

NOISE AND VIBRATION MANAGEMENT PLAN



Maragle 330kV Switching Station and 330kV Transmission Line Connections

Document number: 3200-0645-PLN-037-CEMP-NVMP

Revision date: 15/08/2024

Revision: 0.06

Plan Approval

Rev.	Approval	Name	Position	Organisation	Signature	Date
0.06	Approved By	Tim McCarthy	Project Manager	UGL		15/08/2024
0.06	Endorsed By	Andrew Buttigieg	Senior PM (Delivery)	Transgrid		16/08/2024

Document Revision History

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
0.01	29/09/2022	Jane Love	Whitney Heiniger	Trevor Noble	Initial issue for review
0.02	08/11/2022	Jane Love	Whitney Heiniger	Trevor Noble	Required plan review
0.03	02/05/2023	Claire Hobbs	Jane Love	Trevor Noble	Address Transgrid and stakeholder comments
0.04	13/07/2023	Whitney Heiniger	Jane Love	Trevor Noble	Address DPE comments
0.05	27/07/2023	Whitney Heiniger	Jane Love	Trevor Noble	Address DPE comments
0.06	15/08/2024	Camille Palmer	Brendan Toohey	Tim McCarthy	Address IEA Comments

TABLE OF CONTENTS

1	INTRODUCTION	6
1.1	CONTEXT	6
1.2	ENVIRONMENTAL MANAGEMENT SYSTEM	6
1.3	PURPOSE AND OBJECTIVES	6
2	ENVIRONMENTAL ASSURANCE	7
2.1	RELEVANT LEGISLATION AND GUIDELINES	7
2.2	PERMITS AND LICENCES	8
2.3	PROJECT CONDITIONS OF APPROVAL	8
3	CONSULTATION	10
3.1	DPE	10
3.2	SVC	10
4	EXISTING ENVIRONMENT	12
4.1	SITE DESCRIPTION AND SENSITIVE RECEIVERS	12
4.2	HERITAGE ITEMS	13
4.3	BACKGROUND NOISE	13
5	NOISE AND VIBRATION CRITERIA	16
5.1	INTERIM CONSTRUCTION NOISE GUIDELINES	16
5.2	QUANTITATIVE NOISE ASSESSMENT CRITERIA	16
5.3	VIBRATION	19
6	ENVIRONMENTAL ASPECTS AND IMPACTS	23
6.1	CONSTRUCTION ACTIVITIES	23
6.2	CONSTRUCTION IMPACTS	23
7	NOISE AND VIBRATION MITIGATION MEASURES	25
7.1	CONSTRUCTION HOURS	25
8	COMPLIANCE MANAGEMENT	33
8.1	RESPONSIBILITIES	33
8.2	TRAINING	33
8.3	MONITORING AND INSPECTIONS	33
8.4	NON-CONFORMANCE REPORTING AND INCIDENTS	34
8.5	AUDITING	34
9	REFERENCES	35
	APPENDIX A OUT OF HOURS WORK (OOHW) PROTOCOL	36
	APPENDIX B EXAMPLE OF A COMMERCIAL DRONE (FOR STRINGING)	44

LIST OF FIGURES

FIGURE 4-1 SENSITIVE RECEIVERS WITHIN PROXIMITY TO THE PROJECT (JACOBS, 2021).....	14
FIGURE 4-2 HERITAGE ITEMS WITHIN THE PROJECT AREA (JACOBS, 2021).....	15

LIST OF TABLES

TABLE 2-1 PROJECT CONDITIONS OF CONSENT AND MITIGATION MEASURES RELEVANT TO THE NVMP	8
TABLE 3-1 SVC CONSULTATION AND RESPONSES	10
TABLE 4-1 NOISE SENSITIVE RECEIVERS (JACOBS, 2021).....	12
TABLE 4-2 HERITAGE ITEMS (JACOBS, 2021).....	13
TABLE 4-3 ADOPTED BACKGROUND NOISE LEVELS (DB(A)) FOR THE PROJECT	13
TABLE 5-1 NMLS FOR RESIDENCES.....	16
TABLE 5-2 CONSTRUCTION NMLS – ALL RECEIVERS	18
TABLE 5-3 EXAMPLES OF TYPES OF VIBRATION	19
TABLE 5-4 PREFERRED AND MAXIMUM WEIGHTED ROOT MEAN SQUARED (RMS) VALUES FOR CONTINUOUS/ IMPULSIVE VIBRATION ACCELERATION (M/S ²) 1-80HZ	20
TABLE 5-5 PREFERRED AND MAXIMUM VDVS FOR INTERMITTENT VIBRATION (MS-1.75) (DEC, 2006)	21
TABLE 5-6 TRANSIENT VIBRATION GUIDELINE VALUES.....	21
TABLE 5-7 RECOMMENDED SAFE SETBACK DISTANCES.....	22
TABLE 6-1 PREDICTED WORST CASE CONSTRUCTION NOISE LEVELS (JACOBS, 2021)	24
TABLE 6-2 PREDICTED CONSTRUCTION TRAFFIC NOISE IMPACTS (JACOBS, 2021).....	24
TABLE 7-1 NOISE AND VIBRATION MANAGEMENT AND MITIGATION MEASURES.....	26

ACRONYMS AND ABBREVIATIONS

Term	Definitions
CEMP	Construction Environmental Management Plan
CM	Construction Manager
CNVG	Construction Noise and Vibration Guideline
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
Cth	Commonwealth
DPIE	Department of Planning, Industry and Environment (formerly DPE)
DPE	Department of Planning and Environment
DPHI	Department of Planning, Housing and Infrastructure (formerly DPE and DPIE)
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP&A	<i>Environmental Planning and Assessment Act 1979</i>
EPA	<i>Environment Protection Authority</i>
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EWMS	Environmental Work Method Statement
HSEQ	Health Safety, Environment and Quality
ICNG	<i>Interim Construction Noise Guideline</i>
LGA	Local Government Area
km	Kilometre
KNP	Kosciuszko National Park
kV	Kilovolts
m	Metres
MIC	Maximum instantaneous charge
MPPS	Minister for Planning and Public Spaces
MW	Megawatts
MWh	Megawatt hours
NEM	National Electricity Market
NMLs	Noise Management Levels
NPfi	Noise Policy for Industry
NPWS	National Parks and Wildlife Service
NV	Noise and Vibration
NVMP	Noise and Vibration Management Plan
OOHW	Out of Hours Work
POEO Act	Protection of the Environment Operations Act 1997

Term	Definitions
PoM	Plan of Management
RBL	Rating background level
RMS	Roads and Maritime Services
RNP	Road Noise Policy
SEA	Site Environmental Advisor
SEP	Site Environmental Plan
SVC	Snowy Valleys Council
SWMS	Safety Work Method Statement
TG	Transgrid
UAV	Unmanned aerial vehicle
UGL	United Group Limited

1 INTRODUCTION

1.1 CONTEXT

To connect Snowy 2.0 to the National Energy Market (NEM), a new transmission connection is required. NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (known as Transgrid and the Proponent) received development approval on 2 September 2022 to construct a switching station and overhead transmission lines ('the Project') to facilitate the connection of Snowy 2.0 to the existing electrical transmission network, approximately 27 kilometres (km) east of Tumbarumba, New South Wales (NSW).

This Noise and Vibration Management Plan (NVMP) describes how noise and vibration impacts will be managed by UGL during transmission line construction. The NVMP describes anticipated hazards during noise and vibration management and mitigation measures to identify and manage potential impacts that may occur during Project works. A process is also outlined for the carrying out of 'Out of Hours Works', if needed.

1.2 ENVIRONMENTAL MANAGEMENT SYSTEM

The overall Environmental Management System (EMS) for the Project is described in the Construction Environmental Management Plan (CEMP). This Noise and Vibration Management Plan (NVMP) forms part of the CEMP for the Project and is to be read in conjunction with the overarching CEMP. It is applicable to all staff, contractors and sub-contractors associated with the construction of the Project. The UGL Management System (UGLMS) incorporates the following for the management of noise impacts on the Project:

- UGLMS-131-807 Contractor HSEQ Requirements
- UGLMS-131-401 Noise and Vibration Management Procedure
- UGLMS-5-1229 Environmental Monitoring Instructions
- UGLMS-4-1549 Environmental Inspection Weekly Checklist
- UGLMS-4-1310 Plant Hazard Identification and Risk Assessment Form.

1.3 PURPOSE AND OBJECTIVES

The purpose of this Plan is to address the construction environmental management requirements detailed within the following documents:

- Snowy 2.0 Transmission Connection Project – Environmental Impact Assessment (Jacobs, 2021)
- Snowy 2.0 Transmission Connection Project – Amendment Report (Transgrid, 2022)
- Snowy 2.0 Transmission Connection Project – Biodiversity Development Assessment Report (BDAR) (Jacobs, 2022)
- Infrastructure Approval SSI 9717 (dated 2 September 2022).

The key objective of the NVMP is to ensure that impacts from construction related noise and vibration are minimised and within the scope permitted by the approved Project.

2 ENVIRONMENTAL ASSURANCE

2.1 RELEVANT LEGISLATION AND GUIDELINES

2.1.1 LEGISLATION

Legislation relevant to this NVMP includes:

- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act)
- Environmental Planning and Assessment Regulation 2021
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- Protection of the Environment Operations (Noise Control) Regulation 2008
- *Civil Aviation Act 1988*
- Air Navigation (Aircraft Noise) Regulations 2018.

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix C of the CEMP.

2.1.2 POLICIES AND GUIDELINES

The main guidelines relevant to this Plan include:

- NSW Department of Environment Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG)
- NSW Environment Protection Authority (EPA) 2017, NSW Noise Policy for Industry
- NSW Department of Environment Climate Change and Water (DECCW) 2011, Road Noise Policy (RNP)
- NSW Department of Environment and Conservation (DEC) 2006, Assessing Vibration: a technical guideline
- Australian Standard AS 1055.1 – 1997 Acoustics – Description and measurement of environmental noise
- Australian Standard AS 2187.2 – 2006 Explosives – Storage and Use – Use of Explosives
- Australian Standard AS 2436 – 2010 - Guide to noise and vibration control on construction, demolition, and maintenance sites
- British Standard BS 6472 – 2008 Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard BS 7385 Part 2 – 1993 Evaluation and measurement for vibration in buildings Part 2
- German Standard DIN4150-1999 Structural vibration Part 3: Effects of vibration on Structures.
- Drones in National Parks (DPIE 2019).

