able to see it.
- The main pits that are to be excavated will be visible until they disappear into themselves.

4.2 Existing Lighting Environment

Andrew Read's site visit on 31st July 2025 used the Boffa Miskell Landscape, Natural Character and Visual Effects Assessment report VS drawings as the basis for a late afternoon and dusk tour around the region to view the site from a lighting perspective (3:30pm to 6:30pm), Temp 3 – 6 °C, high overcast cloud, minimal wind, Sunset 5:38pm, Blue Hour 5:51pm to 6:33pm. Figure 2 below shows a photo of the mine area taken from viewpoint 9 in the Boffa Miskell report, the photo was taken during the blue hour at 6:15pm, 37 minutes after sunset. Figure 3 below shows the corresponding visual simulation from viewpoint 9 in the Boffa Miskell Landscape, Natural Character and Visual Effects Assessment report. This viewpoint is from State Highway 8, Bendigo, approximately 10km from Battery Hill Trig B10D in the centre of the mine site.

As the BOGP site is a potential location for a future mine, there is no existing artificial lighting at the site. Figure 2 below demonstrate the lack of observable lighting as viewed from this view point. Figure 2 is indicative of all of the view points observed during the site visit. The hillside presents as dark.

Figure 2 - Dusk view from viewpoint 9 in the Boffa Miskell Landscape, Natural Character and Visual Effects Assessment report. Photo taken during blue hour at 6:15pm, 37 minutes after sunset.

Figure 3 - Visual Simulation of mine area from viewpoint 9 from Boffa Miskell Landscape, Natural Character and Visual Effects Assessment report

The environmental zones (AS/NZS 4282: 2023 Table 3.1 "Environmental Zones") potentially applicable to the BOGP site are as follows:

Environmental Zone A1: Described as

- "Dark" with examples: Relatively uninhabited rural areas…generally roadways without streetlighting through rural areas.

In considering the location of the BOGP site and its environs, the location could be assessed as Zone A1. Note that this interpretation of the recommended environmental zone differs to the lighting designer's proposed environmental zone of A2, which is defined as:

Environmental Zone A2: Described as

- "Low district brightness" with examples: Sparsely inhabited rural and semi-rural areas.

For reference, table 3.1 of AS/NZS 4282:2019 describing the various environmental zones is included below as Figure 4. Final confirmation of the applicable environmental zone should be undertaken at detailed design stage.

Table 3.1 — Environmental zones

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 for dark sky places for example astrotourism, 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) Generally roadways without streetlighting through rural 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.		

Figure 4 - AS/NZS4282:2023 Table 3.1 describing environmental zones

4.3 Anticipated Lighting Environment

A plan of the proposed site layout is included below as Figure 5. The Cosgroves Exterior Lighting Report provides a high-level description of the lighting strategy by area for the Camp Area, the Office Area, The Plant and Infrastructure Area and the Access Roads and Operational Mining Areas.

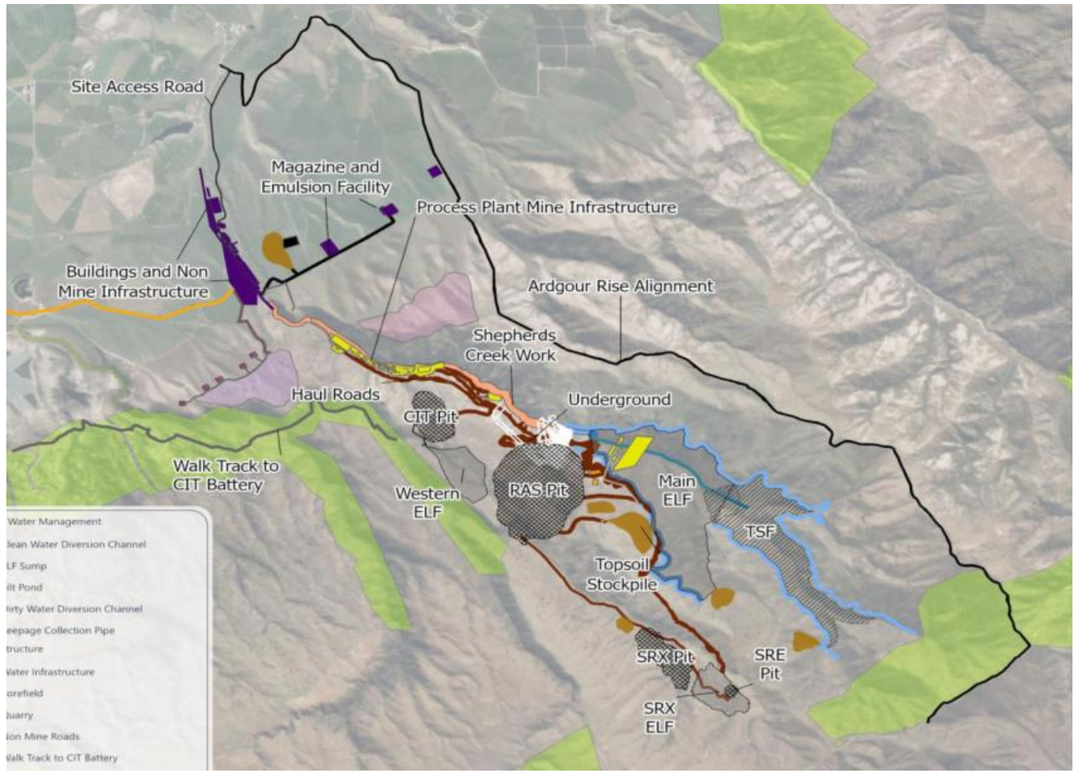

Figure 5 - Part Plan of the proposed site layout from the project description

4.3.1 Camp and Office Area

The lighting strategy from the Exterior Lighting Report proposed for the camp and office area is to utilise discrete and low-output building mounted lighting, supported by bollards or similar if/where required for safe orientation around the area. Uncontrolled floodlighting, for example, will not be used.

