



APPENDIX

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT





Proposed Segment Factory

Biodiversity Development Assessment Report

Prepared for Snowy Hydro Limited
September 2019

Proposed Segment Factory

Biodiversity Development Assessment Report

Report Number

J17188 RP98

Client

Snowy Hydro Limited

Date

25 September 2019

Version

Final

Prepared by



Jason Brown

Senior Ecologist

25 September 2019

Approved by



Nathan Garvey

Associate Director

25 September 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

© Reproduction of this report for educational or other non-commercial purposes is authorised without prior written permission from EMM provided the source is fully acknowledged. Reproduction of this report for resale or other commercial purposes is prohibited without EMM's prior written permission.

Executive Summary

The tunnels for Snowy 2.0, including the exploratory tunnel for Exploratory Works and underground tunnels linking Tantangara and Talbingo reservoirs for the Main Works, would be excavated, for the most part, using tunnel boring machines (TBMs) and would be lined using precast concrete segments. These segments are proposed to be manufactured at the proposed segment factory to be located on the south-eastern side of Polo Flat (the site), which is an industrial area located to the east of Cooma.

This report documents the terrestrial biodiversity assessment methods and results, the initiatives built into the project design to avoid and minimise biodiversity impacts of the proposed segment factory, and the additional mitigation and management measures proposed, including offset requirements, to address any residual impacts not able to be avoided.

The site occurs within the South Eastern Highlands IBRA region and Monaro IBRA subregion. It is within the Monaro Plains Basalts and Sands BioNet NSW Landscapes. An unnamed dry creek flows from the south-east to the north-west through the site. It is located within a low lying and flat area of grassland habitat. The Polo Flat industrial estate is located to the west and north-west of the site. The remaining surrounding area is comprised of various open grassland habitats which is considered suitable to provide connectivity. These surrounding areas are subject to significant disturbance, largely due to African Lovegrass.

Vegetation within the site is historically part of the airfield that was established in 1921 and was used from the 1950s to service the Snowy Scheme. Past land used from airport and grazing activities have resulted in significant amounts of change in the grassland structure and composition. Native vegetation, which includes fauna habitats, have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion. Vegetation mapping identified one PCT within the site. The remaining vegetation within the site could not be classified as a PCT as it contained no native species and was mapped as non-native vegetation. Habitat for threatened species is degraded due to past land use in the site.

One plant community type (PCT) was identified within the site; PCT 320 Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion. Patches of native grassland were defined and mapped where the percentage cover of native vascular plants (including annual and perennial species) was greater than the percentage cover of perennial exotic species. These patches were then assessed further to determine whether they met the thresholds for the Natural Temperate Grassland of the South Eastern Highlands critically endangered ecological community (CEEC) as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The proposed segment factory project was referred to the Commonwealth Minister for the Environment on 26 July 2019. On 13 August 2019 the proposed segment factory was determined to be 'not a controlled action' and therefore does not require further assessment or approval under the EPBC Act. There were no threatened ecological communities (TECs) within the site that are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The habitat assessment identified that the site was subjected to a high level of disturbance from previous and current land uses and exotic species outcompeting native species. The grassland habitat has been maintained as part of the airport operations (slashing/mowing). Preliminary flora and fauna surveys were undertaken in mid-2019, including targeted surveys for reptiles and preliminary flora surveys. Whilst no threatened species were recorded during these surveys, further surveys will be undertaken in spring and summer of 2019. For the purposes of determining credits, a precautionary approach was adopted for the BDAR which assumed that these species are present within the site. Further surveys will reduce this assumed impact and resultant credit requirements.

Residual impacts following implementation of all controls include:

- direct impacts to 0.83 ha of poor condition native vegetation;
- indirect impacts to 0.56 ha of poor condition native vegetation; and
- impacts to 0.83 ha of potential threatened species habitat for six species credit species.

A total of 22 ecosystem credits and 66 species credits are required to offset these impacts.

In summary, the site of the proposed segment factory has been selected to avoid and minimise impacts to identified ecological values. Where this could not be achieved impacts have been minimised and mitigated through implementation of appropriate controls. Residual impacts will be offset in accordance with the steps outlined in the biodiversity offset strategy.

Table of Contents

Executive Summary	ES.1
Part A Stage 1: Biodiversity Assessment	1
1 Introduction	1
1.1 Snowy 2.0	1
1.2 The proposed segment factory	2
1.3 Location of the site	2
1.4 Proponent	5
1.5 Purpose of this report	5
1.6 Assessment guidelines and requirements	5
2 Project description	7
2.1 Introduction	7
2.2 Construction	7
2.2.1 Main activities	7
2.2.2 Earthworks	7
2.2.3 Traffic movements	7
2.2.4 Construction timeframe and hours	8
2.2.5 Workforce	8
2.3 Operations	8
2.3.1 General	8
2.3.2 Site layout	8
2.3.3 Utility connections	10
2.3.4 Segment inputs	10
2.3.5 Segment transport	10
2.3.6 Traffic movements	10
2.3.7 Staff and manpower	10
2.3.8 Hours of operation	10
2.4 Decommissioning	11
3 Legislative context	12
3.1 Introduction	12
3.2 Commonwealth	12

3.2.1	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	12
3.3	State	13
3.3.1	<i>Environmental Planning and Assessment Act 1979</i>	13
3.3.2	<i>Biodiversity Conservation Act 2016</i>	13
3.3.3	<i>Biosecurity Act 2015</i>	14
4	Landscape features	15
4.1	Introduction	15
4.2	Study area and disturbance footprint definitions	15
4.3	Bioregions and landscapes	15
4.4	Watercourses and wetlands	15
4.5	Connectivity	16
4.6	Areas of geological significance and soil hazard features	16
4.7	Areas of outstanding biodiversity value	16
4.8	Assessment of site context	16
5	Native vegetation	19
5.1	Introduction	19
5.2	Background review	19
5.3	Methods	19
5.3.1	Detailed vegetation mapping and habitat assessment	19
5.3.2	Vegetation integrity assessment	20
5.4	Results	20
5.4.1	Vegetation description	20
5.4.2	Plant community types	21
5.4.3	Vegetation zones	21
5.4.4	Assessment of patch size	24
5.4.5	Vegetation integrity score	25
5.5	Groundwater dependent ecosystems	25
5.5.1	Identification of potential GDEs including stygofauna	25
5.5.2	Potential GDEs	26
6	Threatened species	27
6.1	Fauna habitat assessment	27
6.2	Ecosystem credit species assessment	27
6.3	Species credit species assessment	29

6.3.1	Habitat constraints assessment (Step 2)	29
6.3.2	Identifying candidate species credit species for further assessment (Step 3)	31
6.3.3	Targeted survey methods	33
6.3.4	Targeted survey results	36
6.3.5	Species credit species	36
Part B Stage 2: Impact assessment		38
7	Impact assessment (biodiversity values)	39
7.1	Introduction	39
7.2	Potential direct, indirect and prescribed impacts	39
7.3	Measures to avoid, minimise and mitigate impacts	40
7.3.1	Measures to avoid and minimise impacts	40
7.3.2	Measures to mitigate impacts	41
7.4	Impact summary	42
7.4.1	Summary of measures to avoid, minimise and mitigate impacts	42
7.4.2	Serious and irreversible impacts (SAIL)	46
7.4.3	Impacts requiring offsets	46
7.4.4	Impacts not requiring offsets	48
7.5	Biodiversity offset strategy	48
8	Conclusion	49
References		50

Annexures

Annexure A	Vegetation integrity assessment – datasheets
Annexure B	Credit report

Tables

Table 5.1	Definitions used in delineation of vegetation zones	19
Table 5.2	Plant community types mapping within the disturbance footprint	21
Table 5.3	Vegetation zones mapped within the proposed segment factory disturbance footprint	21
Table 5.4	PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	23
Table 5.5	Vegetation zones mapped within the site	25

Table 6.1	Assessment of ecosystem credit species within the disturbance footprint	28
Table 6.2	Assessment of habitat constraint features within the disturbance footprint	30
Table 6.3	Species credit species and status and habitat suitability assessment	31
Table 6.4	Stratification units and site – reptiles	34
Table 6.5	Methods and survey effort – reptiles	34
Table 6.6	Species credit species, habitat suitability and targeted survey results	37
Table 7.1	Summary of impacts, and measures to avoid, minimise and mitigate	43
Table 7.2	Calculation of offsets for indirect impacts	46
Table 7.3	Summary of ecosystem credits required	47
Table 7.4	Summary of species credits required	47
Table A.1	Plot data	A.3

Figures

Figure 1.1	Site location of the project area	3
Figure 1.2	Site location in local context	4
Figure 2.1	Proposed site layout	9
Figure 4.1	Location map	17
Figure 4.2	Site map	18
Figure 5.1	Plant Community Type and vegetation zone mapping within the study area, including plot locations	22
Figure 6.1	Fauna survey locations	35

Photographs

Photograph 5.1	Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion – Plot 3262	24
----------------	---	----

Part A

Stage 1: Biodiversity Assessment

1 Introduction

1.1 Snowy 2.0

Snowy Hydro Limited (Snowy Hydro) proposes to develop Snowy 2.0, a large-scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). Snowy 2.0 is the largest committed renewable energy project in Australia and is critical to underpinning system security and reliability as Australia transitions to a decarbonised economy. Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and a new hydro-electric power station will be built underground.

Snowy 2.0 has been declared to be State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) by the NSW Minister for Planning under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). CSSI is infrastructure that is deemed by the NSW Minister for Planning and Public Spaces to be essential for the State for economic, environmental or social reasons. An application for CSSI must be accompanied by an environmental impact statement (EIS).

Separate applications are being submitted by Snowy Hydro for different phases of Snowy 2.0, including Exploratory Works for Snowy 2.0 (the Exploratory Works) and Snowy 2.0 Main Works (the Main Works).

The first phase of Snowy 2.0, the Exploratory Works (Application Number SSI 9208), includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of the Kosciuszko National Park (KNP). Exploratory Works has been assessed in a separate EIS and is subject to an approval issued by the former NSW Minister for Planning on 7 February 2019. Construction for Exploratory Works has already commenced.

The second phase of Snowy 2.0, the Snowy 2.0 Main Works (Application Number SSI 9687), covers the major construction elements of Snowy 2.0, including permanent infrastructure (such as the underground power station, power waterways, access tunnels, chambers and shafts), temporary construction infrastructure (such as construction adits, construction compounds and accommodation), management and storage of extracted rock material and establishing supporting infrastructure (such as road upgrades and extensions, water and sewage treatment infrastructure, and the provision of construction power). Snowy 2.0 Main Works also includes the operation of Snowy 2.0. The EIS for Snowy 2.0 Main Works was submitted to the NSW Department of Planning, Industry and Environment (DPIE) in September 2019.

A separate application has also been submitted for a proposed factory that would manufacture precast concrete segments that would line the tunnels being excavated for Snowy 2.0 (Application Number SSI 10034). This Biodiversity Development Assessment Report (BDAR) supports the EIS for the proposed segment factory.

On 26 June 2019, Snowy Hydro referred the proposed segment factory (Reference Number 2019/8481) to the Commonwealth Minister for the Environment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 13 August 2019, the proposed segment factory was determined by the Acting Assistant Secretary Assessments and Waste Branch of the Commonwealth Department of the Environment and Energy (DEE), as delegate to the Minister, to be 'not a controlled action' and therefore does not require further assessment or approval under the EPBC Act.

1.2 The proposed segment factory

The tunnels for Snowy 2.0, including the exploratory tunnel for Exploratory Works and underground tunnels linking Tantangara and Talbingo reservoirs for the Main Works, would be excavated, for the most part, using tunnel boring machines (TBMs) and would be lined using precast concrete segments. These segments are proposed to be manufactured at the proposed segment factory to be located on the south-eastern side of Polo Flat (the site), which is an industrial area located to the east of Cooma.

The proposed segment factory would contain a building for the casting and curing of the segments, uncovered storage areas for raw materials and segments, vehicle parking areas and associated offices and workshops.

Main inputs for the segments include aggregate, sand, cement and rebar steel. Primary outputs include the segments which would be transported to the TBM launch sites for Exploratory Works and Main Works within KNP.

The construction phase of the proposed segment factory would last about five months utilising a workforce of about 30 people. Construction would take place six days a week (from Monday to Saturday) and for 10 hours per day.

The factory would operate over a period of about 3.5 years utilising a workforce of about 125 people. It would be operational 24 hours a day, seven days a week.

The proposed segment factory would be constructed and operated by Future Generation Joint Venture (FGJV) which has been contracted by Snowy Hydro to construct Snowy 2.0.

At the completion of the construction of Snowy 2.0, the proposed segment factory would be decommissioned.

Further details of the proposed segment factory are provided in Section 2 of this report.

1.3 Location of the site

The site of the proposed segment factory is located on the south-eastern side of Polo Flat, predominantly on the southern part of the land owned by Snowy Hydro. The site is located to the east of Polo Flat Road and to the north of Carlaminda Road.