The Kosciuszko National Park Plan of Management (KNP PoM) (NPWS, 2006) outlines tranquillity as a high priority environmental quality of the park. As relevant to this Project, the plan lists potential noise impacts to visitors and wildlife as arising from recreational scenic flights and road traffic.

The Project may use helicopters and drones for line stringing and possibly tower erecting if approved by Transgrid. However, these are not classified as recreational use and as such is not covered by the KNP PoM Management Policies. The principle of reducing this impact where possible is noted and addressed in this plan.

2.2 PERMITS AND LICENCES

No external permits or licences are required regarding noise and vibration management however an internal permit for Out of Hours Work (OOHW) procedure and permit (Appendix A). Further details regarding permits and licences are provided in Appendix C of the CEMP.

2.3 PROJECT CONDITIONS OF APPROVAL

The Conditions of Approval (CoA) and mitigation measures relevant to this Plan are listed in Table 3-1 below. A cross reference is also included to indicate where the requirement is addressed in this Plan or other Project management documents.

Table 2-1 Project conditions of consent and mitigation measures relevant to the NVMP

Reference number	Requirement	Document Reference
Conditions of Approval		
B1	Unless the Planning Secretary agrees otherwise, road upgrades, construction, upgrading and decommissioning activities may only be undertaken between 6 am to 6 pm.	Section 7.1 Table 7-1
B2	The following construction, upgrading and decommissioning activities may be carried out outside the hours specified in condition B1 above: <ul style="list-style-type: none"> (a) The delivery or dispatch of materials as requested by the NSW Police Force or other public authorities for safety reasons; or (b) Emergency work to avoid the loss of life, property or to prevent material harm to the environment; or (c) Activities that are inaudible at sensitive receivers that do not require traffic movements on local roads; or (d) Road upgrades required by the relevant roads authority/manager to be undertaken outside the construction hours specified in condition B1; or (e) Works carried out in accordance with an Out-of-Hours Work Protocol approved in accordance with condition B3. 	Section 7.1, Table 7-1 and Appendix A
B3	An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management, and approval of works which are outside the hours defined in condition B1. The Protocol must be approved by the Planning Secretary before commencing these works. The Protocol must: <ul style="list-style-type: none"> (a) Be prepared in consultation with Council; (b) Provide a process for the consideration of out-of-hours works against the relevant noise and vibration criteria, including the determination of low and high-risk activities; (c) Identify an approval process that considers the risk of activities, proposed mitigation, management, and coordination; and (d) Identify Department and Council arrangements for approved out of hours work 	Section 7.1, Table 7-1 and Appendix A Consultation undertaken with Department of Planning and Environment (DPE) and Snowy Valleys Council (SVC) regarding OOWH is summarised in Section 3 and Appendix A (OOHW) has been updated to reflect this consultation.
B4	The Proponent must take all reasonable and feasible steps to minimise the construction, upgrading or decommissioning noise of	Table 7-1

Reference number	Requirement	Document Reference
	the development in the locations where the noise is audible to sensitive receivers, including any associated traffic noise.	
B5	The Proponent must implement mitigation measures with the aim of achieving the road traffic noise assessment criteria for land uses from NSW Road Noise Policy (DECCW, 2011).	Table 7-1
Mitigation measures		
NV1	The standard techniques for controlling noise impacts during construction are presented in the ICNG. During construction relevant standard measures as outlined in Section 6 of the ICNG will be implemented.	Table 7-1
NV2	Do not conduct vibration intensive works within the recommended safe setback distances. Avoid the use of vibration intensive plant within the nominated human comfort distances.	Table 7-1
NV3	Care will be taken when carrying out vibration-intensive activities (e.g., use of hydraulic rock breakers and vibratory rollers,) within distances approaching the recommended safe setback distances around heritage items R45 and R49. Where maintaining these setback distances isn't possible a suitably qualified person will be present, or monitoring will be undertaken during the works to suspend activities in the instance of any issues.	Table 7-1
NV4	A detailed blast plan will be prepared by the blasting contractor prior to each blast to mitigate the potential for the recommended safe setback distances being encroached.	NA - Blasting currently not proposed
BIO22	The requirements of the Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition, and maintenance sites to be integrated in design.	Table 7-1
BIO23	Minimise noise from equipment through measures such as keeping both stationary and mobile plant and equipment in good working condition (including mufflers, enclosures etc), and avoid leaving engines running on standby when machinery is not being used.	Table 7-1
BIO24	Select equipment with the lowest noise rating that meets task requirements and minimise operating loud machinery conjunctively. For example, operating a jackhammer and concrete saw.	Table 7-1

Note: Mitigation Measures taken from the Amendment Report, Snowy 2.0 Transmission Connection Project (December 2021)

3 CONSULTATION

3.1 DPE (NOW DPHI)

Transgrid provided this NVMP and OOWH protocol to DPE for comment as per CoA B3 (d) on 9 March 2023. DPE provided the following response on 10 March 2023:

“While the current approval does document specific construction hours for this project, the Department acknowledges that some construction tasks may require extended construction hours.

The Department does not accept blanket extensions to working hours, but understands that some activities, such as significant concrete pours and craneage use, may occur.

Where reasonable, the Department may accept these requests with additional controls, such as:

- Defining only a precise scope of work
- Notification of surrounding receptors
- Additional mitigation following complaints
- Recording of complaints and incidents

Any request for extension to construction work hours should also be accompanied by an acoustic assessment report which defines the noise impact of these extended work hours and mitigation measures to be utilised.”

Appendix A outlines the OOWH for the Project, which aligns with DPE’s requirements.

3.2 SVC

Transgrid provided this NVMP and OOWH protocol to SVC for comment as per CoA B3 (a) and (d) February 2023. SVC provided a response on 6 and 9 March 2023. SVC requirements and comments are outlined in Table 3-1 below and how the comments have incorporated into the OOWH (Appendix A).

Table 3-1 SVC consultation and responses

Comment	Response
Council require compliance with the EPA Industrial Noise Policy in particular the provisions relating to the maximum dBA guidelines for night time noise emission based on the design scenario ie Rural / Urban etc.	A new section ‘Guidelines and criteria’ included to the OOWH to ensure the modelling and criteria is in accordance with the correct guidelines.
Provision of 48 hours’ notice to Council of any expected or programmed works proposed to occur outside of the hours identified in B1 of the approval.	Updated OOWH to include this detail in step 4 of the protocol.
Provide Council with the contact details of the relevant contractor or supervisor that is responsible for the works.	Updated OOWH to include this detail in step 4 of the protocol.
Provide notice to any affected or potentially affected resident through the provision of a written notice, 7 days prior to the expected date of the works occurring, advising of the proposed work, the nature of the work and a contact number for any enquiries / complaints. In the case where 7 days notice cannot be provided, it should be as soon as practicably possible however in any case not less than 48 Hours prior.	Updated OOWH to include this detail in step 5 of the protocol.
SVC also suggested that considerations should be for water extraction hours from the proposed location at Paddys Flats. Given the camping usage, disturbance to the users of the	Water extraction will be undertaken during the approved construction hours for the Project (6am – 6pm). If it is required outside of these hours it will be assessed and undertaken in accordance

Comment	Response
campground should be mitigated.	<p>with OOWH (Appendix A).</p> <p>New mitigation measure included to Table 7-1:</p> <ul style="list-style-type: none">• NVMP 23 Water extraction from Paddys Flats will be programmed to minimise impacts on users of the campground. Watertruck operators will be informed of these potential sensitive receivers and program requirements.

4 EXISTING ENVIRONMENT

4.1 SITE DESCRIPTION AND SENSITIVE RECEIVERS

The Project is located within the KNP and Bago State Forest. The Project is located in a remote area with the background noise generally dominated by environmental noise sources such as wind blowing through vegetation, wildlife calls and the occasional vehicle travelling along Elliott Way. Background noise may occasionally be impacted by forestry activities within Bago State Forest and recreational activities within the Park and State Forest. The eastern section of the Project will also be impacted by noise from Snowy 2.0 Main Works construction.

The nearest towns to the Project include Cooma, Tumut, Batlow, and Tumbarumba. Two passive recreation areas, including Coonara Point Campground and Rest Area and O'Hares Campground are located within proximity to the Project area. There are also a number of residential properties located along Bradley's Drive, Nurenmerenmong. All of these receivers are located over 1km from the Project, as shown in Table 4-1 and **Error! Reference source not found.**

Table 4-1 Noise sensitive receivers (Jacobs, 2021)

Receiver ID	Receiver details	Receiver type	Distance from the Project
A3	Coonara Point Campground and Rest Area	Passive recreation area	1km north
A5	O'Hares Campground	Passive recreation area	3km south
R20	Private properties at Nurenmerenmong and along TL64 alignment	Residential	4km northwest
A16	Snowy 2.0 works accommodation	n/a*	370 metres (m) north

*Not applicable, the Snowy 2.0 works accommodation forms part of the overall construction works

4.2 HERITAGE ITEMS

Two heritage structures identified as having local significance are also located within the Project area, Lobs Hole Copper Mine Water Race (R45) and Circular Stone Wall (R49) (Table 4-2 and **Error! Reference source not found.**). These structures would be vulnerable to construction vibration within 50m of their respective locations. Therefore vibration monitoring is required where vibration intensive activities (e.g., rock breaking, vibratory rollers) approach the 50m setback for Heritage items R45 and R49 (refer to Section 8.3.2).