It is noted that the camp and office area of the site is on flat ground to the front of the site and will be visible from outside of the site but not from far away as it will be behind and existing escarpment. Some local properties will be able to see it.

4.3.2 Plant and Infrastructure Area

The lighting strategy from the Exterior Lighting Report for the plant and infrastructure area is to use a combination of fixed and mobile wide area lighting, and it is noted that light fitting specifications will be selected to comply with Resource Consent requirements.

It is noted that the location for the plant and infrastructure area will be at the bottom of the Shepherd's Creek. This location is surrounded by hills, even at the bottom of the valley where the river dog legs through the hills. The main plant should therefore be completely hidden from direct view outside of the site.

4.3.3 Access Roads and Operational Mining Area

The lighting strategy from the Exterior Lighting Report for the plant and infrastructure area is to use mobile wide area lighting, and it is noted that light fitting specifications will be selected to comply with Resource Consent requirements.

Furthermore, the follow-up memo states that in terms of assessment and demonstrating compliance of construction-phase lighting, it is proposed that an 'example' installation would be modelled and a set of working guidelines would be produced for the on-site team to follow when setting up temporary construction-phase lighting.

In general, it is expected that mobile lighting plant will be used across the site wherever excavation and dumping is undertaken, and points on the haul road as required for safety. Other lighting will be from the vehicles themselves as they move through the site i.e. vehicles on haul roads and other site tracks. In the early days before the RAS pit becomes a hole in the ground with walls around it, you may also be able to see the task and headlights from diggers loading the haulage trucks. Mobile plant is likely to have normal vehicle head and tail lights, probably flashing beacons for safety, and possibly task lighting (at the front for diggers and at the back for haulage trucks). There will be an underground mine shaft which will most likely have lighting around and adjacent to the portal

4.4 Potential Lighting Effects

The impact of artificial lighting on the night-time environment is defined in AS/NZS 4282:2023 as the following effects:

- Spill Light:
"*Light emitted by a lighting installation that falls outside the boundaries of the property for which the lighting installation is designed*".

- Glare:
A "*Condition of vision in which there is discomfort or a reduction in ability to see, or both, caused by an unsuitable distribution or range of luminance, or to extreme contrasts in the field of vision*".

- Sky Glow:
The *"brightening of the night sky that results from the reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere (gas molecules, aerosols and particulate matter), in the direction of observation"*.

4.4.1 Spill Light Effects

The Exterior Lighting Report prepared by Cosgroves does assess spill light compliance under Rule 12.7.6 of the District Plan, which states that:

> *No activities shall result in greater than 10 lux spill (horizontal and vertical) of light onto any adjoining property or road,…The amount of light that may be spilled onto a neighbouring property may be increased by not more than 100%, in cases where the activity on that neighbouring property is not residential.*

Compliance with this rule is expected to be achievable, given that the majority of mine activities are located far away from neighbouring property boundaries.

4.4.2 Glare Effects

The Resource Consent version of the Exterior Lighting Report explicitly references AS/NZS 4282:2023, including consideration of obtrusive effects such as glare. The report describes mitigation measures including directional lighting, optically controlled luminaires, shielding, and progressive landform screening.

Glare control is a key objective under the Australian/New Zealand Standard AS/NZS 4282:2023 – Control of the Obtrusive Effects of Outdoor Lighting. The Appendix A of this standard provides practical guidance for the design, installation, operation, and maintenance of lighting systems in a manner that achieves necessary function while reducing visual obtrusiveness.

Relevant guidance includes:

- Section A.2 "Principles", paragraph (g):

  Wherever possible, use luminaires with asymmetric beams that permit the front glazing to be kept at or near parallel to the surface being lit.

- Section A3.4 "Siting and aiming of floodlights":

  The objective of the design should be to ensure that, as far as practicable, direct view of the bright parts of the luminaires is prevented from potential viewing positions within neighbouring properties.

4.4.3 Sky Glow Effects

The Resource Consent version of the Exterior Lighting Report addresses sky glow through adoption of AS/NZS 4282:2023 and proposes the use of luminaires with zero Upward Light Ratio (ULR), directional lighting, and shielding.

Upward Light Ratio (ULR) is a technical light parameter of a luminaire describing the ratio of the luminous flux of a luminaire that is emitted, at and above the horizontal, divided by the total luminaire flux when a luminaire is mounted in its designed position.

Minimising the ULR of installed luminaires is a method of minimising the potential for direct sky glow.

Table 3.2 of AS/NZS 4282:2023, included as Figure 6, provides guidance on light technical parameter limits, including ULR, for various environmental zones. Specifically, it recommends a maximum ULR of 0.00 for environmental zone A1.

Table 3.2 — Light technical parameter limits

Zones	Maximum vertical illuminance ($E_{v)\,lux}$		Threshold increment (TI)		Upward Light Ratio
	Non-curfew	Curfew	Maximum TI %	Default Adaptation level (L_{ad}) cd/m²	Maximum ULR_S or ULR_L
A0	0[a]	0.0	N/A	N/A	0.00
A1	2	0.1	20	0.1	0.00
A2	5	1	20	0.2[b]	0.01
A3	10	2	20	1	0.02
A4	25	5	20	5	0.03
TV	N/A	N/A	20	10	0.08

[a] For A0, E_V shall be as close to zero as practicable without impacting safety considerations.
[b] For an internally illuminated sign in a A2 zone, $L_{ad} \leq 0.25$ cd/m²

Figure 6 - Table 3.2 from AS/NZS 4282:2023 detailing light technical parameter limits for various environmental zones

4.4.4 Ecological Effects

The Resource Consent version of the Exterior Lighting Report references relevant ecological assessments prepared for the project and describes mitigation measures intended to minimise potential effects of artificial light at night (ALAN) on wildlife. These include directional lighting, use of luminaires with zero upward waste light ratio, and a general preference for colour temperatures of 3000K or lower where practicable.