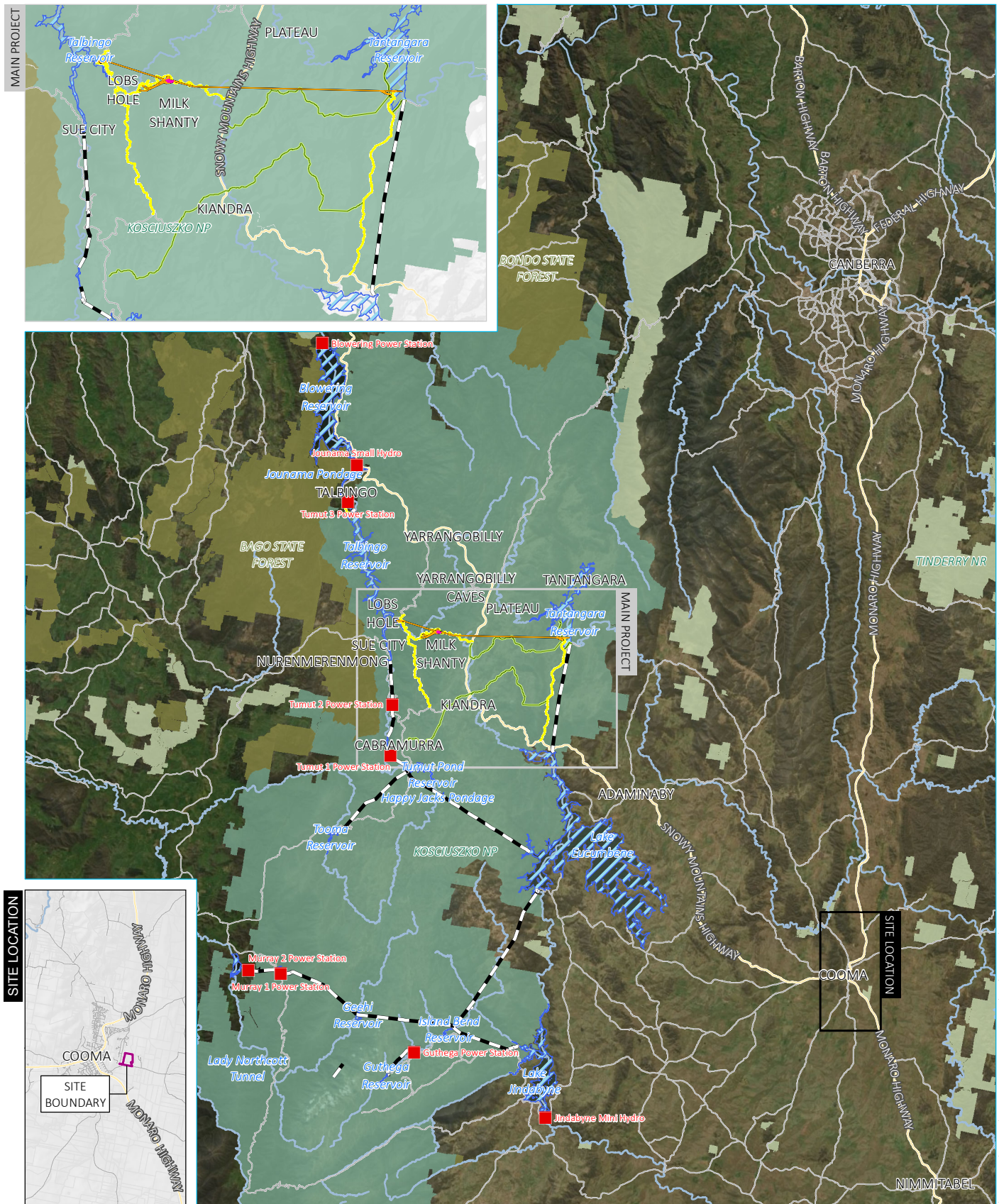
Figure 1.1 shows the location of the site in a regional context and Figure 1.2 shows the site in its local context.

The site contains the following land parcels:

- southern part of Lot 14 in Deposited Plan (DP) 250029 – also known as 9 Polo Flat Road, Polo Flat;
- Lot 3 in DP 238762 – also known as 33 Carlaminda Road, Polo Flat; and
- an unmade road corridor, directly south of the aforementioned lots.

Except for a few buildings located on the southern part of Lot 3 in DP 238762, the site is vacant and dominated by grassland. A third order watercourse flows in a north-westerly direction through the middle of the site.

Lot 14 in DP 250029 is a large parcel of land which contains a private airfield predominantly located in the middle and northern part of the land. This airfield was originally established in 1921 and further developed in the late 1950s and 1960s to service the Snowy Scheme. It became the base for the Snowy Mountains Hydro-electric Authority's (the predecessor to Snowy Hydro) flying unit and aircraft. The land was sold by Snowy Hydro in 1998 where it continued use as a private airfield. Snowy Hydro purchased the land again in early 2019.



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); GA (2011); LPMA (2011)

0 10 20 km
GDA 1994 MGA Zone 55



KEY

- Site boundary
- Rail line
- Main road
- Local road or track
- Watercourse
- Cadastral boundary
- NPWS reserve

Location of site in local context

Snowy 2.0
Biodiversity Development Assessment Report
Proposed Segment Factory
Figure 1.2



The site is surrounded by industrial development to the west and predominantly rural land to the south and east. To the north of the site is the remainder of Lot 14 in DP 250029 which contains the private airfield, and other industrial development. Snowy Hydro's private airfield contains a main north-south aligned runway, hangers and offices. It also contains an above ground fuel tank for the refuelling of planes and helicopters.

Lot 3 in DP 238762 contains a communications tower which ceased use (ie transmission) in August 2019.

There is an isolated industrial operation containing a residence located about 150 metres (m) to the south-east of the site, and an abattoir located about 350 m to the east.

The nearest residence is a rural residence located about 450 m to the south-south-east of the site. The nearest residences within Cooma are located about 1 km to the west of the site.

1.4 Proponent

Snowy Hydro is the proponent for the proposed segment factory. Snowy Hydro is an integrated energy business – generating energy, providing price risk management products for wholesale customers and delivering energy to homes and businesses. Snowy Hydro is the fourth largest energy retailer in the NEM and is Australia's leading provider of peak, renewable energy.

As previously stated, the proposed segment factory would be constructed and operated by FGJV which has been contracted by Snowy Hydro to construct Snowy 2.0.

1.5 Purpose of this report

This BDAR supports the EIS for the proposed segment factory. It documents the terrestrial biodiversity assessment methods and results, the initiatives built into the project design to avoid and minimise impacts to terrestrial biodiversity, and the mitigation and management measures, including offset requirements, proposed to address any unavoidable residual impacts.

The specific objectives of this assessment are to:

- describe the existing biodiversity values and existing environment;
- identify and assess the potential for presence of biodiversity values, including threatened species and communities listed under the *NSW Biodiversity Conservation Act 2016* (BC Act) and/or *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- identify ecological constraints within and impacts arising from the proposed segment factory;
- provide mitigation measures to reduce the impacts from the proposal on biodiversity wherever possible; and
- where impacts are unavoidable, consider compensatory measures that are appropriate for the proposed segment factory.

This BDAR has been prepared in accordance with the Biodiversity Assessment Method (BAM, OEH 2017).

1.6 Assessment guidelines and requirements

This BDAR has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs), issued by DPIE on 31 July 2019.

The SEARs must be addressed in the EIS. Table 1.1 lists the matters relevant to this assessment and where they are addressed in this report.

Table1.1 Relevant matters raised in SEARs and information request

Requirement	Section addressed
An assessment of the impacts of the project on terrestrial ecosystems, including listed State threatened species or communities.	This report
A strategy to offset the residual impacts of the project on these ecosystems.	Section 7.5
A strategy to ensure vehicles transporting products from the site to the Kosciuszko National Park comply with strict vehicle hygiene protocols and minimise the risk of spreading weeds from the site.	Section 7.3 and 7.4.1 also addressed in the Traffic Assessment (SCT 2019)

To inform preparation of the SEARs, the DPIE invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPIE when preparing the SEARs.

2 Project description

2.1 Introduction

It is proposed to construct and operate a factory on the site to supply precast concrete segments that would line the tunnels for Snowy 2.0.

The construction phase of the proposed segment factory would last about five months utilising a workforce of about 30 people. The operational phase would last about 3.5 years utilising a workforce of about 125 people.

The proposed segment factory would be decommissioned at the completion of operations.

2.2 Construction

2.2.1 Main activities

The following main activities would be undertaken for the construction of the proposed segment factory:

- demolition and removal of buildings and decommissioned telecommunications tower on the southern part of site;
- clearing, removal of topsoil and vegetation (topsoil excavated would be stockpiled on site for later use if deemed suitable);
- undertaking earthworks to establish level surfaces;
- establishment of primary access road;
- installation of site services (power, water and communications);
- establishment of site surfaces (ie concrete, asphalt and cement soil); and
- construction of site facilities and buildings, including precast building, concrete batching plant (CBP), workshops, offices, parking areas, storage areas and associated facilities.

2.2.2 Earthworks

Excavation will be carried out at the site to provide level surfaces, establish the access road and create the required trenches for drainage.

Where possible excavated material would be reused on site for filling and compaction (including benching areas of the site where required). Where there is a deficit of excavated material, additional material would be sourced from local quarries.

2.2.3 Traffic movements

Construction vehicle movements will comprise construction worker's light vehicles and heavy vehicles transporting equipment, building and construction materials, waste, and fill material if required.

2.2.4 Construction timeframe and hours

The construction phase of the proposed segment factory would last about five months (estimated to commence in March 2020 subject to obtaining the required approvals). Construction would be undertaken from Monday to Saturday for 10 hours per day. Access to the site would generally start at 6 am for pre-starts and toolbox talks, and construction would commence at 7 am.

2.2.5 Workforce

A workforce of about 30 people would be required to construct the proposed segment factory.

2.3 Operations

2.3.1 General

The segments would be produced by casting concrete (made in the CBP) in reusable steel moulds which would then be cured in a chamber. Following curing, the segments would be temporarily stored onsite before being transported to the TBM launch sites within KNP.

The casting and curing would be undertaken in the precast building. Storage of the segments would predominantly be undertaken in uncovered storage areas.

Main inputs for the segments include aggregate, sand, cement and steel rebar.

Approximately 130,500 segments would be manufactured over the operational period.

2.3.2 Site layout

The layout of the proposed segment factory is shown in Figure 2.1. Details of the site layout are provided below.

i General layout

The CBP and precast building (which contains a casting room and curing chamber) would be located at the southern end of the site. Open storage areas would be located predominantly to the north of the building on the northern part of the site.

Site offices and workshops would be located in the south-western corner of the site.

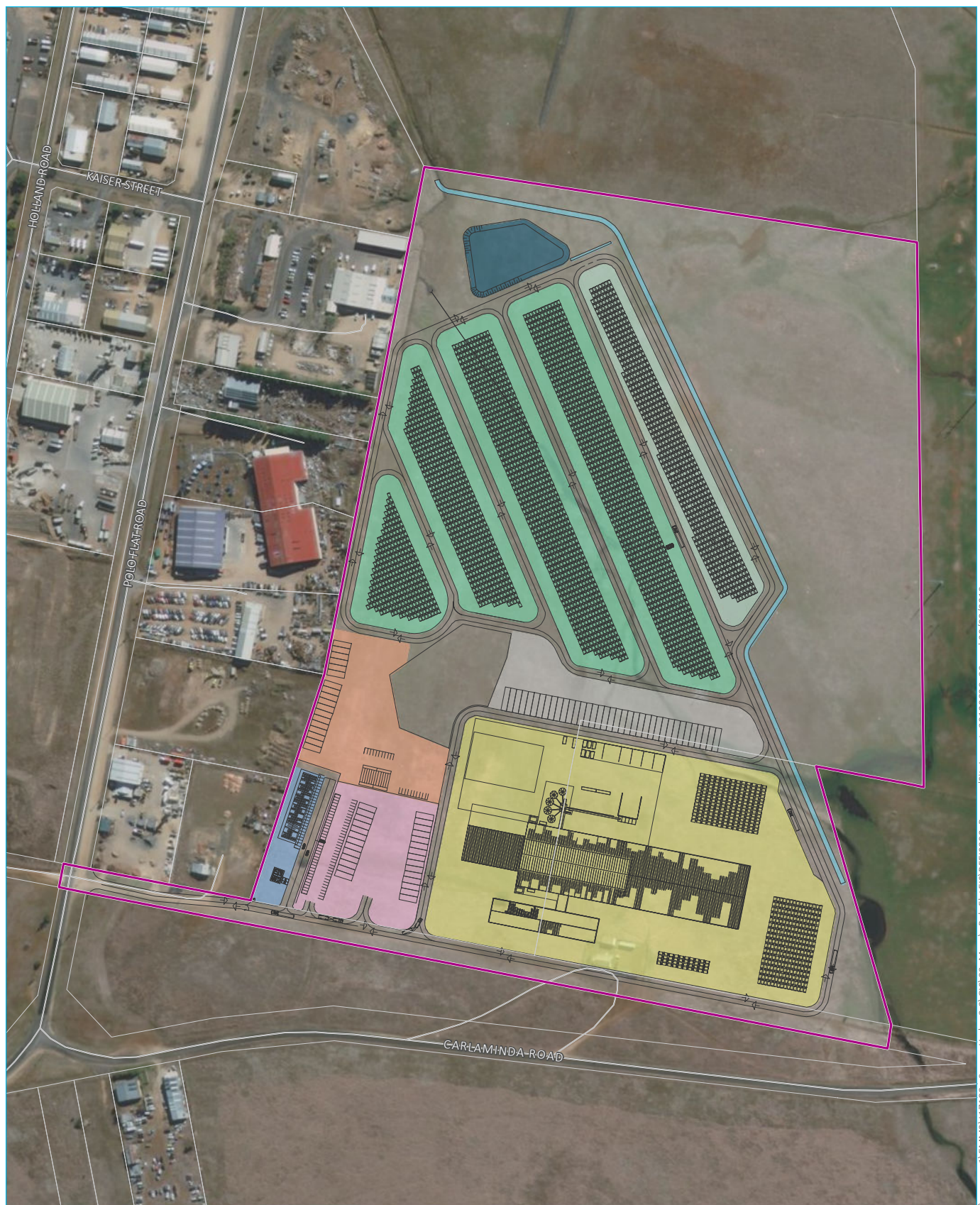
ii Ingress and egress

Vehicle ingress and egress to the site would be provided on a new access road which would connect to Polo Flat Road. The access road would be constructed on an existing informal service road located in the unmade road corridor immediately north of Carlaminda Road.

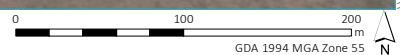
iii Raw materials storage

Cement silos, and aggregate and sand storage areas for the CBP would be located adjacent to the CBP. Storage would be sized to hold approximately three days production.

Other raw materials include steel rebar and concrete admixtures which would be stored in, or adjacent to, the precast building.



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); ESRI (2019); GA (2011); LPMA (2011)



KEY

- | | | |
|--|--|---|
| Site boundary | Precast yard, concrete plant, aggregates area, precast warehouse, segment storage | Trailer parking |
| Local road or track | Bus stop and parking | Storage area |
| Cadastral boundary | Offices, guard house and first aid | Emergency storage area |
| Indicative site layout | Mechanical and plant workshop with parking | Detention basin |
| | | Drainage |

Proposed layout

Snowy 2.0
Biodiversity Development Assessment Report
Proposed Segment Factory
Figure 2.1



iv Parking

Two large parking areas are proposed in the south-western corner of the site, and to the north of the precast building. Parking in the south western area would be used for light vehicles, trucks and buses. Parking to the north of the precast building would be used for trucks.

v Drainage

A diversion drain would be constructed around the eastern perimeter of the site to divert water from the third order watercourse. The drain diversion would be constructed to match the general width and depth of the existing watercourse.