Table 4-2 Heritage items (Jacobs, 2021)

Site ID	Name	Details	Significance	Distance from the Project
R45	Lobs Hole Copper Mine Water Race	This water race is cut into the base of the hill slope on the southern side of the Yarrangobilly River. It extends from Wallaces Creek in the east to the Lobs Hole Copper Mine. It was constructed in 1907 and was originally described as measuring two miles in length, with a dam at its eastern end.	Local	Within Disturbance footprint
R49	Circular stone wall	Semicircular stone wall made with massive natural boulders. The stone forms a flat platform for a horse or other to walk around driving a shaft attached to a mechanical device such as a chaff cutter or wheat grinder.	Local	Within Project area but outside disturbance area

4.3 BACKGROUND NOISE

Owing to low background noise levels attributed to the remote location of the Project, the background noise levels (RBLs) from the Noise Policy for Industry (NPI) (EPA, 2017) were adopted (refer to Table 4-3). No noise monitoring was undertaken onsite.

Table 4-3 Adopted background noise levels (Db(A)) for the Project

Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
35	30	30

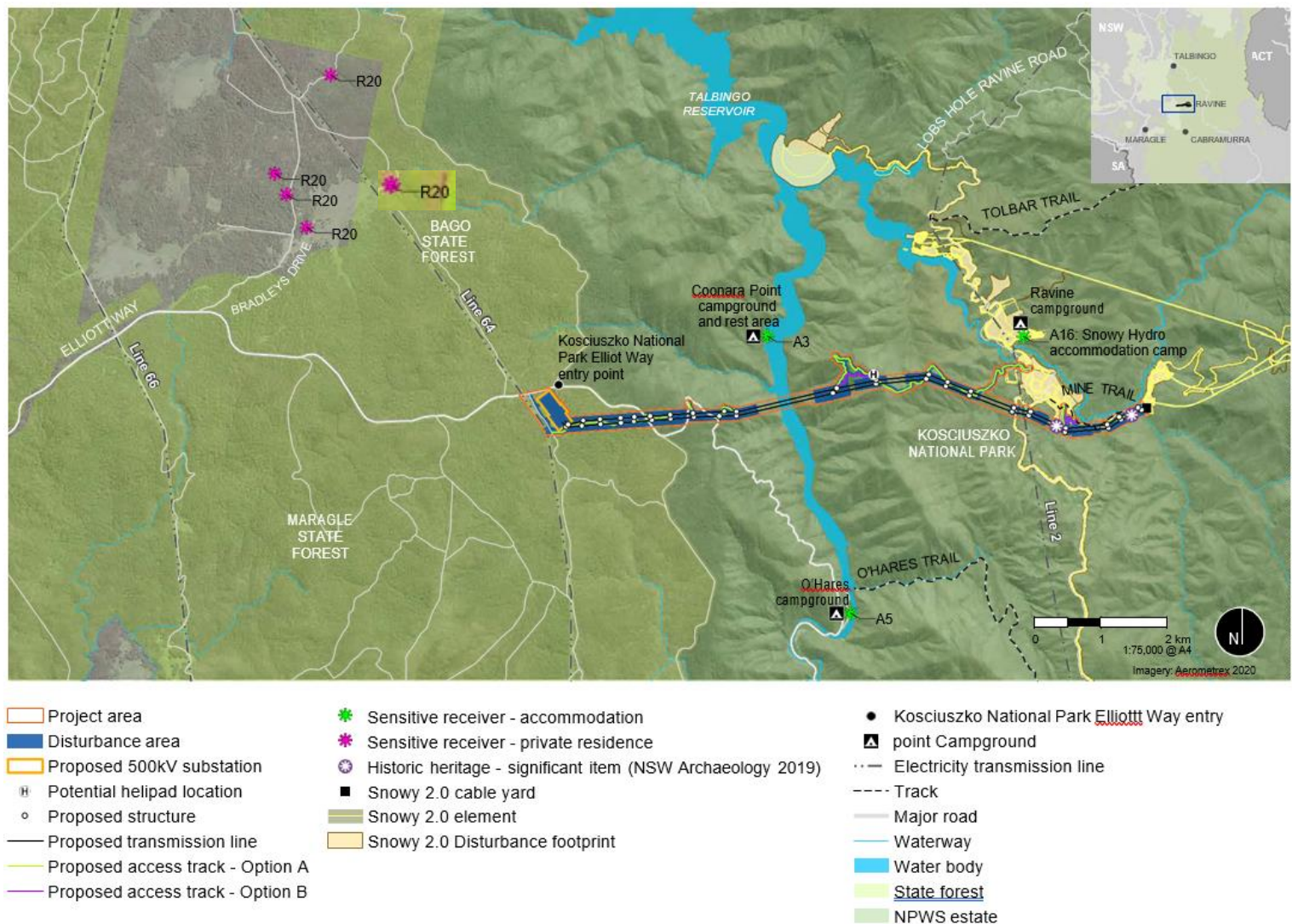


Figure 4-1 Sensitive receivers within proximity to the Project (Jacobs, 2021)

Note: A16 is not considered to be a sensitive receiver as part of the assessment given its affiliation with the Project.

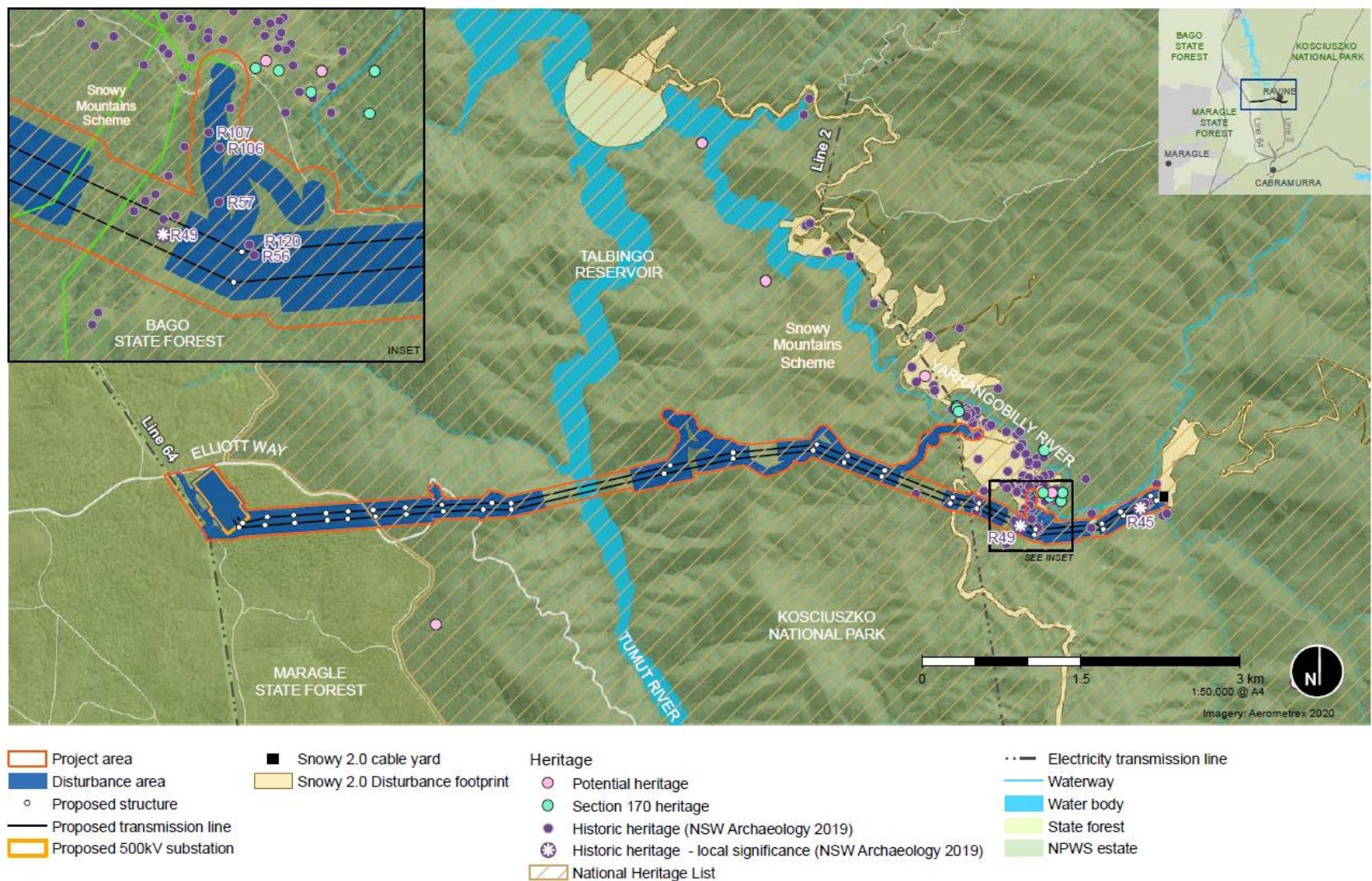


Figure 4-2 Heritage items within the Project area (Jacobs, 2021)

5 NOISE AND VIBRATION CRITERIA

5.1 INTERIM CONSTRUCTION NOISE GUIDELINES

The objectives of the Interim Construction Noise Guidelines (ICNG) (DECC, 2009) are to promote a clear understanding of ways to identify and minimise noise from construction and to identify ‘feasible’ and ‘reasonable’ work practices. The ICNG acknowledges that works outside standard hours (OOHW) may be necessary, however justification should be provided to the relevant authorities.

The ICNG provides two methodologies to assess construction noise emissions, quantitative or qualitative. The quantitative approach was adopted for the Noise and Vibration Assessment (Jacobs, 2021), which included the prediction of noise emissions from construction activities and assessment against ICNG recommended Noise Management Levels (NMLs) at the nearest receivers.

5.2 QUANTITATIVE NOISE ASSESSMENT CRITERIA

5.2.1 NOISE MANAGEMENT LEVELS

Construction noise assessment goals presented in the ICNG refer to noise management levels (NMLs) for residential, sensitive land uses and commercial/ industrial premises.

For residential properties, the rating background level (RBL) is used to determine the management level. The RBL is the overall background noise level measured in each relevant assessment period.

Table 5-1 is from the ICNG and details how the NMLs are determined for each period.