4.4.4.1 National Light Pollution Guidelines for Wildlife

AS/NZS 4282:2023 references the National Light Pollution Guidelines for Wildlife. The aim of the guidelines is that artificial light is managed so that wildlife is:

1. Not disrupted within, or displaced from, important habitat
2. Able to undertake critical behaviours such as foraging, reproduction and dispersal.

The guidelines recognise that animals perceive light differently from humans, with most animals being sensitive to ultraviolet (UV)/violet/blue light. Figure 7 is taken directly from the guidelines (Guidelines Figure 2) and shows comparative light perception among different species groups.

It is noted that the guidelines state that "The guidelines do not infringe on human safety obligations. Where there are competing objectives for lighting, there may be a need for creative solutions that meet both human safety requirements for artificial light and threatened and migratory species conservation".

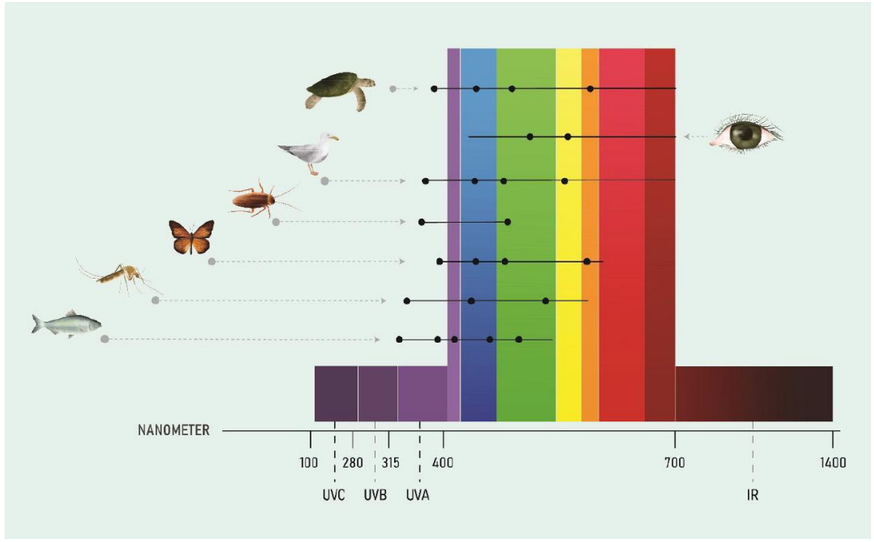

Figure 7 - Comparative light perception among different species groups

(Ability to perceive different wavelengths of light in humans and wildlife shown by horizontal lines. Black dots represent report peak sensitivities.)

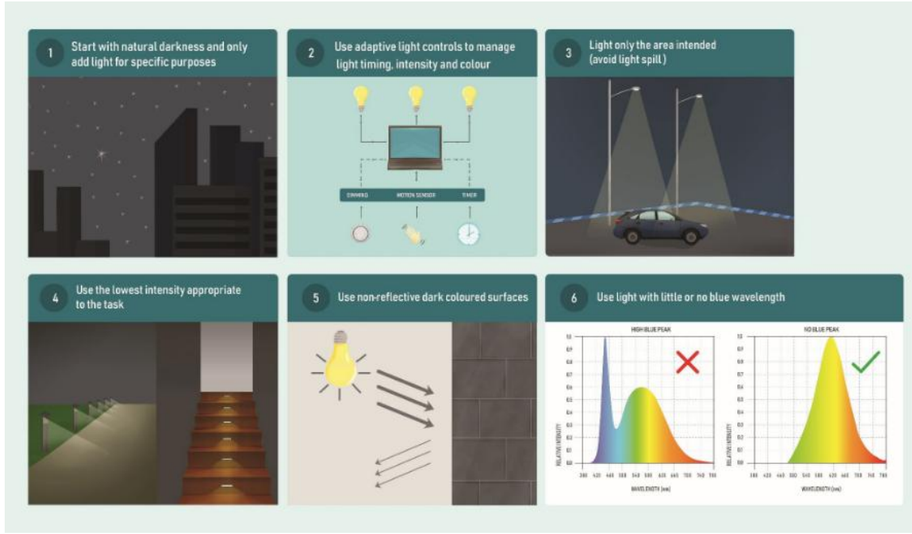

Figure 8 - Best Practice Lighting Design Principles as described in the National Light Pollution Guidelines for Wildlife

The guidelines recommend:

1. Always using best practice lighting design to reduce light pollution and minimise the effect on wildlife.
2. Undertaking an environmental impact assessment of effects of artificial light on listed species for which artificial light has been demonstrated to affect behaviour, survivorship or reproduction.

According to the guidelines, best practice lighting design incorporates the following design principles. Figure 8 (Guidelines Figure 4) illustrates these principles:

1. Start with natural darkness and only add light for specific purposes.
2. Use adaptive light controls to manage light timing, intensity and colour.
3. Light only the object or area intended – keep lights close to the ground, directed, and shielded to avoid light spill.
4. Use the lowest intensity lighting appropriate for the task.
5. Use non-reflective, dark-coloured surfaces.
6. Use lights with reduced or filtered blue, violet and ultraviolet wavelengths.

The guidelines are supported by a series of technical appendices that provide additional information on topics including: "*Best practice lighting design*", "*What is light and how does wildlife perceive it?*", Management of artificial light for wildlife including seabirds, bats, terrestrial mammals, and ecological communities.