A detention basin would be provided to the north of the site to collect surface flows. Overflows from the detention basin would be directed into the diversion drain.

2.3.3 Utility connections

The proposed segment factory would be connected to utility mains, including communications, electricity, water, wastewater and gas.

2.3.4 Segment inputs

As previously stated, main inputs for the precast concrete segments include aggregate, sand, cement and steel rebar. These main inputs would likely be sourced from locations in proximity to site and/or from quarries near Canberra.

In addition to these main inputs, several accessories are also required to produce the segments, such as reinforcement cages, steel fibres, gaskets and inserts. These inputs would likely be sourced locally or from Canberra.

2.3.5 Segment transport

Following casting, curing and storage, the segments would be transported to the TBM launch sites within KNP.

2.3.6 Traffic movements

Operational vehicle movements will comprise light vehicles (worker's vehicles and service vehicles) and heavy vehicles required for the transportation of the main inputs for the segments and for the transportation of the segments from the site to the TBM launch sites within KNP.

2.3.7 Staff and manpower

A workforce of about 125 people would be required to operate the proposed precast segment factory. As many local workers as possible would be sourced from the Snowy Mountains Regional LGA and surrounding localities.

2.3.8 Hours of operation

It is proposed to operate the proposed segment factory 24 hours a day, seven days a week. It is estimated that the factory would operate for a period of about 3.5 years.

2.4 Decommissioning

As previously stated, the proposed segment factory would be decommissioned at the completion of construction of Snowy 2.0 which would include removal of all plant and equipment. Snowy Hydro would retain the main structures such as the precast building, workshops and offices and seek to use these for an alternative industrial use.

It is envisaged that Snowy Hydro would submit a separate application for approval for an alternative use of the site prior to the decommissioning phase of the project.

3 Legislative context

3.1 Introduction

This section provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

3.2 Commonwealth

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as MNES (Matters of National Environmental Significance) under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

An approval under the EPBC Act would be required for Snowy Hydro, which is a Commonwealth agency for the purposes of the EPBC Act, to undertake the proposed segment factory if that action is determined to be a 'controlled action' because:

- it will have or is likely to have a significant impact on MNES; or
- it will have or is likely to have a significant impact on the environment inside or outside the Australian jurisdiction.

The proposed segment factory project was referred to the Commonwealth Minister for the Environment on 26 July 2019. On 13 August 2019 the proposed segment factory was determined to be 'not a controlled action' and therefore does not require further assessment or approval under the EPBC Act.

3.3 State

3.3.1 *Environmental Planning and Assessment Act 1979*

The EP&A Act was enacted to encourage the consideration and management of impacts of proposed development or land-use changes on the environment and the community. The EP&A Act is administered by the NSW Department of Planning, Industry and Environment (DPIE).

The EP&A Act provides the overarching structure for planning in NSW; however, is supported by other statutory environmental planning instruments (EPIs) including State environmental planning policies (SEPPs). EPIs relevant to the natural environment are outlined further below.

i *State Environmental Planning Policy (State and Regional Development) 2011*

Snowy 2.0 has been declared to be CSSI by the NSW Minister for Planning under the provisions of the EP&A Act and is defined in clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011*.

ii *State Environmental Planning Policy No 44 – Koala Habitat Protection*

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than 1 ha and in councils listed in Schedule 1 of SEPP 44. The site is located in the Snowy Monaro LGA, which is listed in Schedule 1.

Notwithstanding the above, the site contains no trees, particularly feed species listed in the SEPP; as such, SEPP 44 is no longer considered within this assessment.

3.3.2 *Biodiversity Conservation Act 2016*

The BC Act commenced operation on 25 August 2017. It repeals and replaces the NSW *Threatened Species and Conservation Act 1995* as the legislation responsible for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the NSW *Biodiversity Conservation Regulation 2017* (BC Regulation), established the Biodiversity Offsets Scheme (BOS).

The BOS includes establishment of the biodiversity assessment method (the BAM, OEH 2017) for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM is to assess the impact of actions on threatened species and threatened ecological communities, and their habitats and determine offset requirements. For CSSI, use of the BAM is mandatory.

The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values on land in order to:

- identify the biodiversity values on land subject to proposed development area;
- determine the impacts of a proposed development; and
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

The biodiversity assessment for the proposed segment factory has been undertaken in accordance with the requirements of the BAM, as set out in this BDAR.

3.3.3 *Biosecurity Act 2015*

The NSW *Biosecurity Act 2015* has superseded the NSW *Noxious Weeds Act 1993*, which has now been repealed.

The primary objective of the *Biosecurity Act* is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

The *Biosecurity Act* stipulates management arrangements for weed biosecurity risks in NSW, with the aim to prevent, eliminate and minimise risks. Management arrangements include:

- any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about;
- applies to all land within NSW and all waters within the limits of the State; and
- local strategic weed management plans will provide guidance on the outcomes expected to discharge duty for the weeds in that plan.

The *South East Regional Strategic Weed Management Plan 2017 - 2022* (SELLS 2017) outlines how government, industry, and the community will share responsibility and work together to identify, minimise, respond to and manage weeds within the South East Region, which includes the proposed segment factory project area. The plan also supports regional implementation of the *Biosecurity Act*.

African Lovegrass (*Eragrostis curvula*), a weed of regional priority within the South East (SELLS 2017) was identified within the site. This species is subjected to regional recommended measures as per those detailed in the *South East Regional Strategic Weed Management Plan 2017 - 2022* (SELLS 2017). These measures require asset protection where land managers are to reduce impacts from the plant on priority assets. Priority assets “typically have high environmental, economic and/or social value” (SELLS 2017 p.58).

This requirement has been used to inform the mitigation measures outlined in Section 7.3.

4 Landscape features

4.1 Introduction

The study area is located in the Polo Flat industrial area. The site is mapped as Zone IN1 General Industrial in the *Cooma-Monaro Local Environmental Plan 2013*. The objectives of this zone include providing for a wide range of industrial and warehouse land uses and supporting and protecting land for industrial uses.

The site has been used for aviation purposes since 1921, when Charles Kingsford Smith arrived at the landing ground. The site was further developed in the 1950s and 60s to service the Snowy Mountains Scheme. The hangars and terminal building from that period are still in use today. The study area has general industrial uses located along the western boundary, with an abattoir located to the east. The Cooma landfill is located approximately 960 m to the south. The vegetation across the study area consists of a mix of native and exotic grasslands. African Lovegrass is prevalent, to the point of infestation, within the site.

The identification of landscape features in the site was determined using Section 4 of the BAM (OEH 2017), as summarised within this section.

4.2 Study area and disturbance footprint definitions

The proposed segment factory would be undertaken within the site as shown in Figure 4.1.

Surveys were undertaken across a larger area at Polo Flat to identify key biodiversity constraints and allow areas of higher biodiversity value to be avoided during detailed design; this is defined as the study area.

The disturbance footprint includes all areas where land could be directly or indirectly disturbed by the proposed segment factory and includes all areas subject to clearing and ground disturbance (including road access and utilities connections) plus areas of indirect impact (20 m from the edge of the direct disturbance boundary). The detailed design for the segment factory, and development of the disturbance footprint, was the result of an iterative design process where the biodiversity values within the study area were taken into consideration. This approach allowed for the identification of constraints early in the process, providing flexibility during the design phase of the project to avoid and minimise impact to identified constraints.

Indirect impacts to retained native vegetation were also assessed.

Both desktop assessments and field surveys have been undertaken to assess the biodiversity values at a State and Commonwealth level that occur across the study area, as shown in Figure 4.2.

4.3 Bioregions and landscapes

The site occurs within the South Eastern Highlands IBRA region and Monaro IBRA subregion. It is within the Monaro Plains Basalts and Sands BioNet NSW Landscapes (Figure 4.1).

4.4 Watercourses and wetlands

An unnamed dry creek flows from the south-east to the north-west through the study area (Figure 4.2). This is a third Strahler order stream, comprised of a clay base with intermediate rocks and patches of vegetation within the creek. The clay bed was observed to be cracked during all site surveys, indicating that the creek remains dry most of the time. Average width of the dry creek was approximately 1 m, with a depth of approximately 0.5 m.

No Directory of Important Wetlands in Australia (DIWA) wetlands or Ramsar wetlands are located within or immediately adjacent to the site.

4.5 Connectivity

The site is located within a low lying and flat area of grassland habitat. The Polo Flat industrial estate is located to the west of the site. The remaining surrounding area is comprised of various open native and exotic grassland habitats which is considered suitable to provide connectivity. These surrounding areas are subject to significant disturbance, largely due to African Lovegrass.

4.6 Areas of geological significance and soil hazard features

The site does not contain karsts, caves, crevices, cliffs or other areas of geological significance. Similarly, there are no soil hazard features that occur within the site.

4.7 Areas of outstanding biodiversity value

There are no areas of outstanding biodiversity value, as declared by the Minister, within the site.

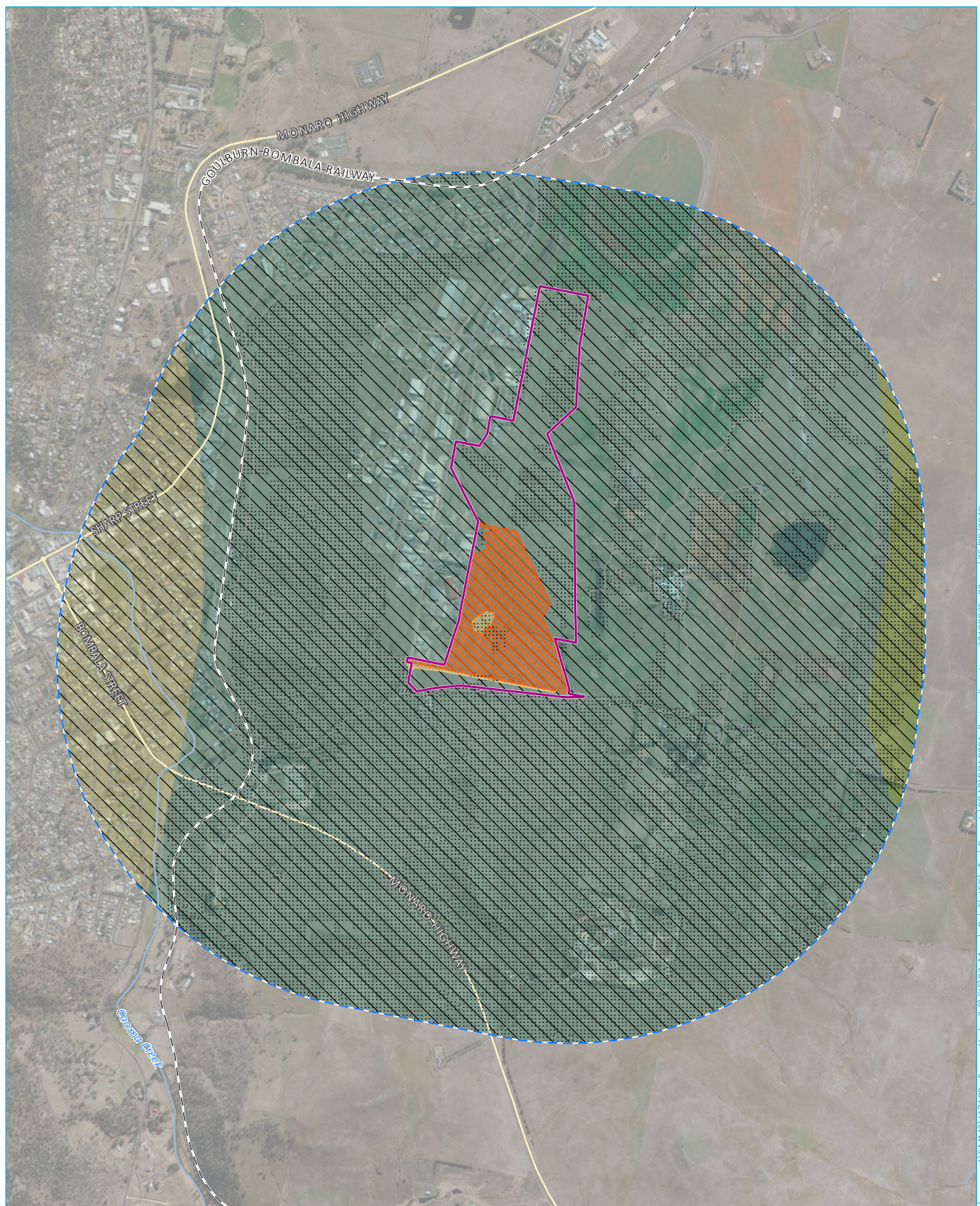
4.8 Assessment of site context

The site context has been assessed in accordance with Section 4.3 of BAM (OEH 2017) for site-based developments.

Mapping of vegetation within a 1,500 m buffer of the site was undertaken using aerial mapping interpretation and spatial data from the *State Vegetation Type Map: South East Local Land Services Biometric vegetation map, 2014. VIS_ID 4211* (OEH 2016a). This mapping was modified using the vegetation extent as mapped by EMM (see Section 5). Four PCTs were mapped within the 1,500 m buffer, including:

- PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 1110 – River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion;
- PCT 1202 – Speargrass grassland of the South Eastern Highlands Bioregion; and
- PCT 1377 – Kangaroo Grass - Snowgrass tussock grassland on slopes and ridges of the tablelands, South Eastern Highlands.

Native vegetation cover within the buffer area (including the site) was determined as the sum of the areas of native vegetation map units listed above, divided by the entire buffer area. Approximately 654.56 ha of native vegetation was mapped within the 1,116 ha buffer area. Native vegetation cover within the buffer area is approximately 59%.