Table 5-1 NMLs for residences

Time of day	Management Level L _{Aeq} (15min)	How to apply
Recommended standard hours: Monday to Friday: 6am – 6pm Saturday and Sunday: 6am to 6pm No work public holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L _{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ul style="list-style-type: none"> • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of day	Management Level L_{Aeq} (15min)	How to apply
Outside recommended standard hours	Noise affected RBL + 5dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p>

5.2.2 ADOPTED PROJECT NOISE MANAGEMENT LEVELS

Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

The following NMLs (listed in) were established to assess potential construction noise impacts at the identified surrounding residential receiver location (receiver R20).

Table 5-2 Construction NMLs – all receivers

Receivers	Period	RBL dB(A)	NML LAeq,15min, db (A)
Residences	Day (during standard hours) Monday to Saturday 7am to 6pm Sundays and public holidays 8am to 6pm	35	45
	Day (outside standard hours)	35	40
	Evening (OOHW)	30	35
	Night	30	35
Passive recreation areas	When in use	n/a	60 (external noise level)

5.2.3 SLEEP DISTURBANCE

The ICNG does not provide a specific method for assessment of potential sleep disturbance noise impacts and guidance on the acceptability of these events is taken from the NSW Road Noise Policy (RNP), (DECCW, 2011).

The RNP provides two criteria:

- Sleep disturbance screening criterion – used to identify situations where there is the potential for sleep disturbance
- Sleep disturbance awakening criterion – levels below which awakening is unlikely to occur.

The sleep disturbance screening criterion recommends that where the $L_{A1} (1 \text{ minute})$ does not exceed the $L_{A90} (15 \text{ minute})$ by 15 dB(A) or more, sleep disturbance impacts are likely to be maintained at an acceptable level.

The $L_{A1}, (1 \text{ minute})$ descriptor is meant to represent a maximum noise level when measured using a 'fast' time response.

The sleep disturbance awakening criterion is the threshold at which an awakening reaction is likely to occur. Research discussed in the RNP identified this threshold to be an internal bedroom noise level of around 50 to 55 dB(A). Windows often allow the greatest amount of sound transmission from outside to inside across a building façade. Noting guidance presented in AS2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites, where bedrooms are ventilated by an opened window, a sleep disturbance awakening criterion measured outside the bedroom window of 60 to 65 dB(A) would generally apply.

5.2.4 CONSTRUCTION TRAFFIC NOISE

Section 9 of the “Construction Noise and Vibration Guideline” (CNVG) (TfNSW, 2023) provides guidance for the assessment of noise associated with additional traffic generated during construction. This guidance was adopted for this assessment and has been reproduced below:

An initial screening test should first be applied by evaluating whether noise levels will increase by more than 2dB(A) due to construction traffic or a temporary reroute due to a road closure. Where increases are 2dBA or less no further assessment is required.

Where noise levels increase by more than 2dB(A) [i.e., 2.1 dBA] further assessment is required using Roads and Maritimes (RMS) Criteria Guideline. This documents RMS' approach to implementing the Road Noise Policy. Consideration should be given under the Noise Criteria Guideline as to whether construction traffic or temporary reroute triggers new road criteria due to changes in road category.

This guidance was considered for the purpose of reviewing potential noise associated with additional traffic generated as a result of the Project.

5.2.5 DRONE USE

As part of the stringing activities for the Project the use of a commercial drone (UAV) has been selected over the more conventional helicopter stringing. The drone guides a thin draw wire through the tower pulleys which is then replaced, using a brake and winch setup, with larger sized draw wires eventually capable of pulling through the conductor. The conductor is then clipped in when the required tension has been achieved.

The drone will be operated by a commercial drone operator under relevant licensing. An example of a suitable sized drone for this commercial operation is provided in Appendix B. The operator has advised generic noise emissions for this unit at an altitude under 50m is estimated to be at 60-70db. Given that the closest sensitive receiver is over 1km to the north (see Figure 3-1), drone noise emissions are not anticipated to be a concern.

5.3 VIBRATION

5.3.1 OVERVIEW

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criteria levels, with the effects of vibration on human comfort having a lower threshold.

Effects of ground vibration resulting from construction may be placed into three categories:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced
- Effects on building contents – vibration where the building contents may be affected

5.3.2 HUMAN COMFORT

Vibration criteria relating to human comfort is sourced from the *Environmental Noise Management – Assessing Vibration: a technical guideline* (DEC, 2006). This guideline defines three vibration types, as detailed in Table 5-3.

Table 5-3 Examples of types of vibration

Continuous vibration	Impulsive vibration	Intermittent vibration
Machinery, steady road traffic, continuous construction activity (e.g., drilling)	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g., occasional dropping of heavy equipment, occasional loading and unloading.	Intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

Preferred and maximum values of human exposure for continuous and impulsive vibrations are listed (DECC, February 2006) in Table 5-4 below.

Table 5-4 Preferred and maximum weighted root mean squared (rms) values for continuous/impulsive vibration acceleration (m/s²) 1-80Hz

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x and y axis	z-axis	x and y axis
Continuous vibration					
Critical areas ²	Day or night	0.0050	0.0036	0.010	0.0072
Residences	Day	0.010	0.0071	0.020	0.014
	Night	0.007	0.005	0.014	0.010
Offices, schools, educational institutions, and places of worship	Day or night	0.020	0.014	0.040	0.028
Impulsive vibration					
Critical areas ²	Day or night	0.0050	0.0036	0.010	0.0072
Residences	Day	0.30	0.21	0.60	0.42
	Night	0.10	0.071	0.20	0.14
Offices, schools, educational institutions, and places of worship	Day or night	0.64	0.46	1.28	0.92
Workshops	Day or night	0.64	0.46	1.28	0.92

¹ Daytime is 7am to 10pm. Night-time is 10pm to 7am

² includes hospital operating theatres or precision laboratories.

Intermittent vibration is assessed differently using vibration dose values (VDV). Preferred and maximum VDV's for different types of receivers have been reproduced in Table 5-5.

Table 5-5 Preferred and maximum VDV_s for intermittent vibration (ms^{-1.75}) (DEC, 2006)

Location	Day time (7 am to 10 pm)		Night time (10 pm to 7 am)	
	Preferred VDV	Maximum VDV	Preferred VDV	Maximum VDV
Critical areas ¹	0.10	0.20	0.10	0.2
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

¹ Includes operating theatres, precision laboratories and other areas where vibration-sensitive activities may occur.

5.3.3 BUILDINGS AND STRUCTURES

The Australian Standard AS 2187.2: 2006 *Explosives – Storage and Use – Use of Explosives* (ABLIS, 2006) recommends that the guideline values provided in BS 7385 Part 2 – 1993 *Evaluation and measurement for vibration in buildings Part 2* (BSi, 1993) be used as vibration damage criteria for building structures, other than heritage buildings. The recommended limits for transient vibration are provided in Table 5-6 and represent minimal risks for cosmetic damage to residential and industrial buildings.

Table 5-6 Transient vibration guideline values

Type of building	Peak component particle range of predominant pulse		
	4Hz to 15 Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures: Industrial / heavy commercial buildings	50mm/s		
Unreinforced or light framed structures: Residential or light commercial type buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz	50mm/s

Guidance for more sensitive structures is presented in the German standard, *DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3: 2016). Vibration velocities not exceeding 3 mm/s at 1 to 10 Hz are recommended in this standard.

Other vibration-sensitive items

AS 2187.2 states that buildings of historical value should not (unless structurally unsound) be assumed to be more sensitive than their surrounding counterparts. The criteria outlined above (7.5mm/s) will be used for historical buildings unless a structural engineer advises otherwise.

The potential effect of vibration on structures can vary depending on many factors including their existing structural integrity and use. Criteria in the order of 20-100 mm/s are typically applied by regulatory authorities to other infrastructure items including tunnels, rock structures and transmission lines.

5.3.4 CONSTRUCTION NOISE AND VIBRATION GUIDELINE

Section 7 of the CNVG (DEC, 2006) provides useful guidance for safe working distances to achieve human comfort. The BS 7385-2:1993 (BSi, 1993) provides cosmetic building damage criteria for a range of different plant and equipment. These have been reproduced in Table 5-7 below.

Table 5-7 Recommended safe setback distances

Plant	Rating / description	Safe working distance (metres)	
		Cosmetic damage (BS7385-2: 1993)	Human response (DECC, 2006)
Vibratory Roller	<50 kN (typically 1-2 tonne)	5m	15 to 20m
	<100 kN (typically 2-4 tonne)	6m	20m
	<200 kN (typically 4-6 tonne)	12m	40m
	<300 kN (typically 7-13 tonne)	15m	100m
	>300 kN (typically 13-18 tonne)	20m	100m
	>300 kN (> 18 tonne)	25m	100m
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2m	7m
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7m	23m
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22m	73m
Vibratory pile driver	Sheet piles	2 to 20m	20m
Pile boring	≤800 mm	2m (nominal)	4m
Jackhammer	Hand-held	1m (nominal)	2m

These guidelines do not provide recommended setbacks for drone or helicopter use, or for blasting. In the unlikely event blasting is required, setbacks will be determined as part of a Blast Management Plan.

As previously mentioned, the use of helicopters for tower erection is unlikely as the towers have not been designed with guidance plates to aide aerial alignment. However, the use of a helicopter for this activity may still be requested if access challenges become apparent. Likewise for stringing if the innovative use of a commercial drone can't achieve the required outcomes of guiding a draw wire into the tower pulleys. In such an event, prior notifications for helicopter use, appropriate setbacks, and zero impact to heritage structures will apply and be observed.

Drone specifications are detailed in Section 4.2.5. Based on these specifications and current drone usage laws in Australia, a minimum setback of 30m to people and sensitive structures has been assigned and will be observed during stringing, unless otherwise governed (and mitigated) by a SWMS.