An environmental impact assessment (EIA) process is recommended if there are species that are known to be affected by artificial light within 20km of a project.

There are 5 steps involved in assessing the potential effects of artificial light on wildlife, and the adaptive management of artificial light requires a continuing improvement process.

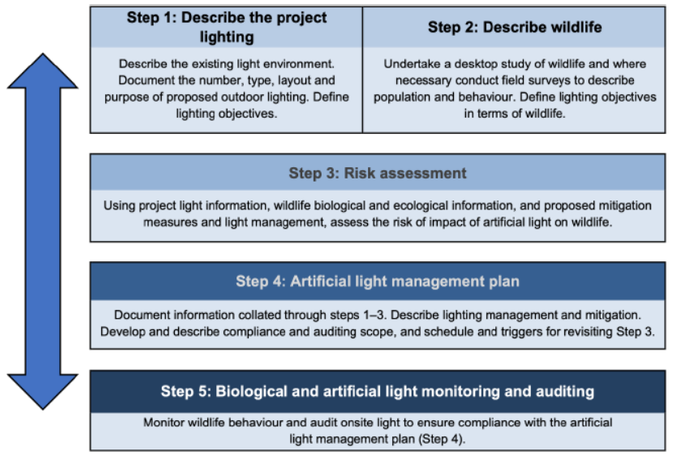

Figure 9 - Flow Chart describing the environmental impact assessment process

5. Assessment of Effects

5.1 Effect Severity Definitions

This assessment of environmental effects uses the following effect severity definitions, as informed by Quality Planning New Zealand in their AEE guidance.

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

Table 2 - Effect Severity Definitions

5.2 Assessment Summary

Refer to Appendix A for the matrix containing the full assessment of the environmental effects (lighting).

Remnant effects associated with the proposed development following implementation of the mitigations summarised in Table 3 below are assessed to be less than minor to minor, depending on selected mitigations. It is recommended that these mitigations form the basis of the Resource Consent conditions for the project.

Type	#	Proposed Mitigation
Construction / mine operations	1	Preparation and implementation of a Lighting Management Plan (LMP) to govern all fixed and mobile lighting.
Construction / mine operations	2	Limit construction activities during hours of darkness where practicable.
Construction / mine operations	3	Use lighting with a colour temperature of ≤3000K (warm light) where practicable.
Construction / mine operations	4	Reduce intensity/output of lighting fittings where practicable.
Construction / mine operations	5	Apply a 'start dark, add light only where needed' approach.
Construction / mine operations	6	Tilt lights downward as much as possible to reduce spill and glare.
Construction / mine operations	7	Consult with affected neighbours regarding construction and operational lighting impacts.
Construction / mine operations	8	Select mobile lighting rig locations strategically (shielded by landforms) when night work is required.
Construction / mine operations	9	Install blinds or coverings to windows and glass doors of site support facilities (e.g. Portacoms) used after dark.
Permanent Fixed Exterior Lighting	10	All fittings to have ≤3000K colour temperature.
Permanent Fixed Exterior Lighting	11	Reduce intensity/output when (exterior) areas are unoccupied by use of appropriate automated lighting controls.
Permanent Fixed Exterior Lighting	12	Use flat-glass luminaires with zero upward light component; no tilt.
Permanent Fixed Exterior Lighting	13	Utilise shielding to control spill light.
Permanent Fixed Exterior Lighting	14	Consult with affected neighbours regarding permanent lighting impacts.
Permanent Fixed Exterior Lighting	15	Apply 'start dark, add light only where needed' principle for permanent lighting.
Permanent Fixed Interior Lighting	16	Fit blinds or coverings to windows and glazed doors of permanent buildings to control interior glare.

Table 3 - Effect Mitigation Summary

5.3 Recommended Resource Consent Conditions - Lighting

Following is a list of recommended potential Resource Consent conditions, based on the mitigations described in Table 3 above.

1. <u>General Lighting Design</u>
    a) All exterior and interior lighting associated with the Bendigo Ophir Gold Project (BOGP) shall be designed, installed, and operated to comply with AS/NZS 4282:2023 – Control of the Obtrusive Effects of Outdoor Lighting and the requirements of the Central Otago District Plan. Compliance shall be demonstrated through lighting calculations prepared by a suitably qualified lighting professional and provided to Council upon request.

2. Lighting Management Plan (LMP)
    a) Prior to commencement of construction, the Consent Holder shall prepare and submit a Lighting Management Plan (LMP) to Council for approval.
    b) The LMP shall set requirements for all fixed and mobile lighting, including vehicle lighting where practicable. It shall include an intent, scope, applicable legislation, roles and responsibilities, certification process and a complaints process.
    c) The LMP shall set out the requirements for all fixed, mobile, and construction artificial lighting to be used as a part of the mine works, including:
        - Use lighting with a colour temperature of ≤3000K, except where a higher colour temperature is demonstrated to be necessary for operational safety.
        - Reduce intensity/output of fittings to the minimum required for safety.
        - Direct and tilt all lighting downward, avoiding spill onto roads, waterbodies, and residential areas.
        - Apply a "start dark, add light only where needed" approach to all lighting decisions.
        - Strategically locate lighting rigs to take advantage of natural landform shielding.
        - Limit works to during daylight hours where appropriate. E.g. construction of buildings, mine remediation works.
        - Installation of blinds to windows and glass doors where buildings are to be used after dark.

3. Operational Lighting Controls
    a) All permanent fixed exterior lighting shall:
        - Be flat-glass type luminaires with zero upward light component (ULR = 0).
        - Be installed without tilt and fitted with shielding where required.
        - Use lighting with a colour temperature of ≤3000K, except where a higher colour temperature is demonstrated to be necessary for operational safety.
        - Be dimmed or switched off when areas are unoccupied, using timers, sensors, or other automated controls.
        - All façade and feature uplighting is prohibited.