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); ESRI (2019); GA (2011); LPMA (2011)

KEY

— Rail line
— Main road
— Local road or track
— Watercourse

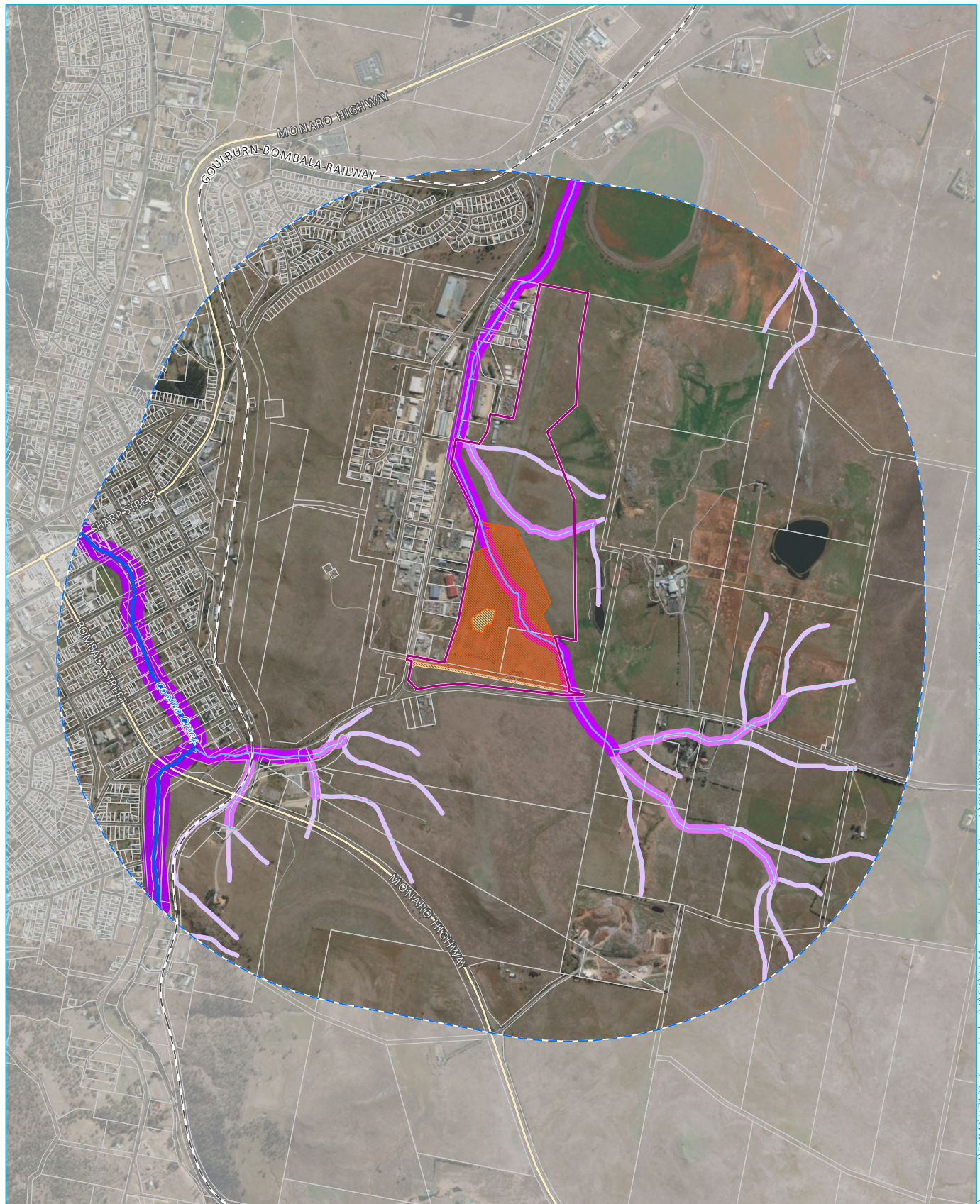
Study area
1500 m disturbance footprint buffer
Native vegetation
Disturbance footprint
Direct disturbance
Indirect disturbance

IBRA 7 (region - sub region)
South Eastern Highlands - Monaro Mitchell landscape
Coolangubra - Good Good Plateau
Monaro Plains Basalts and Sands
Monaro Plains Granites

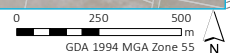
Regional locality

Snowy 2.0
Biodiversity Development Assessment Report
Proposed Segment Factory
Figure 4.1





Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); ESRI (2019); GA (2011); LPMA (2011)



KEY

— Rail line	Study area	Strahler stream order	Riparian buffer
— Main road	1500 m buffer	1st order	10 m
— Local road or track	Disturbance footprint	2nd order	20 m
— Cadastral boundary	Direct disturbance	3rd order	30 m
	Indirect disturbance	5th order	50 m

Site map

Snowy 2.0
Biodiversity Development Assessment Report
Proposed Segment Factory
Figure 4.2



\\emmsrv1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\1_PoloflatES_Tech Reports\BDA\BDA002_SiteLocation_20190825_02.mxd 25/09/2019

5 Native vegetation

5.1 Introduction

The extent of native vegetation within study area was determined using Section 5 of the BAM (OEH 2017), as summarised within this section.

5.2 Background review

A review of regional vegetation mapping (OEH 2016a) was undertaken to inform the site survey. OEH (2016a) identifies one PCTs within the site:

- PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion.

The presence of this PCTs was assessed and confirmed in line with the methods outlined below.

5.3 Methods

The following sections outline the methods employed to map vegetation, and to assess the vegetation integrity of native vegetation within the site.

5.3.1 Detailed vegetation mapping and habitat assessment

A preliminary assessment of the study area was undertaken on 6, 7 and 25 March 2019. This preliminary assessment included detailed vegetation mapping and habitat assessments. The site was traversed on foot, with vegetation mapped and aligned with NSW PCTs. PCTs were stratified into vegetation zones based on broad condition state using the definitions in Table 5.1.

Table 5.1 Definitions used in delineation of vegetation zones

Condition class	Description
Moderate/good - High	Largely intact with all stratum present and minimal disturbance.
Moderate/good - Medium	Some elements or stratum missing or immature, but minimal disturbance.
Moderate/good - Other	Regeneration is occurring due to previous human impacts, such as clearing or fire, but minimal to moderate disturbance to other stratum.
Moderate/good - Poor	Tree stratum present (where applicable), but understorey vegetation degraded due to weeds or other major disturbance.
Low	Tree stratum and shrub stratum missing (where applicable). Native vegetation restricted to groundcover. Groundcover generally degraded.

Vegetation was mapped in the field using GPS-enabled tablet computers using Collector for ArcGIS™.

Areas of native grassland were also mapped in accordance with the minimum thresholds outlined in the *Approved Conservation Advice (including listing advice) for Natural Temperate Grassland of the South Eastern Highlands* (TSSC 2016). Patches of native grassland were defined and mapped where the percentage cover of native vascular plants (including annual and perennial species) was greater than the percentage cover of perennial exotic species. These patches were then assessed further to determine whether they met the thresholds for the Natural Temperate Grassland of the South Eastern Highlands critically endangered ecological community (CEEC) as listed under the EPBC Act.

5.3.2 Vegetation integrity assessment

Following the stratification of vegetation zones within the site, native vegetation integrity was assessed using data obtained via a series of plots, as per the methodology outlined in Section 5 of the BAM (OEH 2017). Plot data was collected from the site on 6, 7 and 25 March 2019. At each plot location the following was undertaken:

- one 20 x 20 m plot, for assessment of composition and structure; and
- one 20 x 50 m plots for assessment of function, including a series of five 1 x 1 m plots to assess average leaf litter cover.

The assessment of composition and structure, based on a 20 x 20 m plot, recorded species name, stratum, growth form, cover and abundance rating for each species present within the plot. Cover (foliage cover) was estimated for all species rooted in or overhanging the plot, and recorded using decimals (if less than 1%, rounded to whole number (1-5%) or estimated to the nearest 5% (5- 100%). Abundance was counted (up to 20) and estimated above 20, and recorded using the following intervals: 1, 2, 3, 4, 5, 10, 20, 50, 100, 500, 1,000, 1,500, 2,000 etc.

The assessment of function recorded the number of large trees (if present), the presence of tree stem size class, tree regeneration, number of trees with hollows and length of fallen logs, as well as leaf litter cover within the 20 x 50 m plot and five 1 x 1 m subplots. The minimum number of plots and transects per vegetation zone was determined using Table 4 of the BAM (OEH 2017). A total of four plots were undertaken within or in close proximity (250 m) to the site, with four plots used in determining vegetation integrity scores. Datasheets and compiled plot data are provided in Annexure A.

5.4 Results

5.4.1 Vegetation description

Vegetation within the site is historically part of the Cooma – Polo Flat Airport that was established in 1921 and was used in the 1950s and 60s to service the Snowy Mountain Scheme. In 2001 the facilities were updated for private use. Outside of the runway and associated airport infrastructure, the land within the site has previously been used for cattle grazing. It is unsure if the land has been cultivated in the past; some evidence of potential historic ploughing was observed in the east during the site survey and potentially on older satellite imagery from 2013. In the Monaro region, African Lovegrass is identified as a priority weed due to significant infestations of the species occurring, reducing and eliminating native species. The site has a significant infestation of African Lovegrass, with some areas dominated by this species with close to 100% cover.

These activities and past land use have resulted in significant amounts of change in the grassland structure and composition. Native vegetation, which includes fauna habitats, have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion.

5.4.2 Plant community types

Site investigations, including determination of vegetation communities using the methods described in Section 5.3.1, identified the presence of one PCT within the proposed segment factory disturbance footprint (Figure 5.1). The remaining areas are mapped as non-native vegetation; as these areas could not be classified into a PCT due to the cover of non-native species, including African Lovegrass, Viper's Bugloss (*Echium vulgare*), Skeleton Weed (*Chondrilla juncea*), Buchan Weed (*Hirschfeldia incana*), St. Johns Wort (*Hypericum perforatum*), Lamb's Tongues (*Plantago lanceolata*), *Salvia verbenaca* and Common Crowfoot (*Erodium cicutarium*).

The PCT, vegetation formation and vegetation class (Keith 2004) are described within Table 5.2.

Table 5.2 Plant community types mapping within the disturbance footprint

Plant community type	Vegetation formation	Vegetation class	Area (ha)
PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Grasslands	Western Slopes Grasslands	1.39 (0.83 ha direct plus 0.56 ha indirect)

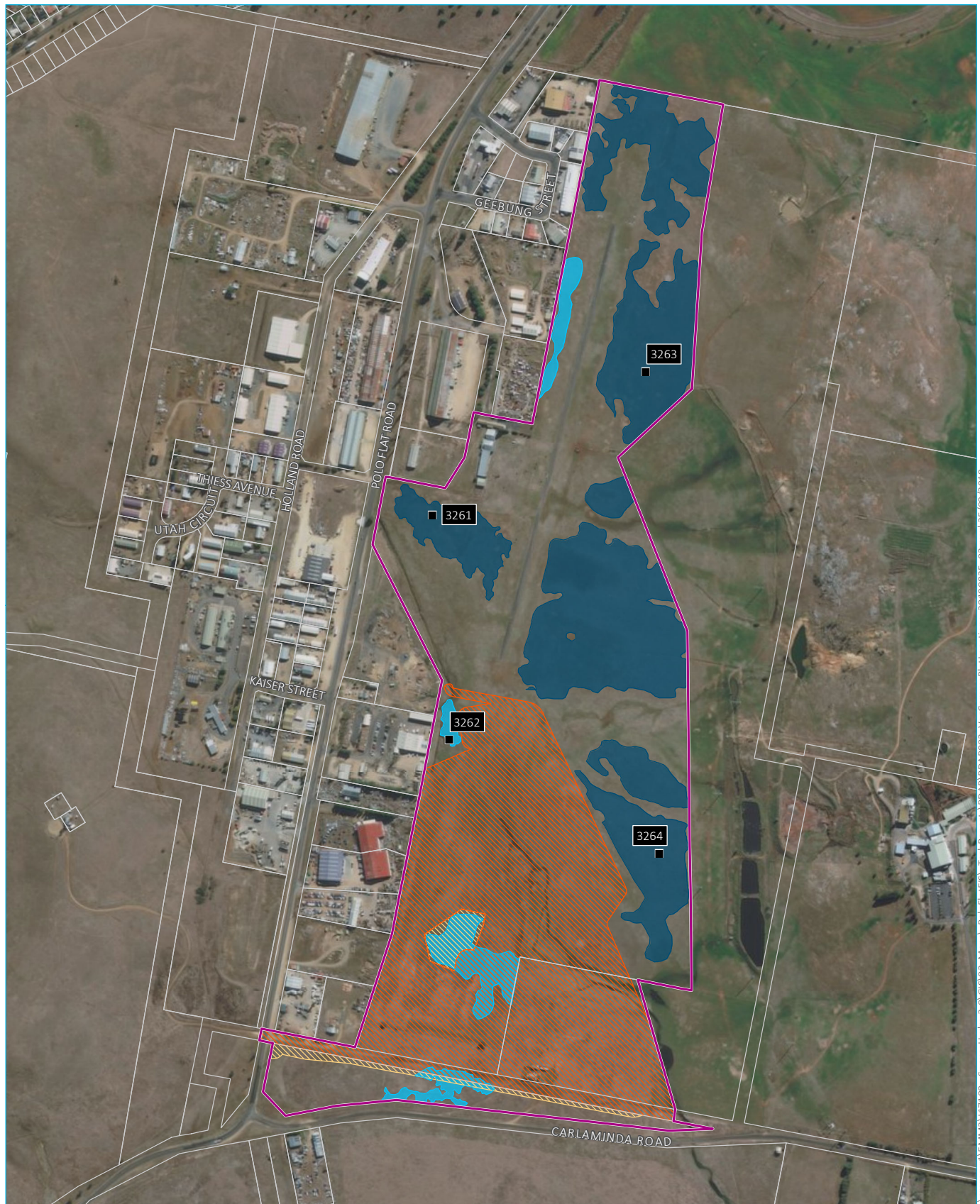
5.4.3 Vegetation zones

The PCT identified within the proposed segment factory disturbance footprint was stratified into vegetation zones based on broad condition state, as per the method outlined in Section 5.3.1, and allocated a condition class as per the descriptions in Table 5.1. This process identified one vegetation zones within the sites, as outlined in Table 5.3.

Table 5.3 Vegetation zones mapped within the proposed segment factory disturbance footprint

Plant community type	Condition	Area (ha)
PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Poor	1.39 (0.83 ha direct plus 0.56 ha indirect)

Description of the PCT is provided in the following table. PCT and vegetation zones are mapped in Figure 5.1.