6 ENVIRONMENTAL ASPECTS AND IMPACTS

6.1 CONSTRUCTION ACTIVITIES

The Project will involve a range of activities incorporating various heavy machinery, plant and equipment that will operate in a number of locations across the Project. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of construction activity likely to interact with these receivers are identified below:

- Early works and site establishment
- Earthworks and vegetation clearing
- Construction of access tracks
- Civil, foundations and building works
- Tower assembly
- Tower erection of structures including the potential use of helicopters
- Stringing of lines using drones
- Pre commissioning activities and
- Site clean-up and landscaping

6.2 CONSTRUCTION IMPACTS

The Noise and Vibration assessment included in the EIS (Jacobs, 2021) determined that noise impacts would be below the Project NMLs at the identified receiver locations. Levels up to 59 dB(A) were predicted at receiver A16 (Snowy 2.0 works accommodation), although A16 is not considered to be a sensitive receiver given its affiliation with the Project. It is expected that the Snowy 2.0 works accommodation would meet relevant requirements to provide adequate levels of amenity. Additional traffic movements from Project construction activities are not expected to result in unacceptable changes in traffic noise levels at sensitive receivers along the intended haulage routes (Jacobs, 2021).

The major potential sources of vibration impact for the Project would be the use of hydraulic rock breakers and vibratory rollers activities, and to a lesser extent soil auguring for tower foundations. Due to the distance to sensitive receivers, building cosmetic damage and human comfort impacts would unlikely be impacted. However, care would need to be taken if works involving use of hydraulic rock breakers and vibratory rollers are required within 50 metres of heritage items R45 and R49 (Jacobs, 2021).

The predicted noise and vibration impacts determined during the EIS Noise and Vibration Assessment are summarised below. The complete assessment is available in Appendix J of the EIS (Jacobs, 2021).

6.2.1 CONSTRUCTION NOISE

The construction noise levels for each stage of the development at each of the identified sensitive receivers is outlined Table 6-1. The predicted worst-case noise levels during construction were predicted to remain below Project NMLs at the identified receiver locations (refer to Section 3.1). Levels up to 59 dB(A) were predicted at receiver A16 (Snowy 2.0 works accommodation) although this is not considered to be a sensitive receiver given its association with Snowy 2.0.

The potential for sleep disturbance impacts from noise during construction activities was also evaluated. The highest predicted LA1 (1 minute) at R20 for all activities was 26 dB(A), well below the sleep disturbance limit of 55 dB(A). Considering this, it is unlikely that sleep disturbance impacts would occur during construction of the Project.

Table 6-1 Predicted worst case construction noise levels (Jacobs, 2021)

Stage	NML Leq 15 min dB(A) for R20				NML Leq 15 min dB(A) for A3 and A5	Predicted worst-case Leq 15 min dB(A)			
	Day, standard hours	Day, outside standard hours	Evening	Night	When in-use	A3	A5	R20	A16
Switching yard	45	40	35	35	60	<20	<20	<20	<20
Transmission line	45	40	35	35	60	32	<20	<20	59
Other works	45	40	35	35	60	30	<20	<20	57

6.2.2 CONSTRUCTION TRAFFIC IMPACTS

The noise and vibration assessment prepared for the Snowy 2.0 Main Works EIS (EMM, 2019) included traffic forecasts along key haulage routes. This data was used to determine existing conditions at the Project area. Table 6-2 summarises the predicted volume of traffic and most-affected sensitive receivers as a result of construction traffic impacts. Although increases greater than 2 dB(A) at night were predicted at the most affected receivers along the Snowy Mountains Highway and Link Road, the resulting overall levels (including traffic from Snowy 2.0) do not exceed the criteria listed in the RNP. As such, it can be concluded that additional traffic movements from Project construction activities are not expected to result in unacceptable changes in traffic noise levels at sensitive receivers along these key haulage routes.

Table 6-2 Predicted construction traffic noise impacts (Jacobs, 2021)

Haulage road	Predicted change in noise levels at most-affected receiver dB(A)		Predicted noise levels at most-affected receiver dB(A)		RNP criteria [external] dB(A)	
	Day	Night	Day	Night	Day	Night
Snowy Mountains Highway	+1.0	+2.6	54.0	52.2	60	55
Link Road	+1	+2.4	52.7	51.2	60	55
Lobs Hole Ravine Road	+0.6	+1.4	53.2	51.8	60	55

*Day hours = 7am to 10pm, Night hours = 10pm to 7am

6.2.3 CONSTRUCTION VIBRATION IMPACTS

Given the setback distances for hydraulic rock breakers and vibratory rollers and the relative location of sensitive receivers, it was concluded that building cosmetic damage and human comfort impacts from the use of these plant and equipment would be unlikely. Care would need to be taken if works involving use hydraulic rock breakers and vibratory rollers is required within 50m of heritage items R45 and R49. Vibration monitoring is addressed in Section 8.3.2 of this report.

7 NOISE AND VIBRATION MITIGATION MEASURES

7.1 CONSTRUCTION HOURS

7.1.1 STANDARD CONSTRUCTION HOURS

Construction activities for the Project will be undertaken during the following construction hours Monday to Sunday 6am to 6pm.

7.1.2 OUTSIDE STANDARD CONSTRUCTION HOURS

The conditions of approval outline the following construction activities which may be carried out outside the construction hours specified above:

- The delivery or dispatch of materials as requested by the NSW Police Force or other public authorities for safety reasons
- Emergency work to avoid the loss of life, property or to prevent material harm to the environment;
- Road upgrades required by the relevant roads authority/manager to be undertaken outside the construction hours specified above; and
- Works carried out in accordance with the approved Out of Hours Work (OOHW) Protocol (Refer Appendix A).

Activities which may result in the need for OOHW approval include prolonged concrete pours, traffic closures, over dimension deliveries, and interaction with other Snowy Hydro construction contractors. Such needs should be assessed and communicated well ahead of time to ensure approval timeframes can be met.

Table 7-1 Noise and vibration management and mitigation measures

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
General					
NVMP01	Training will be provided to all Project personnel, including relevant sub-contractors on noise and vibration management practices including the out of hours work procedure and the requirements from this plan through inductions, toolboxes, and targeted training	Induction package Toolbox training material Targeted training material	Pre-construction Construction	Construction Manager Site Environmental Advisor (SEA)	NV1 RNP ICNG
NVMP02	Relevant noise and vibration management measures from this plan will be included in site environmental documents including for example, Environmental Work Method Statements (EWMS) and/or Site Environmental Plans (SEPs)	CEMP	Pre-construction Construction	SEA	NV1
Procedures and plans					
NVMP03	An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of works which are outside the Project construction hours. The Protocol must be approved by the Planning Secretary before commencing these works. The Protocol must: (a) Be prepared in consultation with Council; (b) Provide a process for the consideration of out-of-hours works against the relevant noise and vibration criteria, including the determination of low and high-risk activities; (c) Identify an approval process that considers the risk of activities, proposed	Out of hours works Protocol (Appendix A)	Pre-construction Construction Post-construction	Construction Manager SEA	B3

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	mitigation, management, and coordination; and (d) Identify Department and Council arrangements for approved out of hours work				
Working hours					
NVMP04	Construction activities for the Project will be undertaken 7 days a week between 6am to 6pm.		Pre-construction Construction	Construction Manager SEA	B1
NVMP05	The following construction activities may be carried out outside the standard construction hours specified above: <ul style="list-style-type: none"> • The delivery or dispatch of materials as requested by the NSW Police Force or other public authorities for safety reasons; • Emergency work to avoid the loss of life, property or to prevent material harm to the environment; • Activities that are inaudible at sensitive receivers that do not require traffic movements on local roads; • Road upgrades required by the relevant roads authority/manager to be undertaken outside the Project construction hours; and • Works carried out in accordance with the approved Out-of-Hours Work Protocol. 	Out of hours works Protocol (Appendix A)	Pre-construction Construction	Construction Manager SEA	B2 B3
Plant and equipment					
NVMP06	Where practicable, noise generating equipment		Pre-construction	Site Supervisor	B4

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	will be strategically positioned to take advantage of natural screening from geographical features or other structures to reduce the transmission of noise between work sites and receiver locations		Construction		NV1 RNP ICNG
NVMP07	Where possible equipment selected will be with the lowest noise rating that meets task requirements.	Procurement Availability of plant and equipment	Pre-construction Construction	Site Supervisor	BIO24 ICNG
NVMP08	Where practical, minimise operating loud machinery conjunctively.		Pre-construction Construction	Site Supervisor	BIO24 ICNG
NVMP09	In cases where noise or vibration levels are identified as likely exceeding applicable criteria (Section 4), and impact to sensitive receivers is a concern, modification or substitution of work methods will be undertaken wherever possible, including but not limited to: <ul style="list-style-type: none"> • Work programming assessments • Equipment/plant substitution • Application of plant/equipment noise suppressed and/or • Applied noise barriers or earthen bunds Targeted NV monitoring during the works may be applied to assist with this determination		Pre-construction Construction	Construction Manager	B4 NV1
NVMP10	All construction plant and equipment used on the site will be, in addition to other relevant requirements: <ul style="list-style-type: none"> • Fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications • Maintained in an efficient condition including exhaust systems • Operated in a proper and efficient manner 	Personnel Inspection forms Maintenance records	Pre-construction Construction	Plant foreman Site Supervisor	B4 BIO22 BIO23 NV1 RNP ICNG

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
NVMP11	Avoid, when possible, the use of engine compression brakes within residential areas	Procurement Availability of plant and equipment	Pre-construction Construction	Site Supervisor	B4 B5 NV1 RNP
NVMP12	Preference will be given to hydraulic and electric powered plant over combustion engine or pneumatic powered plant, when possible	Procurement Availability of plant and equipment	Pre-construction Construction	Site Supervisor	B4 BIO24 NV1 ICNG
NVMP13	Minimise the use of reversing alarms on mobile equipment where not impacting health and safety requirements	Procurement	Construction	Site Supervisor	B4 NV1 ICNG
NVMP14	Do not conduct vibration intensive works within the recommended safe setback distances for each public utility, structure and building will be carried out where: (a) Piling activities within 100m (c) Excavation by hammering or ripping within 100m (d) Vibratory compactor >7 tonne plant within 50m (e) Vibratory compactor <7 tonne plant within 25m	Section of this plan 5.3.4	Construction	SEA Site Supervisor	NV2
NVMP15	Avoid the use of vibration intensive plant within the nominated human comfort distances.	Section 5.3.2 of this plan	Construction	SEA Safety Advisor Site Supervisor	NV2
NVMP16	If vibration-intensive activities need to occur within the recommended safe setback distance of 50m of heritage items R45 and R49, a suitably qualified person will be present, or monitoring will be undertaken during the works to suspend activities in the instance of any issues	Vibration monitoring Section 8.3	Construction	SEA Site Supervisor	NV3