4. Interior Lighting
    a) All site buildings (temporary and permanent) shall be fitted with blinds, tinted glazing, or equivalent treatments on windows and glazed doors to minimise light spill and glare to the exterior environment.

5. Ecological Mitigation
    a) Lighting design and operation shall be consistent with the principles of the National Light Pollution Guidelines for Wildlife (2023), including use of warm-coloured lighting (≤3000K), except where a higher colour temperature is demonstrated to be necessary for operational safety, minimisation of upward light, and avoidance of unnecessary overnight lighting

6. Neighbour Consultation
    a) The Consent Holder shall engage with potentially affected neighbours on the proposed lighting strategy prior to construction and shall implement reasonable and practicable measures raised through that consultation.
    b) Where lighting complaints are received and substantiated, the Consent Holder shall implement reasonable and practicable mitigation measures.

7. Monitoring and Review
    a) The Consent Holder shall undertake compliance checks to verify lighting levels, spill light, and glare control against AS/NZS 4282:2023 within 6 months of commissioning permanent lighting.
    b) Monitoring shall include measurement of spill light (lux) at site boundaries and assessment of glare in accordance with AS/NZS 4282:2023.
    c) Results shall be provided to Council on request.
    d) Adaptive management measures shall be implemented if measured spill light or glare exceeds the limits of AS/NZS 4282:2023 or the levels assessed in the Assessment of Effects.

8. Environmental Zone Confirmation
    a) Prior to final lighting design, the Consent Holder shall confirm the applicable AS/NZS 4282:2023 Environmental Zone as confirmed in writing by CODC, and all lighting shall be designed to comply with the requirements of that zone.

6. Review of applicant's proposed consent conditions – Lighting

6.1 Proposed consent conditions

The applicant has proposed a set of conditions relating to the exterior lighting associated with the BOGP. The conditions relevant to lighting are listed below in Table 4.

No.	Condition	Comment
28.	Lighting from all activities within the Project Site (excluding vehicle headlights) must not result in greater than 10 lux spill (horizontal and vertical) of light onto any adjoining private property (not owned by the Consent Holder or related company, or subject to an agreement with the Consent Holder or related company) or public road. This condition does not apply to any streetlight installed for safety purposes insofar as it causes light spill on the public road. The amount of light that may be spilled onto a neighbouring private property may be increased by not more than 100% (compared to the situation in the absence of the lighting), in cases where the activity on that neighbouring property is not a residential activity.	Per BOGP Exterior Lighting report and District Plan.
29.	Where luminaires are visible from external locations or are high output floodlights: a. They must be installed such that their light producing faces are horizontal to the ground as far as reasonably practicable; b. Luminaires must be aimed away from external locations (i.e. into the Project Site); and c. They must be of luminous intensity not exceeding the limits set out in AS/NZS 4282:2023 "Control of the obtrusive effects of outdoor lighting" for the applicable environmental zone (i.e. Environmental Zone A2, with no specific curfew).	
30.	The final lighting arrangement must be modelled to demonstrate compliance with the Dark Sky Reserve Requirements as far as reasonably practicable, and where safe to do so, as follows: a. All fixed exterior lighting must be directed away from any adjacent roads, residential properties and lakes; b. All outdoor lighting (excluding mobile equipment) must be shielded from above the light in such a manner that the edge of the shield is below the light source; c. Only light-emitting diode (LED), low pressure sodium and high-pressure sodium lamps are to be used; and d. Lighting must be limited to a maximum of 12 lumens per square metre except where required for operational practicality or health and safety requirements.	
31.	To minimise ecological impacts, the Consent Holder must, as far as reasonably practicable, use lighting with the following characteristics: a. For fixed lighting (such as the construction workers accommodation and office areas): i) Low-output, warm-coloured LED lighting at 3,000K (or less); ii) Building-mounted lighting with bollard support to limit horizontal and vertical light spill; and iii) Automated timing controls, dimming functions, and movement sensors to reduce unnecessary luminance. b. For fixed lighting (such as the processing plant and infrastructure areas): i) Horizontal and upward lighting fixture controls to contain light spill where feasible. As far as reasonably practicable, the Consent Holder must avoid direct lighting toward the high-value ecosystems (i.e. Cushionfields / Mixed depleted herbfield and grassland) shown in **Attachment A** to this Land Use Consent. This condition does not apply to vehicles and mobile plant.	
32.	Within six months of the commencement of this consent, the Consent Holder must engage a suitably qualified and experienced lighting engineer to model and review the	

No.	Condition	Comment
	lighting arrangements proposed for the construction / site establishment activities and mining operations for the BOGP and confirm that the lighting levels comply with Conditions 28 to 31 (above) of this consent. A copy of the certification from the suitably qualified and experienced lighting engineer required under Condition 32 (above) must be held on site and provided to the Central Otago District Council.	

Table 4 - Summary of proposed consent conditions for lighting

6.2 Assessment of adequacy of proposed consent conditions

The proposed consent conditions incorporate several elements of recognised lighting management practice, including spill light limits, reference to AS/NZS 4282:2023, and requirements relating to directional lighting design. These provisions are generally consistent with the mitigation principles identified in Section 5.2 of this report. However, comparison with the mitigation measures outlined in Table 3 indicates that several important controls are not fully captured in the proposed conditions. Accordingly, a number of amendments are recommended to ensure that the mitigation measures relied upon in the lighting assessment are clearly secured through enforceable consent conditions.