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); ESRI (2019); GA (2011); LPMA (2011)

KEY

■ Plot
 — Cadastral boundary

Study area
 Disturbance footprint
 Direct disturbance
 Indirect disturbance

PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

High
 Poor

Plant Community Type and vegetation mapping within the Polo Flat project area, including plot locations

Snowy 2.0
 Biodiversity Development Assessment Report
 Proposed Segment Factory
 Figure 5.1



Table 5.4 PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	
PCT ID	320
Common name	Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
Condition classes	Poor
Extent within the site	Total: 1.39 ha <ul style="list-style-type: none"> • Direct impacts: 0.83 ha • Indirect impacts: 0.56 ha
Description	Vegetation consists of native and non-native grasses and forbs. Native grasses include Wallaby Grass (<i>Rytidosperma</i> spp.), Yangabil (<i>Austrostipa bigeniculata</i>), Common Couch (<i>Cynodon dactylon</i>), Speargrass (<i>Austrostipa scabra</i>), Common Wheatgrass (<i>Elymus scaber</i>), Red Grass (<i>Bothriochloa macra</i>), Hairy Panic (<i>Panicum effusum</i>), Kangaroo Grass (<i>Themeda triandra</i>) and <i>Enneapogon nigricans</i> . Native forb species include Crowfoot (<i>Erodium</i> spp.), Fuzzweed (<i>Vittadinia</i> spp.), Small Crumbweed (<i>Dysphania pumilio</i>), Common Everlasting (<i>Chrysocephalum apiculatum</i>), Bluebell (<i>Wahlenbergia</i> spp.), Swamp Dock (<i>Rumex brownii</i>), Pigweed (<i>Portulaca oleracea</i>), Woodruff (<i>Asperula</i> spp.), Hairy Sheep's Burr (<i>Acaena agnipila</i>), Climbing Saltbush (<i>Einadia nutans</i>) and <i>Calotis</i> spp.. Exotic species were also recorded within the site including African Lovegrass, Viper's Bugloss, Skeleton Weed, Buchan Weed, St. Johns Wort, Lamb's Tongues, <i>Salvia verbenaca</i> and Common Crowfoot.
Survey effort	Poor: one plot (3262)
Condition description	The community was considered to be in poor condition. Within the disturbance footprint, groundcover vegetation is simplified due to the presence of significant infestation of African Lovegrass adjacent to this patch. The patch generally had fewer non-grass species when compared to other patches of the PCT.
Characteristic species used for identification of PCT	According to the NSW VIS Classification Version 2.1, the ground layer species recorded within this community align with the characteristic composition of this PCT. These species included Redleg Grass, Wallaby Grass, Hairy Panic, Yangabil, Common Wheatgrass, <i>Enneapogon nigricans</i> , Common Everlasting, Bluebell, Crowfoot, Fuzzweed and Woodruff.
Justification of evidence used to identify the PCT	PCT 320 was compared to all PCTs in the Grasslands vegetation formation which occur in the South East Highlands IBRA region and Monaro subregion. PCT 320 was considered best fit based on location in the Monaro sub-region of the NSW South Eastern Highlands Bioregion, landscape position on broad flats and floristic composition. PCT 894 was excluded based on location (north-west and east of Canberra); PCT 1187 was excluded based on location (drier areas, i.e. in the Monaro rainshadow); PCT 1202 was excluded based on landscape position (upper slopes or ridges); PCT 1289 was excluded based on location (northern Monaro) and floristic composition.
Status	Commonwealth EPBC Act: Natural Temperate Grassland of the South Eastern Highlands listed as critically endangered BC Act: not listed Justification: PCT 320 meets all key diagnostic criteria listed in TSSC (2016), as well as condition thresholds, including: <ul style="list-style-type: none"> • the percentage cover of native vascular plants is greater than the percentage cover of perennial exotic species; • the presence of at least four non-grass native species (at non-favourable sampling times); and • the presence of at least one indicator species (at non-favourable sampling times). On this basis, PCT 320 is considered to meet the criteria for the Natural Temperate Grassland of the South Eastern Highlands CEEC (EPBC listed).

Table 5.4 PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

Estimate of percent cleared value of PCT	96%
--	-----



Photograph 5.1 Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion – Plot 3262

5.4.4 Assessment of patch size

For each vegetation zone within the disturbance footprint, patch size was assessed using a select process in ArcGIS, using existing vegetation mapping and aerial imagery. All intact native vegetation separated by a distance of less than 30 m (non-woody vegetation ecosystems) was mapped sequentially.

This process showed that vegetation within the study area forms part of large patches of connecting vegetation with patch size of greater than 100 ha. This patch size was used in the BAM calculator.

5.4.5 Vegetation integrity score

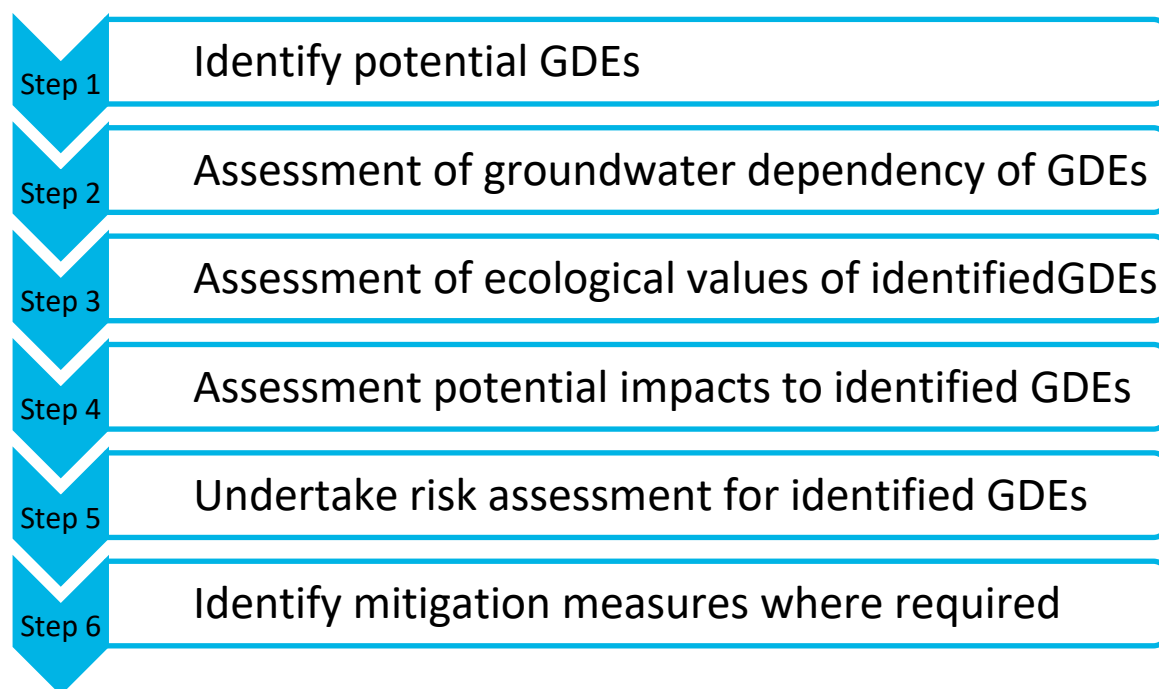
The vegetation integrity score for each vegetation zone is presented in Table 5.5.

Table 5.5 Vegetation zones mapped within the site

Plant community type	Condition	Vegetation integrity score
PCT 320 – Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Poor	35

5.5 Groundwater dependent ecosystems

A groundwater dependent ecosystem (GDE) risk assessment has been completed in accordance with the NSW Government *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (Serov et al. 2012). This assessment follows the process detailed below:



5.5.1 Identification of potential GDEs including stygofauna

Ecosystems that could rely on either the surface or subsurface expression of groundwater within or surrounding the study area are those associated with:

- creeks where deep groundwater is discharging and provides baseflow;
- shallow (perched) groundwater systems;
- springs; and
- terrestrial vegetation overlying shallow groundwater (within the vegetation's root zone).

These ecosystems have been classified into three categories according to their dependence on groundwater:

- non-dependent;
- facultative;
- entirely dependent/obligate:
 - opportunistic;
 - proportional; and
 - highly dependent.

Considerations in evaluating PCTs and their potential dependency on groundwater included:

- the physiology of plant species that occur in that community and their likely dependence on water availability;
- the PCTs location in the landscape; and
- if the rooting depth of vegetation would be able to take up groundwater based on likely depth of the aquifer and soil characteristics.

Access to the groundwater is dependent on a number of factors with the core factor being the depth to the water table. As terrestrial vegetation communities are composed of a range of vegetation types with a range of rooting depths and strategies there is a relationship between groundwater depth and the types and composition of the vegetation that is able to access it (Serov P 2013).

5.5.2 Potential GDEs

There was no listed high priority terrestrial or aquatic GDEs within the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* within or surrounding the site. No PCTs within the study area were considered to be dependent on groundwater. As such, no further assessment for GDEs are required for this assessment.

6 Threatened species

6.1 Fauna habitat assessment

Concurrent with the vegetation mapping, a habitat assessment was undertaken seeking to identify the following fauna habitat features within the site:

- habitat trees including large hollow-bearing trees;
- availability of flowering shrubs and feed tree species;
- waterway condition;
- quantity of ground litter and logs;
- rocky habitats suitable to support reptile species;
- suitable ground cover habitat such as native tussocky grass that provide microhabitats for reptiles; and
- searches for indirect evidence.

The habitat assessment identified that the site was subjected to a high level of disturbance from previous and current land uses and exotic species outcompeting native species. The grassland habitat has been either maintained as part of the airport operations (slashing/mowing) or left fallow.

6.2 Ecosystem credit species assessment

A list of ecosystem credit species predicted to occur within the site, based on the PCTs present and generated by the calculator associated within the BAM (OEH 2017), is provided in Table 6.1. The potential for these species to occur within the proposed segment factory disturbance footprint was assessed in accordance with Section 6.2 of the BAM (OEH 2017).

Table 6.1 **Assessment of ecosystem credit species within the disturbance footprint**

Scientific name	Common name	Justification for exclusion
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Excluded from the site. Grassland habitat in the study area is not considered suitable for species.
<i>Circus assimilis</i>	Spotted Harrier	Not excluded.
<i>Epthianura albifrons</i>	White-fronted Chat	Excluded from the site. No suitable grassy wetland habitat within the study area.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle (foraging)	Excluded from the site. Grassland habitat in the study area not considered suitable foraging habitat for species.
<i>Hieraetus morphnoides</i>	Little Eagle (foraging)	Not excluded.
<i>Petroica boodang</i>	Scarlet Robin	Not excluded.
<i>P. phoenicea</i>	Flame Robin	Not excluded.
<i>Stagonopleura guttata</i>	Diamond Firetail	Not excluded.
<i>Suta flagellum</i>	Little Whip Snake	Not excluded.

6.3 Species credit species assessment

6.3.1 Habitat constraints assessment (Step 2)

An assessment of habitat constraints for threatened species was undertaken in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017). For those threatened species predicted to occur, for which habitat constraints are listed, an assessment was undertaken of the presence of the habitat constraint and/or geographic limitation within the site.

The BAM calculator did not, initially, identify any geographic or habitat constraints for any listed candidate threatened species. However, as the Pink-tailed Legless Lizard (*Aprasia parapulchella*) has been recorded on the Atlas of NSW Wildlife in the locality, and is associated with grassland habitats, this species was added manually to the list of species credit species requiring consideration. Habitat constraints are identified for this species (Table 6.2); however, these constraint do not occur within the disturbance footprint or broader Polo Flat site. The Pink-tailed Legless Lizard

Table 6.2 **Assessment of habitat constraint features within the disturbance footprint**

Scientific name	Common name	Feature	Sensitivity to gain class	Habitat constraint present in development site	Justification
<i>Aprasia parapulchella</i>	Pink-tailed Lizard	Legless <ul style="list-style-type: none"> Rocky area; or Within 50 m of rocky areas. 	High	No	The disturbance footprint does not support rocky areas suitable for this species.

6.3.2 Identifying candidate species credit species for further assessment (Step 3)

To develop a list of species credit species for further assessment, an assessment was undertaken in accordance with Step 3 of Section 6.4 of the BAM (OEH 2017), as shown in Table 6.3.