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
Behaviour controls					
NVMP17	Plan worksites and activities to minimise noise and vibration. Place as much distance between plant or equipment and sensitive receivers.	Personnel Worksite plan	Construction	Site Supervisor	Best practice RNP ICNG
NVMP18	Plan traffic flow, parking, and loading/unloading areas to minimise reversing movements within the site	Personnel Traffic Management Plan	Construction	Site Supervisor	Best practice B4 B5 RNP
NVMP19	Reduce throttle setting and turn off equipment when not being used.	Personnel	Construction	Site Supervisor	Best practice B4 RNP
NVMP20	Where possible, materials dropped from heights into or out of trucks will be minimised	Personnel	Construction	All site workers Site Supervisor	Best practice
NVMP21	Workers should avoid shouting, throwing materials, using horns for signalling, warming up plant, and slamming vehicle doors near sensitive receivers	Personnel	Construction	All site workers Site Supervisor	Best practice ICNG
NVMP22	Workers will be using Project nominated UHF/VHF radio channels for Project communications and vehicle call outs. Workers will remain respectful of other users and the system, and only engage in work relevant communications.	Personnel	Construction	All site workers	Best practice
NVMP23	Water extraction from Paddys Flats will be programmed to minimise impacts on users of the campground. Watertruck operators will be informed of these potential sensitive receivers and program requirements.	Induction package	Construction	All site workers Site Supervisor	In response to consultation with SVC
Traffic and access					

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
NVMP24	Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling)	Traffic Management Plan Driver induction	Pre-construction Construction	Construction Manager	NV1 B4 B5 RNP ICNG
NVMP25	Where possible, amalgamate deliveries to reduce traffic numbers and congestion.	Traffic Management Plan Driver induction	Pre-construction Construction	Construction Manager	NV1 B4 B5 RNP ICNG
Drones					
NVMP26	All drones will be operated by a licenced and registered pilot and in accordance with relevant legislation and policies including: <ul style="list-style-type: none"> NPWS Drone Use Policy Air Navigation (Aircraft Noise) Regulations 2018 	Personnel	Construction	Project Manager	Best practice
Consultation and complaints management					
NVMP27	All complaints, including those related to property damage, will be managed in accordance with the Communication Strategy	Communication Strategy	Pre-construction Construction	SEA Construction Manager Transgrid	Best practice
NVMP28	Prior to such activities, the Proponent will advise in writing any 'at risk' sensitive receivers of activities that are likely to affect their noise and vibration amenity in accordance with the Communication Strategy. Information provided will include: <ul style="list-style-type: none"> The types of activities that will be undertaken The timings of the activities, including 	Communication Strategy	Pre-construction Construction	Transgrid	Best practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	<p>expected start and finish</p> <ul style="list-style-type: none"> • The location of activities; and • Information on how to make an enquiry and/or complaint 				
Monitoring and reporting					
NVMP29	Noise and vibration monitoring will be undertaken in accordance with Section 8.3	Section 8.3.	Pre-construction Construction	SEA	NV2 NV3

8 COMPLIANCE MANAGEMENT

8.1 RESPONSIBILITIES

UGL's organisational structure and overall roles and responsibilities are outlined in Section 4.11 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 7 of this Plan.

8.2 TRAINING

All site personnel will undergo the UGL site induction training relating to noise and vibration management issues. The induction training will address elements related to noise and vibration management including:

- Existence and requirements of this NVMP
- Relevant legislation
- Normal working hours
- The process for seeking approval for out of hours works, including consultation
- Location of sensitive receivers and heritage structures
- Roles and responsibilities for noise and vibration management
- Noise and vibration mitigation and management measures.

Further details regarding staff induction and training are outlined in Section 6 of the CEMP.

8.3 MONITORING AND INSPECTIONS

Regular monitoring and inspections will be undertaken during construction. Noise and vibration monitoring is outlined below.

Noise and vibration monitoring will be undertaken by an Acoustic Consultant or the SEA during the construction phase of the Project and where relevant for the OOHW approval.

Requirements and responsibilities in relation to monitoring and inspections are documented in Section 9 of the CEMP.

8.3.1 NOISE MONITORING

Noise monitoring will only be undertaken in response to a complaint, or an identified concern of potential exceedance. The monitoring will include operator-attended noise monitoring and be undertaken in accordance with the relevant Australian Standards and EPA guidelines including:

- AS 1055.1 – 1997 Acoustics – Description and measurement of environmental noise – General procedures
- AS/NZS IEC 61672.1 – 2019 Electroacoustics – Sound level meters, Part 1: Specifications
- NSW Noise Policy for Industry (NPfI) (EPA, 2017)

All acoustic instrumentation used for monitoring under this plan will have current NATA or manufacturer calibration certificates.

The noise monitoring results will be compared to the criteria provided in

Table 5-1. If an exceedance is found it will be reported to Transgrid and the mitigation measures reviewed to see if any additional measures can be implemented.

8.3.2 VIBRATION MONITORING

Vibration monitoring is required where vibration intensive activities (e.g., rock breaking, vibratory rollers) approach the 50m setback for Heritage items R45 and R49.

Vibration monitoring will include equipment placed at the heritage item with a trigger level based on the frequency dependent DIN 4150-3 vibration criteria. If the vibration level on the equipment is reached a visual alarm should be triggered to alert the operators that the vibration criteria have been exceeded.

Vibration measurements will be undertaken in accordance with the procedures documented in the OEH's Assessing Vibration - a technical guideline (2006) and BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings.

8.4 NON-CONFORMANCE REPORTING AND INCIDENTS

Reporting requirements and responsibilities are documented in Section 4.11 of the CEMP.

Details on incident reporting is included in Section 8 of the CEMP. Environmental incidents relating to noise and vibration incidents may include but not be limited to:

- Exceedances of noise and vibration criteria
- Potential damage to structures, buildings, and heritage items

UGL will promptly advise Transgrid on events that are non-conforming with the CoAs, Project permits and Project licences. Transgrid will advise the Department accordingly for any notifiable non-conformances.

8.5 AUDITING

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, infrastructure approval and other relevant approvals, licences, and guidelines. Audit requirements are detailed in Section 9.3 and Appendix D of the CEMP.

9 REFERENCES

- ABLIS. (2006). *Australian Standard AS 2187.2:2006 Explosives - Storage and Use - Use of Explosives*. Retrieved from Australian Business Licence and Information Services: <https://ablis.business.gov.au/service/vic/australian-standard-as-2187-2-2006-explosives-storage-and-use-use-of-explosives/24201>
- ANZEC. (1990). *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*. Australian and New Zealand Environment Council.
- BSi. (1993). *Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from groundborne vibration*. Retrieved from British Standard Institution: <https://www.alexandriava.gov/uploadedFiles/special/WaterfrontPlan/info/measurementforbuildingvibrations.pdf>
- DEC. (2006). *Environmental Noise Management: A technical guideline*. Department of Environment and Conservation.
- DECC. (2009). *Interim Construction Noise Guideline*. Department of Environment and Climate Change.
- DECCW. (2011). *NSW Road Noise Policy*. Department of Environment, Climate Change and Water.
- EMM. (2017). *Biodiversity Development Assessment Report Exploratory Works for Snowy 2.0*. EMM Consulting.
- EMM. (2019). *Biodiversity Management Plan Snowy 2.0 - Exploratory Works*. EMM Consulting.
- EMM. (2019). *Snowy 2.0 Main Works EIS*. EMM.
- EPA. (2017). *Noise policy for industry*. Retrieved from Environmental Protection Authority: [https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-\(2017\)](https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017))
- EPA. (2017). *Noise Policy for Industry*. Environmental Protection Authority .
- Jacobs. (2021). *Snowy 2.0 Transmission Connection Project EIS*. Jacobs Pty Ltd.
- Jacobs. (2022). *Snowy 2.0 Transmission Connection Project Appendix C Biodiversity Development Assessment Report*. August 2022, Rev 7.
- NPWS. (2006). *Kosciuszko National Park - Plan of Management*. National Parks and Wildlife Service.
- TfNSW. (2023). *Construction Noise and Vibration Guideline*. Transport for NSW (formerly Roads and Maritime Services).
- Transgrid. (2022). *Snowy 2.0 Transmission Connection Project Amendment Report*. March 2022.

APPENDIX A OUT OF HOURS WORK (OOHW) PROTOCOL

Introduction

This process defines the OOHW process for the Maragle Transmission Line Project. A flowchart for assessment is provided by Figure A-1.

Objectives

This procedure outlines the Project requirements for construction working hours and documents a process to be implemented when work outside of Project hours is required. The key objective is to meet the Project conditions of approval and mitigation measures.

Project Requirements

The Project construction hours is 7 days a week between 6am and 6pm.

In accordance with condition of approval B3:

An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of works which are outside the hours defined in condition B1. The Protocol must be approved by the Planning Secretary before commencing these works. The Protocol must:

- (a) Be prepared in consultation with Council;
- (b) Provide a process for the consideration of out-of-hours works against the relevant noise and vibration criteria, including the determination of low and high-risk activities;
- (c) Identify an approval process that considers the risk of activities, proposed mitigation, management, and coordination; and
- (d) Identify Department and Council arrangements for approved out of hours work.

Activities outside 6am and 6pm require approval under this OOHW with exception for:

- The delivery or dispatch of materials as requested by the NSW Police Force or other public authorities for safety reasons; or
- Emergency work to avoid the loss of life, property or to prevent material harm to the environment; or
- Activities that are inaudible at sensitive receivers that do not require traffic movements on local roads; or
- Road upgrades required by the relevant roads authority/manager to be undertaken outside the Project construction hours.