Topic	**Assessment**
Spill light limits	Adequate
AS/NZS 4282 compliance	Adequate, however discussion required regarding environmental zone.
Dark Sky requirements	Mostly adequate
Colour temperature	Partially implemented
Lighting Management Plan	Missing
Construction Lighting Control	Missing
Adaptive controls (timers/dimming)	Adequate
Monitoring and verification	Partial
Environmental Zone confirmation	Missing
Neighbour Consultation	Missing

Table 5 - Assessment of adequacy of proposed consent conditions

6.3 Recommended amendments to consent conditions

Table 6 below reproduces the proposed lighting conditions in the format provided by the applicant, with recommended amendments shown as insertions (red text) and deletions (~~red strikethrough~~). The amendments are intended to ensure that the mitigation measures identified in Section 5 of this report are appropriately reflected in the consent conditions, and that the lighting effects associated with the project can be effectively managed through enforceable provisions.

No.	**Condition**	**Comment**
28.	Lighting from all activities within the Project Site (excluding vehicle headlights) must not result in greater than 10 lux spill (horizontal and vertical) of light onto any adjoining private property (not owned by the Consent Holder or related company, or subject to an agreement with the Consent Holder or related company) or public road. This condition does not apply to any streetlight installed for safety purposes insofar as it causes light spill on the public road. The amount of light that may be spilled onto a neighbouring private property may be increased by not more than 100% (compared to the situation in the absence of the lighting), in cases where the activity on that neighbouring property is not a residential activity.	Per BOGP Exterior Lighting report and District Plan.
29.	Where luminaires are visible from external locations or are high output floodlights: a. They must be installed such that their light producing faces are horizontal to the ground as far as reasonably practicable; b. Luminaires must be aimed away from external locations (i.e. into the Project Site); and c. They must be of luminous intensity not exceeding the limits set out in AS/NZS 4282:2023 "Control of the obtrusive effects of outdoor lighting" for the applicable environmental zone ~~(i.e. Environmental Zone A2, with no specific curfew).~~ d. Prior to final lighting design, the Consent Holder shall obtain written confirmation from CODC of the applicable AS/NZS 4282:2023 environmental zone, and the lighting design carried out in compliance with the requirements of the confirmed zone.	
30.	The final lighting arrangement must be modelled to demonstrate compliance with AS/NZS 4282:2023 and, where	We have recommended compliance with the AS/NZS4282:2023 limits

No.	Condition	Comment
	practicable and safe to do so, the principles of the Dark Sky Chapter Provisions of the CODP ~~the Dark Sky Reserve Requirements as far as reasonably practicable, and where safe to do so,~~ as follows: a. All fixed exterior lighting must be directed away from any adjacent roads, residential properties and lakes; b. All outdoor lighting (excluding mobile equipment) must be shielded from above the light in such a manner that ~~the edge of the shield is below the light source~~ no direct light is emitted above the horizontal; c. Only light-emitting diode (LED), low pressure sodium and high-pressure sodium lamps are to be used; and d. ~~Lighting must be limited to a maximum of 12 lumens per square metre except~~ The lighting design shall demonstrate compliance with the obtrusive lighting limits of AS/NZS4282:2023 for the applicable environmental zone, except where additional illuminance is required for operational practicality or health and safety requirements. e. All permanent exterior luminaires shall have zero upward light ratio (ULR = 0) when installed.	instead of the lumens per square metre recommendations of the Dark Sky Chapter Provisions of the CODP as this is difficult to measure in practical terms.
31.	To minimise ecological impacts, the Consent Holder must, as far as reasonably practicable, use lighting with the following characteristics: a. For fixed lighting (such as the construction workers accommodation and office areas): i) Low-output, warm-coloured LED lighting at 3,000K (or less); ii) Building-mounted lighting with bollard support to limit horizontal and vertical light spill; and iii) Automated timing controls, dimming functions, and movement sensors to reduce unnecessary luminance. b. For fixed lighting (such as the processing plant and infrastructure areas): i) Horizontal and upward lighting fixture controls to	

No.	Condition	Comment
	contain light spill where ~~feasible~~ practicable. Where practicable, these requirements shall be applied to all permanent exterior lighting across the project site. As far as reasonably practicable, the Consent Holder must avoid direct lighting toward the high-value ecosystems (i.e. Cushionfields / Mixed depleted herbfield and grassland) shown in **Attachment A** to this Land Use Consent. This condition does not apply to vehicles and mobile plant that is temporarily located at a work site and repositioned as part of normal operations, but shall apply to any plant or equipment that remains in a fixed location for more than 7 consecutive days.	
32	Within six months of the commencement of this consent, the Consent Holder must engage a suitably qualified and experienced independent lighting engineer to model and review the lighting arrangements proposed for the construction / site establishment activities and mining operations for the BOGP and confirm that the lighting complies ~~levels comply~~ with Conditions 28 to 31 (above) of this consent. The lighting engineer undertaking this review shall not be the lighting designer responsible for preparing the lighting design for the project. A copy of the certification from the suitably qualified and experienced independent lighting engineer required under Condition 32 (above) must be held on site and provided to the Central Otago District Council. Where the review identifies that the lighting design does not comply with the consent conditions, the lighting design shall be modified and recertified to demonstrate compliance.	We have recommended that the reviewer is independent to avoid a conflict of interest.
33 (New)	Lighting Management Plan a. Prior to commencement of construction, the Consent Holder shall prepare and submit a Lighting Management Plan (LMP) to CODC for approval. b. The LMP shall set requirements for all fixed and mobile lighting, including vehicle lighting where practicable. It shall include an intent, scope, applicable legislation, roles	