Table 6.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
Flora			
<i>Calotis glandulosa</i>	Mauve Burr-daisy ¹	Yes	<p>Sprawling, branched herb confined to the Monaro and Kosciuszko regions. Colonizes bare patches and along roadsides at higher altitudes in Temperate Montane Grasslands, Subalpine Woodlands, Tableland Clay Grassy Woodlands and Southern Tableland Wet Sclerophyll Forests.</p> <p>The species has been recorded adjacent to the study area, including to the north-east and west.</p> <p>The species is considered to have potential to occur within the study area, as suitable grassland habitat is present.</p>
<i>Dodonaea procumbens</i>	Creeping Hop-bush ¹	Yes	<p>Low, spreading shrub occurring in the dry areas of Monaro between Michelago and Dalgety. Grows on near vertically tilted shale outcrops and in bare, open patches in a variety of communities including Natural Temperate Grassland, Snow Gum <i>Eucalyptus pauciflora</i> Woodland, Montane Lakes and Freshwater Wetlands. Grows on sandy-clay soils.</p> <p>The species has been recorded to the east of the study area, along Carlaminda Road.</p> <p>The species is considered to have potential to occur within the study area, as suitable grassland habitat is present.</p>
<i>Rutidosis leiolepis</i>	Monaro Golden Daisy ¹	Yes	<p>The Monaro Golden Daisy, is a low, tufted perennial with dark green leaves, with a woolly under surface, to about 10 cm. The solitary, slightly domed flower-heads are about 15 mm across, and occur on erect woolly stems to about 25 cm tall.</p> <p>The species has been recorded immediately adjacent to the study area.</p> <p>The species is considered to have potential to occur within the site, as suitable grassland habitat is present.</p>
<i>Swainsona sericea</i>	Silky Swainson-pea	Yes	<p>The Silky Swainson-pea is a prostrate or erect perennial, growing to 10 cm tall. Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. Its stronghold is on the Monaro. Found in Natural Temperate Grassland and Snow Gum <i>Eucalyptus pauciflora</i> Woodland on the Monaro.</p> <p>The species has been recorded to the south of the study area, in Kuma Nature Reserve.</p> <p>The species is considered to have potential to occur within the site, as suitable grassland habitat is present.</p>

Table 6.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
Fauna			
<i>Delma impar</i>	Striped Legless Lizard ¹	Yes	<p>The Striped Legless Lizard is a member of the family Pygopodidae. As with other members of the legless lizard family, the species lacks forelimbs and has only very reduced vestigial hind limbs. The species is patchily distributed in grasslands of south-eastern NSW, the ACT, north-eastern, central and south-western Victoria, and, possibly, south-eastern South Australia. The species inhabits both native, derived and exotic grasslands; the presence of a relatively dense and continuous structure, rather than the floristic composition of the grasslands, may be important in influencing the persistence of the species.</p> <p>The species has been recorded in grassland habitat to the east of the study area, and extensively in Kuma Nature reserve to the south-east.</p> <p>The site contains suitable tussock grassland habitat to support this species.</p>
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle (Breeding)	No	<p>Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.</p> <p>No nests or suitable nesting sites for the species were observed during the habitat assessment. Breeding habitat is absent from the site.</p>
<i>Hieraetus morphnoides</i>	Little Eagle (Breeding)	No	<p>The Little Eagle occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used. The species nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.</p> <p>No nests or suitable nesting sites for the species were observed during the habitat assessment. Breeding habitat is absent from the site.</p>
<i>Tympanocryptis pinguicollis</i>	Grassland Earless Dragon ¹	Yes	<p>Occurs at sites dominated by wallaby grasses, spear grasses, Poa Tussock, Red Grass, Kangaroo Grass and introduced pasture grasses. It prefers areas open structure, with small patches of bare ground between the grasses and herbs. Partially embedded surface rocks, and spider and insect holes are used for shelter. Rocks and arthropod holes provide important thermal refuges.</p> <p>The species has been recorded in grassland habitat to the east of the study area, and extensively in Kuma Nature reserve to the south-east.</p> <p>The site contains suitable tussock grassland habitat to support this species.</p>

Notes: 1. As a number of species recorded in the locality and associated with grassland habitats were not nominated as candidate species, these species were added manually for PCT 320.

This assessment identified the following species as candidate species requiring further assessment:

- Mauve Burr-daisy;
- Creeping Hop-bush;
- Monaro Golden Daisy;
- Silky Swainson-pea;
- Striped Legless Lizard; and
- Grassland Earless Dragon.

Preliminary flora and fauna surveys were undertaken in mid-2019, including targeted surveys for reptiles and preliminary flora surveys. Whilst no threatened species were recorded during these surveys, further surveys will be undertaken in spring and summer of 2019. For the purposes of determining credits, a precautionary approach was adopted for the BDAR which assumed that these species are present within the site. Further surveys will reduce this assumed impact and resultant credit requirements.

Survey methods and outcomes are discussed further below.

6.3.3 Targeted survey methods

i Targeted flora surveys

No targeted flora surveys have been undertaken within the site due to the proposed works been commissioned outside of the survey period for the candidate species. A precautionary view has been adopted and these species have been assumed to be present within the study area as part of this assessment.

All areas of native vegetation have been identified as a part of the species' polygons for these species.

Targeted flora surveys will be undertaken in accordance with OEH (2016) and DoE (2013) guidelines, and include transects spaced at intervals of 10 m in all areas of potential habitat (native vegetation).

ii Targeted fauna surveys

Stratification units, as well as survey methods and effort are outlined below. Fauna survey locations are illustrated in Figure 6.1. Targeted fauna surveys were conducted within the site between May and July for reptiles. It was noted that these surveys were undertaken outside of the required survey period, as per guidance in DSEWPac 2011a & 2011b and in the BAM (OEH 2017).

Reptile surveys were undertaken to target two reptile species listed under the BC Act and EPBC Act:

- Striped Legless Lizard; and
- Grassland Earless Dragon.

Stratification units and area of each survey unit in the site are shown in Table 6.4.

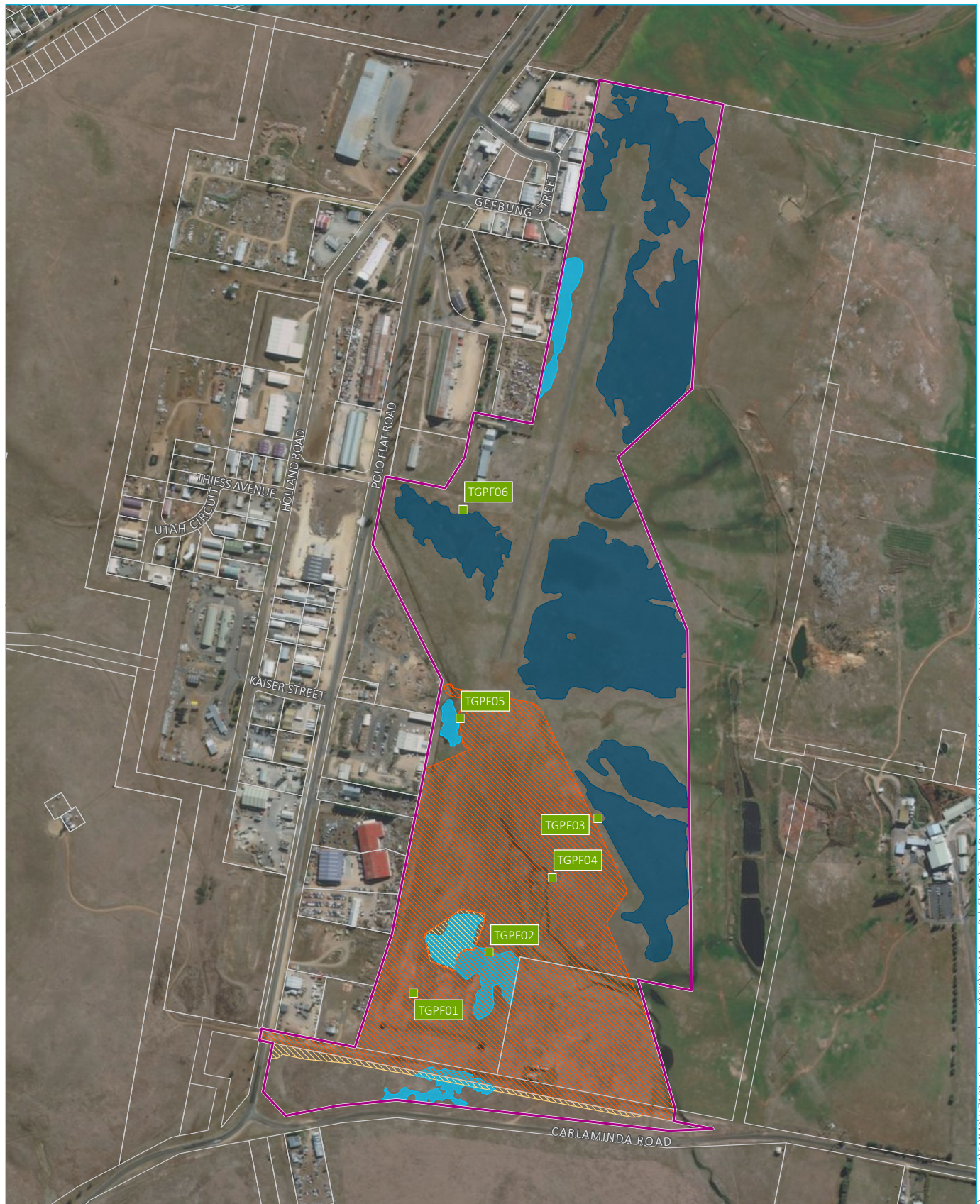
Table 6.4 **Stratification units and site – reptiles**

Vegetation class/site	Area (ha)
Western Slopes Grassland	1.39
Non-native vegetation	30.31
TOTAL	31.70

Methods and survey effort are outlined in Table 6.5.

Table 6.5 **Methods and survey effort – reptiles**

Method	Survey description	Survey effort
Tile grids (for all species)	<p>Each tile grid was set out as follows:</p> <ul style="list-style-type: none"> • Tile grid, consisting of 50 tiles spaced at 5 m spacing between tiles in a 5 x 10 grid. • The corner of each grid is marked with a star picket, and each tile labelled A1 to E10. • Tile grids have been checked at least twice a month, when temperatures are below 28°C. • If the species is detected at a tile grid the grid will be collected and moved to an alternate location to increase survey coverage. <p>DSEWPac (2011a) recommends tile grids are installed at least three months prior to the initial survey/checks (by June).</p>	<p>Minimum survey requirements for the Striped Legless Lizard recommends that 10 tile grids are deployed for sites greater than 30 ha in size. Six tile grids have been established across the Polo Flat site.</p> <p>Surveys are to be undertaken between September – December. Survey sites were established in May, and check weekly between May and mid July. Surveys will recommence in September.</p>
Arthropod traps (Grassland Earless Dragon)	<p>Arthropod traps, constructed of PVC tubing, are used in accordance with the following method:</p> <ul style="list-style-type: none"> • Prior to placing the traps, ground cover vegetation within a 1 m radius is slashed short to improve visibility of the artificial burrows to the dragon. • PVC tube is inserted vertically into the substrate, with the opening level with the surface. • An inner tube is placed into this to allow removal of trapped animals or debris. • A metal roof is placed over each trap to shelter animals from sun and rain, and to assist in locating tubes. <p>Inspection of tubes is carried out by torch, with traps checked once every two to three days over a five week period.</p>	<p>No minimum survey effort is specified in DSEWPac (2011a). Transects of traps are recommended. It is proposed to establish five transects, consisting of 10 traps placed at 10 m intervals. Two transects will be placed in areas of PCT 320, with three placed in non-native vegetation.</p> <p>No trapping for this species has been undertaken at present. These surveys will commence in September.</p>



Source: EMM (2019); FGJV (2019); Snowy Hydro (2019); DFSI (2017); ESRI (2019); GA (2011); LPMA (2011)

KEY

- Tile grid
- Cadastral boundary
- Study area
- Disturbance footprint
- Direct disturbance
- Indirect disturbance

PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

- High
- Poor

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Proposed Segment Factory
Figure 6.1



6.3.4 Targeted survey results

No reptiles were recorded during the surveys between May and July. As these surveys were undertaken outside of the recommended survey period a precautionary approach was adopted for the BDAR which assumed that these species are present within the site. Further surveys to be undertaken in spring and summer of 2019 will reduce this assumed impact and resultant credit requirements.

6.3.5 Species credit species

A list of candidate species credit species predicted to occur within the site, along with an assessment of whether the species will be impacted by the proposed segment factory is provided within Table 6.6.

Based on the assumed presences of species, the following species may be impacted:

- Mauve Burr-daisy;
- Creeping Hop-bush;
- Monaro Golden Daisy;
- Silky Swainson-pea;
- Striped Legless Lizard; and
- Grassland Earless Dragon.

These species will require offsets in accordance with the BAM (OEH 2017).

Table 6.6 Species credit species, habitat suitability and targeted survey results

Scientific name	Common name	Biodiversity risk weighting	Habitat present within the study area	Recorded during field surveys	Impacted by development	Justification
Flora						
<i>Calotis glandulosa</i>	Mauve Burr-daisy	3.00	Yes All areas of native grassland habitat	Assumed presence	Yes -	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.
<i>Dodonaea procumbens</i>	Creeping Hop-bush	1.50	Yes All areas of native grassland habitat	Assumed presence	Yes	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.
<i>Rutidosia leiolepis</i>	Monaro Golden Daisy	2.00	Yes All areas of native grassland habitat	Assumed presence	Yes	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.
<i>Swainsona sericea</i>	Silky Swainson-pea	2.00	Yes All areas of native grassland habitat	Assumed presence	Yes	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.
Fauna						
<i>Delma impar</i>	Striped Legless Lizard	1.50	Yes All areas of native grassland habitat	Assumed presence	Yes	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.
<i>Tympanocryptis pinguicollis</i>	Grassland Earless Dragon	2.00	Yes All areas of native grassland habitat	Assumed presence	Yes	A precautionary approach was adopted for the BDAR which assumed that these species are present within all areas of PCT 320 directly impacted.

Part B

Stage 2: Impact assessment

7 Impact assessment (biodiversity values)

7.1 Introduction

This section identifies the potential impacts of the proposed segment factory on the biodiversity values. Measures taken to date to avoid and minimise impacts are summarised and recommendations to assist in the design of a development that further avoids, minimises and mitigates impacts are provided in the following sections.

7.2 Potential direct, indirect and prescribed impacts

Potential direct impacts prior to any avoidance, minimisation or mitigation, include:

- clearing of native vegetation; and
- clearing of threatened species habitat.

Removal of native vegetation and threatened species habitat has the potential to result in fragmentation of flora and fauna habitat, with resultant effects on fauna species movement, reproduction and gene flow (Bennett 1990, Keller and Largiadèr 2003, Dixo et al. 2009). Clearing can result in the inability of species to move between patches of suitable habitat and undertake important lifecycle processes. Ultimately, this can increase the vulnerability of flora and fauna populations to sporadic events and extinction (Bennett 1990, Smith and Hellmann 2002, Fischer and Lindenmayer 2007).

Unmitigated, the proposed segment factory will have potential to result in indirect impacts, including:

- increased noise, vibration and dust levels;
- lighting for night works;
- increase in weeds; and
- degradation of retained native vegetation and fauna habitat.

Construction activities may result in increased levels of noise and vibration and as a result of the construction works, the factory activities and vehicle movements to site. Noise has been observed to modify animal behaviour (Hoskin and Goosem 2010). These activities may also result in increased dust levels, covering adjacent vegetation and inhibiting growth. Lighting for night works also has the potential to result in light spill into adjacent habitat areas, and ongoing disturbance to fauna species (Davies et al. 2014, Schroer et al. 2016). Unmitigated, there is also potential for spread of African Lovegrass from the proposed segment factory into areas of high biodiversity value, notably Kosciuszko National Park.

Prescribed impacts, as per Section 8.2.1.2 of the BAM (OEH 2017), that could occur as a result of works include:

- impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range, such as Kuma Nature Reserve to the south and habitat to the north;

- impacts of development on movement of threatened species that maintains their life cycle. Fragmentation of areas listed above could impact on movement of flora and fauna species across their range as well as dispersal and gene flow; and
- impacts of vehicle strikes on threatened species. Increased vehicle movements associated with the proposed segment factory both on site and to site have the potential to result in increased fauna vehicle strikes, and associated fauna mortality (Taylor and Goldingay 2010).