Guidelines and criteria

Noise criteria and modelling required for this OOHW will be in accordance with:

- NSW Department of Environment Climate Change (DECC) 2009, *Interim Construction Noise Guideline* (ICNG)
- NSW Environment Protection Authority (EPA) 2017, *NSW Noise Policy for Industry*.

Expected OOHW

All activities that are anticipated to occur outside of the approved Project construction hours, excluding those that are listed as exemptions above, require approval under this OOHW. Activities that may require to occur outside of the Project hours include prolonged concrete pours, traffic closures, over dimension deliveries, and interaction with other Snowy Hydro construction contractors.

Consultation

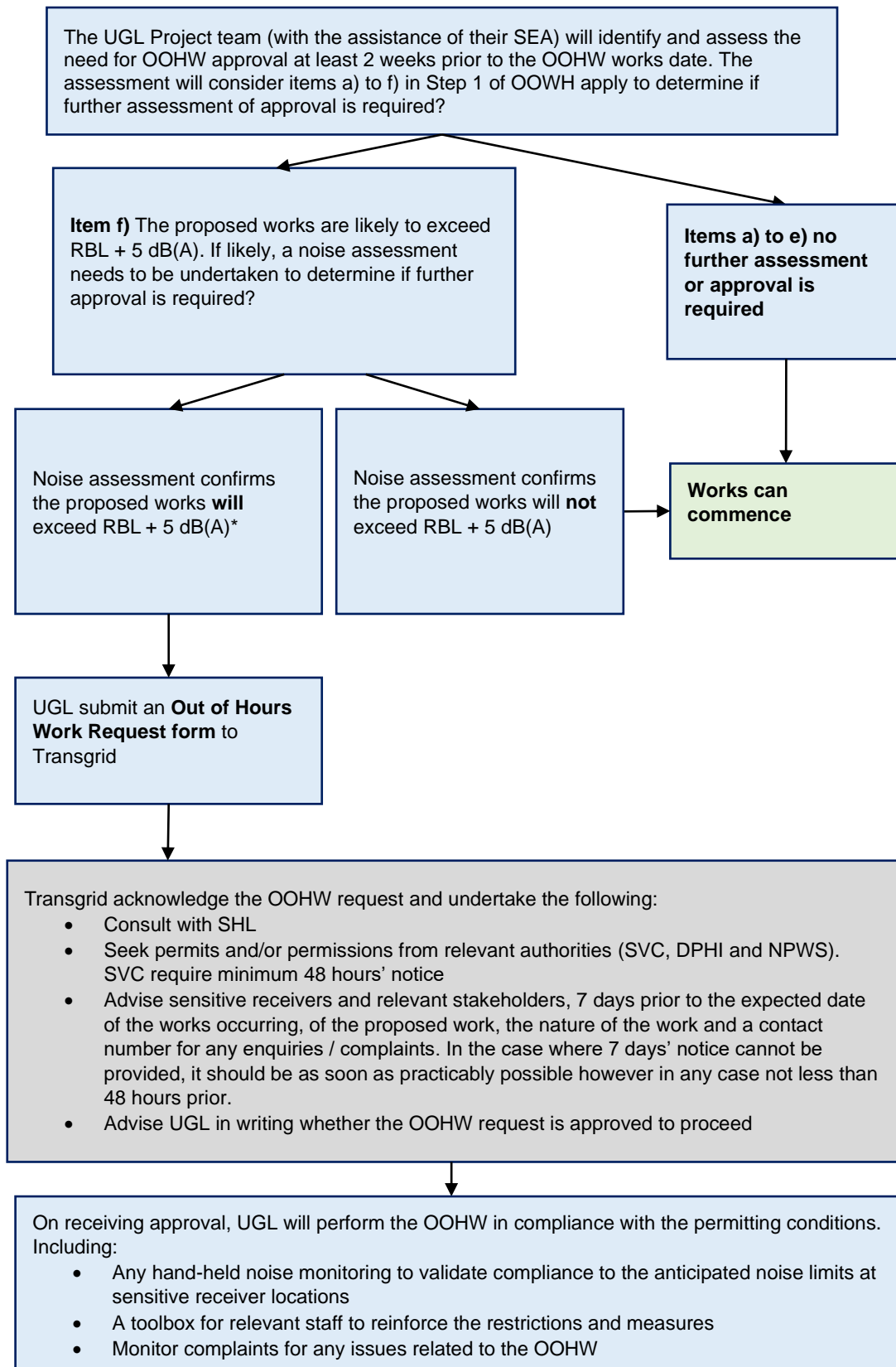
In accordance with Conditions of Approval B3, consultation has been undertaken with DPHI and SVC. Consultation and how comments have been addressed is provided in Section 3 of the NVMP. Consultation requirements during the protocol are outlined in the process below.

OOHW Assessment and Request Form Process

1. The UGL Project team (with the assistance of their SEA) will identify and assess the need for OOHW approval at least 2 weeks prior to the OOHW works date. The assessment will consider:
 - (a) Whether the works are inaudible at all non-Project related residences or other noise sensitive locations;

- (b) If the works are further than 500m from sensitive receivers (for the purposes of this OOHW Approval Procedure, works further than 500m from sensitive receivers can be assumed to not generate noise or vibration levels in excess of the relevant management levels);
 - (c) If the works are for the delivery of materials required outside of standard hours by the NSW Police Force or other authorities for safety reasons;
 - (d) Where it is required in an emergency to avoid injury or the loss of life, property and/or to prevent environmental harm;
 - (e) If the works involve Road upgrades required by the relevant roads authority/manager to be undertaken outside the Project construction hours; and
 - (f) Whether the proposed works are likely to exceed $RBL + 5 \text{ dB(A)}$ or the Noise Management Levels specified in Table 3 of the Interim Construction Noise Guideline (refer to Section 5.2.1 of this NVMP).
2. If any of the above items a) to e) apply, then no further assessment or approval is required however SVC, DPHI and NPWS must be advised.
3. If the above item f) applies then a noise assessment is to be undertaken and if results determine that the subject works will generate $Leq,15min$ noise levels significantly less than the NML and no vibration impacts are expected, then no further assessment or approval is required. If proposed OOHW are deemed likely to be confirmed via noise modelling to be more than 5dB(A) above background levels at the relevant sensitive receivers, then UGL will submit an Out of Hours Work Request form to Transgrid. The form will outline:
- The proposed scope of works
 - Location of works
 - Duration of works
 - Justification for the OOHW
 - Noise criteria
 - Predicted noise impacts and results of noise modelling
 - Location of sensitive receivers
 - Management measures to be implemented
 - Any consultation required
 - Any approvals required.
4. The Transgrid Project team will acknowledge the OOHW request when received, and meet / achieve the following:
- Give due consideration to the request
 - Consult SHL for endorsement of the request (including engagement with the community team)
 - Advise the Project Environmental Representative (if required)
 - Seek permits and/or permissions from relevant authorities (DPHI, NPWS and SVC) regarding the request. For SVC this includes:
 - Provision of 48 hours' notice to council of any expected or programmed works proposed to occur outside of hours.
 - Provide contact details of relevant contractor or supervisor that is responsible for the works.
 - Advise sensitive receivers and relevant stakeholders, 7 days prior to the expected date of the works occurring, of the proposed work, the nature of the work and a contact number for any enquiries / complaints. In the case where 7 days' notice cannot be provided, it should be as soon as practicably possible however in any case not less than 48 hours prior.

- Advise UGL in writing whether the OOHW request is approved to proceed
 - Where circumstances occur that a variation to the OOHW Procedure is required, then approval will be sought from the relevant regulator dependent on the type of works.
5. On receiving approval, UGL will perform the OOHW in compliance with the permitting conditions. This may include hand-held noise monitoring to validate compliance to the anticipated noise limits at sensitive receiver locations. A toolbox will also be held for relevant staff to reinforce the restrictions and measures. Both UGL and Transgrid will monitor complaints for any issues related to the OOHW.



* RBL + 5 db(A) is relevant to the actual sensitive receiver locations

Figure A-1 OOHW Approval Flowchart

Example Out of hours request form

Maragle 330kV Switching Station and 330kV Transmission Line Connections - UGL	
Out of Hours Request No:	
Application Date:	
Name of Person Requesting Work:	
Why work outside of standard hours is required? Include any alternatives considered	

CONTACT DETAILS	Name	Mobile number	Email
UGL's Representative:			
UGL's 24 Hour Contact:			
Transgrid Project Manager:			
Transgrid Environmental Manager			
Transgrid Communications Officer			

OUT OF HOURS WORK DETAILS	
Location:	
Description of the Work:	
Proposed Dates / Duration:	
Start Time of Works (each day):	
Finish Time of Works (each day):	
OOHW Period Classification:	
Plant and Equipment to be Used: List all plant and noise generating equipment / activities to be used Where plant is not used for entire OOHW period, note when it will be used	
Map Attached showing worksites and nearest noise sensitive receivers	<input type="checkbox"/> Yes
Names of Foremen Supervising Work:	
Subcontractor Details (if applicable):	
Details on any concurrent OOHW being undertaken in same area (within 500m):	

NOISE AND VIBRATION	
Distance from works to nearest sensitive receivers:	
Are there any shielding features (barriers / buildings) between works and receivers that can be used to reduce noise levels?	
Could the works generate audible noise or perceptible vibration at the nearest sensitive receivers? Describe plant / equipment / activities that may generate audible noise or perceptible vibration	
Preliminary noise assessment If unsure, acoustic report should be prepared	<input type="checkbox"/> Less than RBL + 5 dB(A) (select if distance to receivers > 500 m) <input type="checkbox"/> Above RBL + 5 dB(A) (NOISE REPORT REQUIRED)
Preliminary vibration assessment If unsure, vibration report should be prepared	<input type="checkbox"/> Works occurring outside safe working distance for human comfort <input type="checkbox"/> Works occurring inside safe working distance for human comfort (VIBRATION REPORT REQUIRED)
Noise and/or Vibration report attached Check all that apply	<input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Not required
Programming measures to be implemented Detail work programming that will be adopted to minimise impacts on particular receivers	
Noise mitigation measures to be implemented Refer to NVMP and provide specific measures for equipment to be used	
Vibration mitigation measures to be implemented Refer to NVMP and provide specific measures for equipment to be used	
Noise and vibration monitoring to be undertaken? Provide details of location and frequency	

TRAFFIC IMPACTS

Will the work require traffic control?	
Describe the location and nature of any disruption to traffic from OOHW	
Who is planning the traffic control?	
Who is responsible for traffic control during the work?	