No.	Condition	Comment
	and responsibilities, certification process and a complaints process. c. The LMP shall set out the requirements for all fixed, mobile, and construction artificial lighting to be used as a part of the mine works, including: i) Use lighting with a colour temperature of ≤3000K, except where a higher colour temperature is demonstrated to be necessary for operational safety. ii) Reduce intensity/output of fittings to the minimum required for safety. iii) Direct and tilt all lighting downward, avoiding spill onto roads, waterbodies, and residential areas. iv) Apply a "start dark, add light only where needed" approach to all lighting decisions. v) Strategically locate lighting rigs to take advantage of natural landform shielding. vi) Limit works to during daylight hours where appropriate. E.g. construction of buildings, mine remediation works. vii) Installation of blinds to windows and glass doors where buildings are to be used after dark. d. The LMP shall include Lighting Audit requirements and Periodic Review. e. The LMP shall be prepared by a suitably qualified and experienced lighting professional.	
33 (New)	Neighbour Consultation a. The Consent Holder shall engage with potentially affected neighbours on the proposed lighting strategy prior to construction and shall implement reasonable and practicable measures raised through that consultation. Where lighting complaints are received and substantiated, the Consent Holder shall implement reasonable and practicable mitigation measures.	

Table 6 - Recommended amended consent conditions for lighting. Proposed deletions shown ~~red strikethrough~~, proposed insertions shown as red text.

The recommended amendments set out above are minor in nature and do not materially alter the lighting approach described in the applicant's exterior lighting report. Rather, the proposed amendments ensure that the mitigation measures relied upon in the lighting assessment are clearly secured though enforceable consent conditions.

7. Conclusion

Artificial lighting associated with the BOGP has the potential to cause spill light, glare, sky glow, ecological disturbance, and adverse amenity effects if not carefully controlled.

The updated lighting report substantively addresses the issues identified in the pre-lodgement review.

This report has also reviewed the proposed Resource Consent conditions relating to lighting, which were provided by the applicant. While these conditions incorporate several elements of recognised lighting management practice, the assessment identified that some mitigation measures were not fully secured through the proposed conditions. Accordingly, amendments to the proposed consent conditions have been recommended to ensure that mitigation measures are appropriately reflected in enforceable consent conditions.

The recommended consent condition amendments primarily clarify compliance verification, environmental zone confirmation, and operational lighting controls rather than materially altering the lighting approach proposed by the applicant

Provided that the recommended amendments to the lighting consent conditions are adopted, the residual effects of lighting associated with the project are expected to be less than minor to minor.

By securing these mitigation measures through enforceable consent conditions, CODC can be confident that lighting effects from the BOGP will be appropriately controlled throughout construction and operation of the project.

Subject to the above, no outstanding lighting matters of concern are identified at the Resource Consent Stage.

Appendix A. Assessment of Effects Matrix

A.1 Effect Definitions

This assessment of environmental effects uses the following effects definitions, as informed by Quality Planning New Zealand in their AEE guidance.

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

A.2 Assessment Matrix

Lighting Type	Lighting Subtype	Effect Type[2]	Identified Effect	Proposed Mitigation	Mitigated Severity
Existing[1]		Flora & Fauna	-	-	-
Existing[1]		Night Sky and Astronomy	-	-	-
Existing[1]		Residents	-	-	-
Construction/mine operations	Vehicle headlights and area lighting	Flora & Fauna	Artificial lighting from vehicles and mobile floodlights may disturb native fauna by altering natural behaviour and activity patterns, increasing predation risk through greater visibility, affecting prey distribution, and leading to habitat avoidance.	A Lighting Management Plan (LMP) will set requirements for all fixed and mobile lighting. Measures include: limiting works during hours of darkness where practicable; using warm-coloured lights (≤3000K); reducing intensity/output; and applying a "start dark, add light only where needed" approach.	Less than minor to minor (depending on implementation).
Construction/mine operations	Area lighting	Night Sky and Astronomy	Construction and mine operation lighting produces light above the horizontal plane, increasing sky glow and blue light component.	As above (LMP). Additional measures: lights tilted downward, use of ≤3000K fittings, and minimising duration and output.	Less than minor to minor (depending on implementation).
Construction/mine operations	All construction and mine operation lighting	Residents	Construction and mine operation lighting may be visible to nearby residents, creating nuisance or glare.	Neighbour consultation, downward aiming of lights, reduced intensity/output, and careful siting of lighting rigs. All construction and mine operation lighting to be directed away from any adjacent roads, residential properties and lakes.	Less than minor to minor (depending on implementation).

Lighting Type	Lighting Subtype	Effect Type[2]	Identified Effect	Proposed Mitigation	Mitigated Severity
Construction/mine operations	Amber beacon safety lighting	Residents	Flashing construction and mine operation lighting (eg. amber beacons) causing glare effects during nighttime works.	Limit night construction where practicable; where required, select locations shielded by landforms; use LMP controls.	Less than minor to minor (depending on implementation).
Construction/mine operations	Portacom lighting		Interior lighting from construction buildings (i.e. portacoms etc) causing glare through windows and doors.	Install blinds to windows and glass doors where site support facilities (i.e. Portacoms) are to be used after dark.	Less than minor.
Permanent Fixed Lighting	Exterior and façade, camp, office and infrastructure area	Flora & Fauna	Lighting may disrupt native fauna (behaviour, predation risk, habitat avoidance).	All fittings ≤3000K colour temperature; reduce intensity where practicable; apply "start dark, add light only where needed" principle.	Less than minor to minor, depending on selected mitigations..
Permanent Fixed Lighting	Exterior and façade, camp, office and infrastructure area	Flora & Fauna	Light spill and upward light causes disruption to nocturnal birds.	Use flat-glass luminaires with zero upward component and shielding to prevent spill.	Less than minor.
Permanent Fixed Lighting	Exterior and façade, camp, office and infrastructure area	Night Sky and Astronomy	Permanent fixed lighting produces light above the horizontal plane, increasing sky glow and blue light component.	All fittings ≤3000K, flat-glass type, 0° tilt, ULR of 0, reduced output where practicable.	Less than minor.
Permanent Fixed Lighting	Exterior and façade, camp, office and infrastructure area	Residents	Permanent lighting may be visible to nearby residents, creating nuisance or glare.	Neighbour consultation, use of flat-glass fittings with ULR of 0, reduced output, "start dark, add light only where needed."	Less than minor.
Permanent Fixed Lighting	Interior lighting	Residents	Interior lighting from permanent buildings causing glare through windows.	Install blinds to windows and glass doors.	Less than minor.