7.3 Measures to avoid, minimise and mitigate impacts

Snowy Hydro, in consultation with EMM and the design team (FGJV) have undertaken steps to avoid, minimise and mitigate impacts for the proposed segment factory.

The key focus of the project design has been to avoid and minimise impacts to biodiversity values identified during the field surveys. The process below has been followed to ensure impacts are avoided and minimised to the greatest extent possible, within the design and other limitations of the proposed segment factory:

- identification of biodiversity values;
- communication of identified values to the project team, including Snowy Hydro and the design team;
- consultation between the design team and project ecologists on various elements to consider both direct and indirect impacts and work through an iterative design process, with multiple iterations of design elements to achieve best practice outcomes;
- consultation with key government stakeholders, including the OEH, DoEE, including species experts, to seek input and discuss measures proposed to avoid, minimise and mitigate impacts;
- feedback of consultation into the design process; and
- finalisation of measures to avoid, minimise and mitigate impacts.

Measures undertaken to avoid, minimise and mitigate impacts that have arisen during the process outlined above are discussed below.

7.3.1 Measures to avoid and minimise impacts

The original design for the proposed segment factory was located further to the north on Lot 14, close to the existing hangers. This location would have resulted in greater impacts on areas of Natural Temperate Grassland of the South Eastern Highlands (PCT 320) in High condition.

The final design and location for the proposed segment factory has been located in an area that supports the lowest quality areas of PCT 320 in the study area. These patches of PCT 320 were heavily degraded due to exotic weed species, supported a lower abundance and diversity of non-grass species when compared to other patches of the PCT and are separated (greater than 100 m) from patches of PCT 320 in high condition. This revised location avoids impacts to the High condition remnant to the north along with larger, higher quality areas of PCT 320 located within the study area and Lot 14 to the north and north-east.

Early designs also included an access road to the north, as well as a drainage detention basin impacting on a small Poor condition area of PCT 320. The access road and detention basin location have been refined to avoid direct impacts to native vegetation. Access to the proposed segment factory will be provided near to Polo Flat Road, which will reduce the distance from the current access which is located to the north off Airstrip Road. Having access from the south will reduce the disturbance and fragmentation to suitable habitat located to the north of the disturbance footprint. The detention basin has been re-shaped and moved to the east, avoiding impacts.

7.3.2 Measures to mitigate impacts

Indirect impacts could occur to the two patches of PCT 320 that are to be retained within the disturbance footprint. Both patches would be isolated from other areas of suitable habitat by the proposed segment factory operational areas and by the drain and detention basin. Indirect impacts may include an increase in dust, runoff and weed species if proper mitigation is not adopted as part of the construction and operation design. There is also potential for indirect impacts, including a reduction in value of retained native vegetation to the south of the proposed segment factory. To prevent this occurring the following controls are to be implemented:

- the two patches of retained native grassland located within the segment factory will be fenced with a post and wire fence, and signed as “No-go zones – Environmentally sensitive areas”;
- the road interfacing with the retained native grassland to the south will also be fenced and signed as above; and
- all three areas will be actively managed to reduce indirect impacts and retained the native grassland structure. This will include implementation of a weed monitoring and control program, including monitoring of weeds and control of any outbreaks of key weed species; and
 - this will include all areas of native grassland within the two retained patches, as well as an area 20 m from the disturbance boundary for the area of retained native grassland to the south.

To minimise the impacts of weeds on-site, and prevent spread of weed off-site, the following controls will be implemented:

- weeds will be controlled across Lot 14 outside of the disturbance footprint, to stop their spread. All control measures should follow guidance detailed in NSW WeedWise (DPI 2019);
- active and intensive control will be undertaken within 50 m of the disturbance footprint to reduce the cover of weeds adjacent to the proposed segment factory, preventing the spread of weeds into the operational areas and reducing the risk of weeds being transported off-site;
- disturbed areas should be rehabilitated as soon as practicable following clearing with desirable and persistent groundcover species; and
- a weed wash-down station will be constructed at a suitable location on the site. Wash-down of all vehicles will be completed before and after any movements on- or off-site.

The Striped Legless Lizard and Grassland Earless Dragon have been assumed to be present within suitable habitat associated with PCT 320; other threatened flora and fauna species may also occur. There is potential for impacts to these species to occur due to clearing of native vegetation and ground disturbance during construction. To reduce this risk the following controls will be implemented if the species are found to occur within the study area during further surveys to be undertaken in spring and summer of 2019:

- a toolbox talk will be provided to all contractors working on the site to inform them of the potential presence Striped Legless Lizard, Grassland Earless Dragon and other threatened flora and fauna species. The toolbox talk will include identification of all reptile species likely to be in the area, what the procedures should be if any listed reptiles are found during the works. The toolbox talk will be undertaken by a suitably experienced ecologist during induction of all staff and contractors;
- clearing of all exotic and native vegetation will be undertaken in accordance with the following procedure:
 - Stage 1: All vegetation within the disturbance footprint is to be cut to a minimum height of 15 cm during the active season (September to December) to reduce the habitat suitability for these species and to aid in their dispersal outside of this area. All species observed are to be actively removed from the disturbance footprint;
 - Stage 2: The removal of habitat features (eg refuge features) from the disturbance footprint by hand. A minimum of 24 hours will be allowed between Stage 1 and Stage 2;
 - any fauna species are to be relocated to habitat identified during the pre-clearing process or, if injured, transported to a veterinarian or wildlife carer; and
- clearing of African Lovegrass should include appropriate disposal of this vegetation at a registered landfill or through deep burial on-site, including the soil seed bank.

These measures will be incorporated into a Construction Environmental Management Plan (CEMP).

7.4 Impact summary

7.4.1 Summary of measures to avoid, minimise and mitigate impacts

A summary of impacts arising from proposed segment factory, and measures outlined above to avoid, minimise and mitigate impacts, is provided in Table 7.1.

Table 7.1 **Summary of impacts, and measures to avoid, minimise and mitigate**

Project element	Impact	Impact avoidance	Impact minimisation	Impact mitigation
Proposed segment factory	<p><i>Removal of native vegetation.</i></p> <p>Type: direct impact.</p> <p>Frequency: once, during construction.</p> <p>Intensity: direct impacts 0.83 ha of native vegetation including habitat listed as critically endangered natural temperate grassland of the South Eastern Highlands under the EB&BC Act.</p> <p>Duration: initial stages of construction.</p> <p>Consequence: direct impacts to a critically endangered community.</p>	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320 in Poor condition. 	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> Pre-clearing process.
	<p><i>Fragmentation of native vegetation.</i></p> <p>Type: indirect impact.</p> <p>Frequency: during construction and ongoing during operation.</p> <p>Intensity: greatest impact will be associated with the patches of PCT 320 that will be retained in the middle of proposed segment factory and the two adjacent patches, one located in the north and the other to the east of the disturbance footprint.</p> <p>Duration: for the life of the project.</p> <p>Consequence: indirect impacts to a critically endangered community.</p>	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320 in Poor condition. 	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> Pre-clearing process. Fencing and designation of retained native vegetation as No-go zone. Implementation of a weed monitoring program. Implementation of a weed control program.

Table 7.1 **Summary of impacts, and measures to avoid, minimise and mitigate**

Project element	Impact	Impact avoidance	Impact minimisation	Impact mitigation
	<p><i>Introduction of weeds into the works and areas of retained vegetation and spread of weeds off-site.</i></p> <p>Type: indirect impact.</p> <p>Frequency: ongoing during operation.</p> <p>Intensity: indirect impacts to 0.56 ha of retained native vegetation and impacts to high biodiversity value areas in KNP.</p> <p>Duration: ongoing through construction phase.</p> <p>Consequence: potential to impact on the critically endangered natural temperate grassland community and on threatened species habitat, resulting in the decline in habitat quality.</p>	<ul style="list-style-type: none"> • Not required 	<ul style="list-style-type: none"> • Construction of wash-down stations at a suitable location. • Washdown required for weeds. • Wash-down of all vehicles will be completed prior to movement on and off site. 	<ul style="list-style-type: none"> • Control of weed across Polo Flat on land owned by Snowy Hydro. • Intensive control of weeds within 50 m of the proposed segment factory (where owned by Snowy Hydro). • Implementation of a weed monitoring program. • Implementation of a weed control program. • Rehabilitation of disturbed areas as soon as practicable following clearing. • Removal and appropriate disposal of weeds removed during vegetation clearing.
	<p><i>Increase in noise, vibration, dust and light pollution.</i></p> <p>Type: indirect impact.</p> <p>Frequency: during construction and ongoing during operation.</p> <p>Intensity: habitat degradation for critically endangered natural temperate grassland of the South Eastern Highlands under the EB&BC Act, Mauve Burr-daisy, Creeping Hop-bush, Monaro Golden Daisy, Silky Swainson-pea, Striped Legless Lizard and Grassland Earless Dragon.</p> <p>Duration: for the life of the project.</p> <p>Consequence: indirect impacts to habitat for the retained and adjacent critically endangered community, one endangered species and three vulnerable species.</p>	<ul style="list-style-type: none"> • The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> • The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> • Site induction within the CEMP.

Table 7.1 **Summary of impacts, and measures to avoid, minimise and mitigate**

Project element	Impact	Impact avoidance	Impact minimisation	Impact mitigation
	<p><i>Removal of threatened species habitat.</i></p> <p>Type: direct impact.</p> <p>Frequency: once, during construction.</p> <p>Intensity: removal of 0.83 ha of assumed habitat for Mauve Burr-daisy, Creeping Hop-bush, Monaro Golden Daisy, Silky Swainson-pea, Striped Legless Lizard and Grassland Earless Dragon.</p> <p>Duration: once, during construction.</p> <p>Consequence: potential impacts to habitat for one endangered species and three vulnerable species.</p>	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> Pre-clearing process. Staged clearing (Stage 1 and 2) for all areas of suitable habitat.
	<p><i>Fragmentation of habitat for threatened species.</i></p> <p>Type: indirect impact.</p> <p>Frequency: once, during construction</p> <p>Intensity: habitat fragmentation for Mauve Burr-daisy, Creeping Hop-bush, Monaro Golden Daisy, Silky Swainson-pea, Striped Legless Lizard and Grassland Earless Dragon.</p> <p>Duration: for the life of the project.</p> <p>Consequence: indirect impacts to habitat for one endangered species and three vulnerable species.</p>	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> Pre-clearing process. Staged clearing (Stage 1 and 2) for all areas of suitable habitat.
	<p><i>Vehicle strikes for threatened species.</i></p> <p>Type: prescribed impact.</p> <p>Frequency: during construction and operation.</p> <p>Intensity: incidental mortality for Striped Legless Lizard and Grassland Earless Dragon.</p> <p>Duration: for the life of the project.</p> <p>Consequence: indirect impacts for one endangered species and one vulnerable species.</p>	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> The site selection within Snowy Hydro owned land for the disturbance footprint is within an area with the least amounts of PCT 320. 	<ul style="list-style-type: none"> Access from the south reducing access distance.

7.4.2 Serious and irreversible impacts (SAIL)

No species or communities were identified as candidates for serious and irreversible impacts (SAIL). As such no further assessment is required for SAILs.

7.4.3 Impacts requiring offsets

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10 of the BAM (OEH 2017).

i Impacts on native vegetation

Impacts to native vegetation requiring offset include:

- direct impacts on 0.83 ha of PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- indirect impacts on 0.56 ha of PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion, including:
 - 0.46 ha of PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion located within the proposed segment factory but to be retained; and
 - 0.10 ha of PCT 320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion located within 20 m of the access road along the southern boundary.

Offset for indirect impacts were calculated in accordance with the scores shown in Table 7.2. It was assumed that, due to the controls outlined above, retained vegetation would be partially impacted, with a reduction in native species abundance (composition) and cover (structure) due to adjacent human activity.

Table 7.2 Calculation of offsets for indirect impacts

	Trees	Shrubs	Grass and grass like	Forb	Fern	Other
Composition						
Pre-construction	0	0	6	9	0	1
Post-construction	0	0	4	5	0	1
Structure						
Pre-construction	0	0	46.2	1.7	0	0.1
Post-construction	0	0	30	.8	0	0.1

These values were used to calculate the change in vegetation integrity score of areas of indirect impact. Areas of direct impact were assumed to have a future vegetation integrity score of 0.

A total of 22 ecosystem credits are required to offset the residual impacts of the proposed segment factory. A summary is provided in Table 7.3 and a credit report is provided in Annexure B. Offsets will be provided in accordance with the biodiversity offset strategy outlined in Section 7.5.

Table 7.3 Summary of ecosystem credits required

PCT	Vegetation zone name	Area	Vegetation integrity loss	Credits required
320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	320_MG_Poor	1.39	28.4	22

ii Impacts on threatened species

Impacts to threatened species habitat requiring offsets include:

- direct impacts on 0.83 ha of habitat for the Mauve Burr-daisy;
- direct impacts on 0.83 ha of habitat for the Creeping Hop-bush;
- direct impacts on 0.83 ha of habitat for the Monaro Golden Daisy;
- direct impacts on 0.83 ha of habitat for the Silky Swainson-pea;
- direct impacts on 0.83 ha of habitat for the Striped Legless Lizard; and
- direct impacts on 0.83 ha of habitat for the Grassland Earless Dragon.

A total of 63 species credits are required to offset the residual impacts of the proposed segment factory. A summary is provided in Table 7.4 and a credit report is provided in Annexure B. Offsets will be provided in accordance with the biodiversity offset framework outlined in Section 7.5.

Table 7.4 Summary of species credits required

Species	Vegetation zone name	Area	Biodiversity risk weighting	Credits required
Mauve Burr-daisy (<i>Calotis glandulosa</i>)	320_MG_Poor	0.83	3	18
Striped Legless Lizard (<i>Delma impar</i>)	320_MG_Poor	0.83	1.5	9
Creeping Hop-bush (<i>Dodonaea procumbens</i>)	320_MG_Poor	0.83	2	0
Monaro Golden Daisy (<i>Rutidosis leiolepis</i>)	320_MG_Poor	0.83	2	12
Silky Swainson-pea (<i>Swainsona sericea</i>)	320_MG_Poor	0.83	2	12
Grassland Earless Dragon (<i>Tympanocryptis pinguicolla</i>)	320_MG_Poor	0.83	2	12

7.4.4 Impacts not requiring offsets

Areas not requiring assessment in accordance with Section 10.4 of the BAM (OEH 2017) include:

- cleared and highly disturbed land (non-native grassland); and
- watercourses (dry creekline).