OTHER CONSIDERATIONS

Identify other potential impacts of the works:	<input type="checkbox"/> Dust <input type="checkbox"/> Lighting <input type="checkbox"/> Pedestrian access <input type="checkbox"/> Other (specify)	<input type="checkbox"/> Public transport e.g. schedule changes <input type="checkbox"/> Parking <input type="checkbox"/> Property access
Describe mitigation measures to be implemented to address these potential impacts		
What lighting is to be provided for night work?		
Does the work team comprise a minimum of two persons?		
Who in the work team holds current senior first aid qualifications?		
Where is the first aid kit to be located?		
What means of communications is to be used to summon assistance in an emergency?		
Has a check of the functionality of the proposed emergency means been made?		

CONSULTATION & NOTIFICATION STRATEGY

Detail consultation and notification strategy for works Ensure strategy is in accordance with NVMP requirements	
Is negotiation required with affected receivers? Refer to situations under which this is required in OOHW Approval Procedure	<input type="checkbox"/> Yes (Attach negotiation summary and evidence of submission to SVC,DPHI and NPWS) <input type="checkbox"/> No

UGL APPROVALS	
ENVIRONMENTAL	NAME: _____ DATE: _____ SIGNATURE: _____
COMMUNITY	NAME: _____ DATE: _____ SIGNATURE: _____
SAFETY	NAME: _____ DATE: _____ SIGNATURE: _____
TRAFFIC	NAME: _____ DATE: _____ SIGNATURE: _____

TRANSGRID REVIEW & APPROVAL	
TRANSGRID COMMUNICATIONS TEAM Provide comments on consultation and notification strategy	
	<input type="checkbox"/> Community notification required? <input type="checkbox"/> Application on Register?
TRANSGRID APPROVAL	NAME: _____ DATE: _____ SIGNATURE: _____

APPENDIX B EXAMPLE OF A COMMERCIAL DRONE (FOR STRINGING)



Callisto 50 Modular Industrial Multirotor System



The Callisto 50 has world leading performance with up to 26 kg payload capacity while maintaining single propulsion fault tolerance in the event of a propeller out failure (up to 50 kg TOW). Flight endurance on lithium batteries can exceed 35 mins with <5 kg payload allowance (refer to performance graph for details). A series hybrid petrol-electric ICE range extender & ground power tether system are available to increase flight endurance significantly. (see separate details)

Ideally suited for heavy lift operations, slung tether payloads, LiDAR surveying, scientific instrument payloads, BVLOS operations and more. The Callisto 50 has full autonomous BVLOS mission capability via ArduCopter autopilot system with long range comms, telemetry & other advanced features.

The Callisto 50 has been granted CASA Type Rating Approval for standard and tethered operations. Freespace Operations offers full support Australia wide including p projects, custom payload integration, mission planning, consultation, training, maintenance, and more.



HIGH PERFORMANCE VTOL MULTIROTOR

The Callisto 50 is a VTOL multirotor allowing take-off and landing from any suitable platform providing sufficient minimal clearance is available (at least 1 aircraft width each side of the propeller tips). It's dynamic stability allows operations in 15 - 25 m/s winds up 1500 m above sea level.

Flight Modes

The Callisto 50 offers 3 basic flight control configurations:

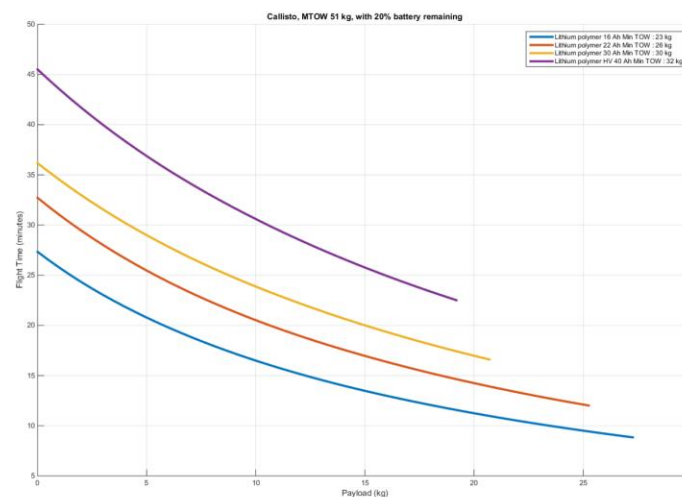
- Remote Pilot manual control with multiple autopilot assisted flight modes such as Loiter
- Full autonomous flight modes following internal waypoint navigation. (typical BVLOS scenario)
- Guided Mode flying where the aircraft is commanded via an external source (eg. Onboard companion computer / server such as a Raspberry Pi with custom navigation software).

Flight modes can be changed anytime the aircraft is in flight.

Payloads – Performance & Configurations

Callisto 50 offers 2 flight & payload weight configurations for different licenses categories:

- < 25 kg TOW configuration allows up to 7 kg of payload (dependant on battery configuration)
- 52 kg TOW configuration allows up to 26 kg of payload (dependant on battery configuration)





Designed and Manufactured in Australia, for Australia Conditions

The Callisto 50 was conceived for DST Group Australia to provide a platform for RAAF Plan Jericho LiDAR UAS proof of concept and based on the success of those trials was developed to commercialisation. The airframe comprises mainly of high strength carbon fibre composites with aircraft grade aluminium components. These components are designed to be extremely light, strong and durable able to withstand the unique loads / vibrations that a large multirotor incurs.

The autopilot and avionics code can be made available for security review, allowing clients comfort knowing that their RPAS has zero risk of foreign cyber espionage or data breaches.

Ground Powered Tether System Accessory for Persistent Operations

The Callisto 50 is mated with our Freespace 6 kW Ground Powered Tether System accessory providing persistent flight at altitudes up to 100 m and payloads up to 10 kg and/or 1 kW power.



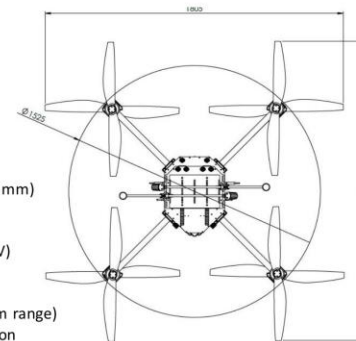
Packaging, Handling and Transportation

The Callisto 50 is a very compact aircraft for the performance and capability it delivers. It fits into two easily transportable interlocking tough cases with assembly and disassembly taking less than 15 mins for an experienced crew. Easily transportable in typical fleet vehicles and standard commercial airliner checked baggage. Customisable options available upon request.



Technical Specifications

Aircraft Type: Multirotor (X8 Octocopter)
 Frame Size: 1525 mm (motor to motor exterior)
 Airframe Weight: 15 kg dry (including landing gear)
 Propeller: 32" to 34" for high altitude use (810 - 860 mm)
 Motor: 100 K_v, 4.0 kW
 ESC: 52.2 V, 80 A rated (100 A peak)
 Battery system: 12s LiPo (50.4 V) / LiHV packs (52.2 V)
 Autopilot: ArduCopter autopilot system (ArduPilot)
 GPS: Moving Baseline Heading Dual RTK system
 LiDAR: Precision Landing & Terrain Following (<100 m range)
 Telemetry Radio Modem: RFD900x with 4G/LTE option
 Pilot Radio: Skydroid H16 Pro with GCS Telemetry to Android tablet
 Comms Range: 5 – 20 km standard (up to 40 km with suitable antennas)
 Aircraft Camera: Various situational awareness & payload camera options configurable
 Take-off Weight: TOW 52 kg rated (single propulsion failure tolerant up to 52 kg TOW)
 Max Effective Payload: 26 kg payload (fully redundant with single propulsion fault tolerance)
 Flight Time: ≥ 40 min (with suitable LiHV battery system to maximise endurance vs payload)
 Flying Speed: > 25 m/s Max, 15-20 m/s Cruise, Max Climb Rate: 10 m/s, Max Descent Rate: 10 m/s
 Environmental Conditions: Suitable for all Australian conditions, mining & marine environments
 VTOL: Metal Hull Boat / Moving Platform take-off and landing capable (autonomous)
 Wind Tolerance: 15 m/s (54 kph) with gusts up to 25 m/s (90 kph)
 Environmental Protection: designed to IP 54 (suitable for use in inclement conditions & light rain)
 Payload Mounting: NATO accessory rail (STANAG 4694) mounting system with 12mm carbon tubes
 Payload Power Supplies, Comms Port & connection to Autopilot:
 - 5 V (regulated) x 10 A (50 W), 12.0 V (regulated) x 10 A (120 W)
 - 50 V at 25 A (up to 1.0 kW) [main battery voltage - sagging to 40 V minimum during flight]
 - Serial port, SBUS port, CAN port
 - Analogue In port (x2), PWM Servo out port (x5)
 - USB connection to autopilot
 - HDMI & USB port out (H16 Pro radio/telemetry/data option)
 - Ethernet port in/out (H16 Pro radio/telemetry/data option)



Contact

Phone: +61 (0)409 527 206
 Email: info@freespaceoperations.com.au
 Website: www.freespaceoperations.com.au
 Address: Melbourne, VIC 3000, Australia



Disclaimer: All stated information in the brochure regarding the specification, configuration and performance of the Callisto 50 may vary and are dependent on payload, battery configuration, mission / flight requirements and weather conditions.