1. There is no existing lighting within the proposed development area. It is assessed that the existing lighting has Nil effects across all categories.
2. Effect types as defined by AS/NZS 4282:2023, and then further grouped and refined.

Appendix B. Bibliography

The following information / activities have informed this review:

1. Cosgroves (2025). *Bendigo Ophir Gold Project – Exterior Lighting Report.* Resource Consent Issue, May 2025. Reference: CQ24020.
2. Cosgroves (2025). *Design Memo – Bendigo Ophir Gold Project: Resource Consent Queries.* Memo to Santana Minerals, 25 July 2025. Reference: CQ24020.
3. Cosgroves (2025). *Bendigo Ophir Gold Project – Exterior Lighting Report.* Resource Consent Issue, September 2025. Reference: CQ24020.
4. Boffa Miskell (2025). *Bendigo Ophir Mining Project – Visual Simulations.* Prepared for Matakanui Gold Limited, 08 July 2025.
5. Mitchell Daysh Limited (2025). *Bendigo Ophir Gold Project – Project Description for Technical Reports.* Prepared for Matakanui Gold Limited, April 2025.
6. Landpro (2025). *Fast Track Plans – Bendigo Ophir Gold Project.* Prepared for Matakanui Gold Limited, Version 9, 17 July 2025.
7. A day and night visit to the mine and surrounding environs, undertaken on Thursday 31st July 2025
8. The Central Otago District Plan
9. Australian / New Zealand Standard AS/NZS 4282: 2023, "Control of the obtrusive effects of outdoor lighting".
10. Australian Government, Department of Climate Change, Energy, the Environment and Water, "National Light Pollution Guidelines for Wildlife", May 2023, Version 2.0
11. AEE guidance information Quality Planning website www.qualityplanning.org.nz.
12. Discover the Bendigo Area. Department of Conservation, June 2020.
13. RMA Ecology Ltd (2025). Bendigo-Ophir Gold Project: Avifauna Values Assessment. Prepared for Matakanui Gold Limited.
14. Alliance Ecology Ltd (2025). Bendigo-Ophir Gold Project: Avifauna Management Plan. Prepared for Matakanui Gold Limited, September 2025
15. Habitat NZ Ltd (2025). Bendigo-Ophir Gold Project: Terrestrial Invertebrate Management Plan. Prepared for Matakanui Gold Limited, October 2025.

Appendix C. Glossary of Lighting Terms

The following simple definitions are based upon those within Australian/New Zealand Standard AS/NZS 4282:2023 "Control of the obtrusive effects of outdoor lighting" and apply to terms used in this report:

GLARE

Condition of vision in which there is discomfort or a reduction in the ability to see, or both, caused by an unsuitable distribution or range of luminance, or extreme contrasts in the field of vision.

Visual impairment or discomfort resulting from the intensity of a light source and the brightness contrast with the associated surroundings. It is affected by the light source size and intensity, background brightness, and the location relative to the viewing position.

The two terms that are normally used to describe the effects of glare on the ability to see are *disability* and *discomfort*.

Disability Glare: Glare that impairs the visibility of objects without necessarily causing discomfort.

A typical example of *disability* glare is the glare from approaching headlights on the open highway at night, which prevent anything else being seen on the road. The eye is unable to adapt to the bright headlight and to the significantly lower brightness on the road at the same time. Hence the glare is having a disabling effect. This disabling effect is related to the intensity of the source in the direction of the eye with respect to the brightness of the surroundings. As a comparison, the same car approaching with its headlights on during the day will cause almost no disability because of the brightness of the surroundings.

Discomfort Glare: Glare that causes discomfort without necessarily impairing the visibility of objects.

An example of *discomfort* glare is a bright sky on a sunny day can cause discomfort, particularly to those used to wearing sunglasses who are without them, however the ability to see is not impaired.

The key difference between the two is that *disability* glare has a physiological effect and can be objectively measured, whereas *discomfort* glare has a psychological effect and is much more subjective. What may not cause discomfort to one person may cause significant discomfort to another person.

Note: Both *disability* and *discomfort* glare may be present concurrently

ILLUMINANCE

The measure of illumination level, which is the amount of light or luminous flux (i.e. Lumens) incident on a surface, per unit area, measured in Lux (1 Lux = 1 Lumen /m^2).

LUMINAIRE

The international term for a lighting fitting, which is the assembly that contains a light source and distributes the light output.

LUMINANCE

The measure of brightness, which is a function of concentration or density of luminous intensity (i.e. Candelas) in a given direction per unit area, measured in Candela/m^2 (Cd/m^2).

LUX

The International System (SI) unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square metre.

SKYGLOW

The brightening of the night sky that results from the reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere (gas molecules, aerosols and particulate matter), in the direction of observation.

It comprises two separate components as follows:

Natural Sky Glow: That part of the sky glow that is attributable to radiation from celestial sources and luminescent processes in Earth's upper atmosphere.

Man-Made Sky Glow: That part of the sky glow that is attributable to man-made sources of radiation (e.g. outdoor lighting).

SPILL LIGHT

Light emitted by a lighting installation that falls outside the boundaries of the property for which the lighting installation is designed.