7.5 Biodiversity offset strategy

Snowy Hydro intends to meet the project's ecosystem and species credit requirements through one, or a combination of, the following:

- establishment of a biodiversity stewardship site, managed under a stewardship agreement;
- purchase and retire credits available on the biodiversity credit register; or
- payment into the Biodiversity Conservation Fund (BCF).

Snowy Hydro owns the Polo Flat airfield. This site supports significant areas of PCT 320 in High condition. There is an opportunity to utilise these areas to generate credits to offset impacts arising from the proposed segment factory. Snowy Hydro is currently assessing the feasibility of financial viability of using this site for this purpose. However, given the small number of credits required this may not be a feasible option.

The biodiversity credit registers associated with the Biodiversity Assessment Method and former BioBanking Assessment Method were searched on 14 August 2019 to determine if suitable ecosystem and species credits were available. This search indicated that credits required to offset impacts to PCT 320 are available under the former offset scheme, while suitable offsets are pending review under the BAM. Suitable credits to offset impacts to the Striped Legless Lizard and Grassland Earless Dragon are also available.

Any credits that cannot be acquitted using the two options outlined above will be offset via payment into the BCF.

8 Conclusion

Vegetation within the site is historically part of the airfield that was established in 1921 and was used from the 1950s to service the Snowy Scheme. Past land used from airport and grazing activities have resulted in significant amounts of change in the grassland structure and composition. Native vegetation, which includes fauna habitats, have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion. Vegetation mapping identified one PCT within the site. The remaining vegetation within the site could not be classified as a PCT as it contained no native species and was mapped as non-native vegetation.

Habitat for threatened species is degraded due to past land use in the site. Natural Temperate Grassland provides potential habitat for the threatened Mauve Burr-daisy, Creeping Hop-bush, Monaro Golden Daisy, Silky Swainson-pea, Striped Legless Lizard and Grassland Earless Dragon. Preliminary flora and fauna surveys were undertaken in mid-2019, including targeted surveys for reptiles and preliminary flora surveys. Whilst no threatened species were recorded during these surveys, further surveys will be undertaken in spring and summer of 2019. For the purposes of determining credits, a precautionary approach was adopted for the BDAR which assumed that these species are present within the site. Further surveys will reduce this assumed impact and resultant credit requirements.

A key focus of the final location for the proposed segment factory was to minimise the impacts to PCT 320, which is aligned with the Natural Temperate Grassland of the South Eastern Highlands listed as critically endangered under the EPBC Act. A number of other measures to mitigate indirect and prescribed impacts are outlined above.

Residual impacts following implementation of all controls include:

- direct impacts to 0.83 ha of poor condition native vegetation;
- indirect impacts to 0.56 ha of poor condition native vegetation; and
- impacts to 0.83 ha of potential threatened species habitat for six species credit species.

A total of 22 ecosystem credits and 66 species credits are required to offset these impacts.

In summary, the site of the proposed segment factory has been selected to avoid and minimise impacts to identified ecological values. Where this could not be achieved impacts have been minimised and mitigated through implementation of appropriate controls. Residual impacts will be offset in accordance with the steps outlined in the biodiversity offset strategy.

References

- Bennett AF 1990. Habitat corridors and the conservation of small mammals in a fragmented forest environment. *Landscape Ecology*, 4, pp. 109-122.
- Davies TW, Duffy J, Bennie J, Gaston KJ 2014. Marine light pollution: nature, extent and ecological implications. *Frontiers Ecol Environ* 12, pp.347–355.
- DEC 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities. Department of the Environment and Conservation, Hurstville.
- DECC 2009. Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna. Amphibians. Department of Environment and Climate Change, Sydney.
- Dixo M, Metzger JP, Morgante JS and Zamudio KR 2009. Habitat fragmentation reduces genetic diversity and connectivity among toad populations in the Brazilian Atlantic Coastal Forest. *Biological Conservation*, 142 (8), pp. 1560-1569.
- DoE 2013. Survey Guidelines for Australia's Threatened Orchids. Guidelines for Detecting Orchids Listed As 'Threatened' Under the Environment Protection And Biodiversity Conservation Act 1999. Department of the Environment, Canberra.
- DoE 2014a. EPBC Act referral guidelines for the vulnerable koala. Department of the Environment, Canberra.
- DoEE 2018. Directory of Important Wetlands search undertaken 10 June 2018 <http://www.environment.gov.au/water/wetlands/australian-wetlands-database>
- DPI 2019 NSW WeedWise last visited 15 July 2019 <https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control>
- DSE 2011a. Survey Standards: Spot-tailed Quoll, *Dasyurus maculatus*. Department of Sustainability and Environment, Melbourne.
- DSEWPac 2010a. Survey Guidelines for Australia's Threatened Birds. Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPac 2011a. Survey Guidelines for Australia's Threatened Reptiles. Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPac 2011b. Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable striped legless lizard, *Delma impar*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Fischer J and Lindenmayer DB 2007. Landscape modification and habitat fragmentation: a synthesis. *Global Ecology and Biogeography*, 16, pp. 265–280.
- Hoskin CJ & Goosem MW 2010. Road Impacts on Abundance, Call Traits, and Body Size of Rainforest Frogs in Northeast Australia. *Ecology and Society*, 15(3), pp. 15.
- OEH 2010. NSW Wetlands spatial data. <https://datasets.seed.nsw.gov.au/dataset/nsw-wetlands047c7> accessed 7 July 2019.
- OEH 2016a, South East Local Land Services Biometric vegetation map, 2014. VIS_ID 4211, NSW Office of Environment and Heritage, Sydney.

- OEH 2016b, Mitchell Landscapes Version V3.1, NSW Office of Environment and Heritage, Sydney.
- OEH 2016c. NSW Guide to Surveying Threatened Plants, NSW Office of Environment and Heritage, Sydney.
- OEH 2017. Biodiversity Assessment Method (BAM), NSW Office of Environment and Heritage, Sydney.
- OEH 2018a. Bionet Atlas of NSW Wildlife – profile viewed 10 June 2018 <http://www.bionet.nsw.gov.au/>.
- OEH 2018b. NSW Plant Community Types, Vegetation Information System – profile viewed 7 July 2019 <http://www.environment.nsw.gov.au/research/VISmap.htm>
- SCT 2019, Proposed Segment Factory Traffic and Transport Assessment, report prepared for EMM Consulting Pty Ltd by SCT Consulting Pty Ltd.
- SELLS 2017. South East Regional Strategic Weed Management Plan 2017-2022. South East Local Land Services.
- Serov P, Kuginis L, Williams J.P. 2012. Risk Assessment Guidelines for Groundwater Dependent Ecosystems. Department of Primary Industries, Office of Water, NSW Government.
- Smith NM & Hellmann JJ 2002. Population persistence in fragmented landscapes. *Trends in Ecology and Evolution*, 17 (9), pp.397-399.
- Taylor BD & Goldingay RL 2010. Roads and wildlife: impacts, mitigation and implications for wildlife management in Australia. *Wildlife Research*, 37(4), pp. 320-331.

Annexure A

Vegetation integrity assessment – datasheets

BAM Site – Field Survey Form

Plot ID:	3262	Date:	06-03-19	Survey Name:	Polo flat			Recorders:	RP, JA
Zone:	55	Easting:	693021.7111	Plot dimensions:	20x50			Midline bearing:	359
Datum:	GDA94	Northing:	5988006.891	IBRA region:				Zone ID:	
Plant Community Type:	320: Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion					Confidence:	Medium	Photo #:	
Vegetation Class:	Upper Riverina Dry Sclerophyll Forests					EEC:	Yes	Confidence:	Medium

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	0
	Shrubs:	0
	Grasses etc.:	6
	Forbs:	9
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	0
	Shrubs:	0
	Grasses etc.:	46.2
	Forbs:	1.7
	Ferns:	0
	Other:	0.1
High Threat Weed cover:		0.3

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living. For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	0	0	0	0	0	50	75	55	66	33	0	0	0	0	0	0	0	0	0	
Average of the 5 subplots:	0					55.8					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Lf Element (A)	Footslope	Lf Pattern (A)	Plain	Microrelief	
		Lf Element (B)	<Null>	Lf Pattern (B)	<Null>		
Lithology (A)	<Null>	Soil Surface Texture	<Null>	Soil Colour	<Null>	Soil Depth	<Null>
Lithology (B)	<Null>						
Slope	Flat	Aspect	263 W	Site Drainage	Poor	Distance to nearest water & type	<Null>

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Light	less than 3yo	No evidence
Cultivation (inc. pasture):	<Null>	<Null>	No evidence
Soil erosion:	<Null>	<Null>	<Null>
Firewood / CWD removal:	<Null>	<Null>	<Null>
Grazing (identify native/stock):	<Null>	<Null>	No evidence
Fire damage:	<Null>	<Null>	<Null>
Storm damage:	<Null>	<Null>	<Null>
Weediness:	Moderate	less than 3yo	Echium vulgare, Chloris truncata and Tribulus terrestris
Other:	Severe	3 to 10 yo	Weed invasion through mowing

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF -- circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Polo flat						
		Date:	06-03-19	Plot ID:	3262	Recorders:	RP, JA

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	Cover	Abund	Voucher	N, E or HTE	Stratum
Grass & grasslike	<i>Rytidosperma bipartitum</i>	35	500	<Null>	N	
Grass & grasslike	<i>Austrostipa bigeniculata</i>	5	100	<Null>	N	
Grass & grasslike	<i>Chloris spp.</i>	0.1	3	<Null>	N	
	<i>Eragrostis curvula</i>	0.2	13	<Null>	HTE	
	<i>Echium vulgare</i>	1	130	<Null>	E	
Grass & grasslike	<i>Chloris truncata</i>	0.1	2	<Null>	N	
	<i>Hirschfeldia incana</i>	0.1	20	<Null>	E	
Grass & grasslike	<i>Cynodon dactylon</i>	5	20	<Null>	N	
Forb (FG)	<i>Wahlenbergia spp.</i>	0.1	30	<Null>	N	
	<i>Tribulus terrestris</i>	0.5	10	<Null>	E	
	<i>Hypericum perforatum</i>	0.1	20	<Null>	HTE	
Forb (FG)	<i>Rumex brownii</i>	0.1	5	<Null>	N	
Forb (FG)	<i>Portulaca oleracea</i>	0.1	5	<Null>	N	
Other (OG)	<i>Convolvulus angustissimus</i>	0.1	3	<Null>	N	
	<i>Chondrilla juncea</i>	0.1	1	<Null>	E	
Forb (FG)	<i>Dysphania pumilio</i>	0.1	2	<Null>	N	
Forb (FG)	<i>Asperula spp.</i>	0.2	20	<Null>	N	
Forb (FG)	<i>Hibiscus trionum</i>	0.1	12	<Null>	N	
	<i>Tragopogon porrifolius subsp. Porrifolius</i>	0.1	5	<Null>	E	
Forb (FG)	<i>Acaena agnipila</i>	0.1	2	<Null>	N	
	<i>Salvia verbenaca</i>	0.1	5	<Null>	E	
Forb (FG)	<i>Cullen spp.</i>	0.1	1	<Null>	N	
	<i>Chenopodium album</i>	0.1	2	<Null>	E	
Grass & grasslike	<i>Bothriochloa macra</i>	1	80	<Null>	N	
Forb (FG)	<i>Erodium spp.</i>	0.8	80	<Null>	N	
	<i>Trifolium repens</i>	0.1	5	<Null>	E	
	<i>Eragrostis cilianensis</i>	0.1	2	<Null>	E	

A.2 Plot data

Table A.1 Plot data

funHighThreat Exotic	0.3
funTreeRegen	0
funTreeStem5 0to79	0
funTreeStem3 0to49	0
funTreeStem2 0to29	0
funTreeStem1 0to19	0
funTreeStem5to9	0
funlenFallenLogs	0.0
funlitterCover	0.0
funHollowtrees	0
funlargeTrees	0
strucOther	0.1
strucFerns	0.0
strucForbs	1.7
strucGrass	46.2
strucShrub	0.0
strucTree	0.0
compOther	1
compFerns	0
compForbs	9
compGrass	6
compShrub	0
compTree	0
Bearing	359
Northing	5988007
Easting	693022
Zone	55
Condition class	MG_Poor
Patch size	101
Area	1.18
PCT	320
Plot	3262

Annexure B

Credit report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016607/BAAS17037/19/00016608	Snowy Hydro - Polo Flat	30/08/2019
Assessor Name	Report Created	BAM Data version *
	18/09/2019	13
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
0	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
------	----------------------	----------------------------------	-----------	----------	---	-----------------------------	----------------	-------------------

BAM Credit Summary Report

Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

1	320_MG_Poor	28.4	1.4	0.25	Moderate Sensitivity to Potential Gain	2.25		22
							Subtotal	22
							Total	22

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
Calotis glandulosa / Mauve Burr-daisy (Flora)						
320_MG_Poor	28.4	0.83	0.25	3	True	18
					Subtotal	18
Delma impar / Striped Legless Lizard (Fauna)						
320_MG_Poor	28.4	0.83	0.25	1.5	False	9
					Subtotal	9
Dodonaea procumbens / Creeping Hop-bush (Flora)						
320_MG_Poor	N/A	0	0.25	2	False	0
					Subtotal	0
Rutidosia leiocarpa / Monaro Golden Daisy (Flora)						
320_MG_Poor	28.4	0.83	0.25	2	False	12
					Subtotal	12

BAM Credit Summary Report

<i>Swainsona sericea / Silky Swainson-pea (Flora)</i>							
320_MG_Poor	28.4	0.83	0.25	2	False		12
						Subtotal	12
<i>Tympanocryptis pinguicolla / Grassland Earless Dragon (Fauna)</i>							
320_MG_Poor	28.4	0.83	0.25	2	False		12
						Subtotal	12

