Attachment 5

Warrawoona Gold Project: Big Schist Pipeline Infrastructure

NVCP Application, Supplementary Information Report

Calidus Resources Limited

Warrawoona Gold Project: Big Schist Pipeline Infrastructure

Native Vegetation Clearing Permit (NVCP), Supplementary Information Report

22 July 2021

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This document has been prepared based on assumptions as reported throughout and upon information and data supplied by others.

CALIDUS

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1. INTRODUCTION

1.1. Purpose and Scope

Calidus Resources Limited (Calidus) is currently developing the Warrawoona Gold Project (WGP), a gold mining and processing operation 20km south of Marble Bar in the Pilbara Region of Western Australia (WA) (Attachment 1).

This document is to support a native vegetation clearing permit application for a borefield pipeline and associated road required to facilitate development of the WGP. The area representing this clearing permit application (herein, application area) is a total disturbance of 30.07ha within a total disturbance envelope of 270ha:

- Construction of a pipeline
- Construction of a road to service the pipeline, using existing pastoral tracks where possible

1.2. Environmental Approvals Status

On the 29th of October 2019, the project was referred to the Western Australian (WA) Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (WA) (EP Act). Approval was granted 20th August 2020 (Statement No. 1150).

On the 22nd November 2019, the project was referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Approval was granted 12th February 2021 (EPBC 2019/8584).

An early works native vegetation clearing permit application was submitted to DMIRS and approved 30th July 2020 (CPS 8862/1). This approval has since been surrendered (4th March 2021) to prevent duplication with the Ministerial Statement.

An early works MP and MCP (Reg ID 87218) along with a 5C Licence to take water (GWL204411(1)) were approved on 12th August 2020 and 9th June 2020 respectively.

On the 20th September, Calidus submitted a Mining Proposal (MP) and Mine Closure Plan (MCP) to Department of Mining, Industry Regulation and Safety (DMIRS). Approval was granted 26th February 2021 (Reg ID 90033).

A 5C Licence to take water application was submitted to Department of Water and Environment Regulation (DWER) on the 18th January 2021. Approval was granted 21 April 2021 (GWL204411(2)).

A Works Approval application was submitted to DWER 6th October 2020 (W6464/2020/1). Approval was granted 21st April 2021.

An NVCP Application (CPS 9295-1 Moolyella Pipeline) was submitted to DMIRS on the 18th May 2021. At the time of this submission, approval was still pending.

1.3. Proponent

Calidus is a company incorporated in Australia and has shares listed on the ASX (ABN 98 006 640 553). All compliance and regulatory requirements regarding this assessment should be forwarded to the following address:

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1.3.1. Environmental record

Calidus is committed to the protection of the environment. The business objective is to plan and implement the Warrawoona Gold Project (WGP) in a way that minimises the impact on the environment. To meet environmental objectives, Calidus are committed to the following actions and practices:

- Maintaining an environmental management standard.
- All staff and contractors will be made aware of the environmental policy and procedures with an appropriate level of training provided
- Act within the business towards reducing greenhouse gas emissions and environmental impact wherever possible
- Reduce and where possible, prevent pollution
- Facilitate recycling of materials and resources wherever possible
- Pursue a progressive rehabilitation program by returning disturbed areas where possible to pre-existing conditions
- Working to identify, assess and control environmental risks
- Encourage open dialogue with employees, regulators and the public on environmental issues and be responsive to their concerns
- Monitoring and review for continual improvement of the Company's environmental performance Specific environmental initiatives include:
- Developed a Significant Species Management Plan

Calidus Executive and Management have held Statutory Positions at operating mine sites throughout Western Australia. No Calidus Director or Manager has previously been convicted, or paid a penalty, for an offence under a provision of the EPBC Act or the (WA) EP Act, or similar environmental protection or health-related legislation in Western Australia or elsewhere in Australia. Furthermore, Calidus Executive and Management have not had a licence or other authority suspended or revoked due to a breach of conditions or an offence under the EPBC Act or the (WA) EP Act or similar environmental protection or health-related legislation in Western Australia or elsewhere in Australia.

1.4. Supporting Studies

Calidus has undertaken substantial investigations across a wide range of environmental factors f and has completed a detailed assessment of the risks that the project poses to the environment. Studies that have been completed are shown in Table 1.

Table 1. Summary of studies completed across the project area.

Investigation/Study	Year	Reference	Appendix
1. Terrestrial fauna			
Level 1 Vertebrate Fauna, Desktop SRE and Subterranean Assessment	2017-18	(Biologic 2017b)	On request
Monitoring bats of conservation significance near Marble Bar, Western Australia: November 2016	2016	(Specialised Zoological 2017a)	On request
Monitoring bats of conservation significance near Marble Bar, Western Australia: April 2017	2017	(Specialised Zoological 2017b)	On request
Targeted Bat Assessment, September 2017	2017	(Biologic 2018a)	On request
Targeted Bat Assessment, July 2018	2018	(Biologic 2018b)	On request
Flora and Vertebrate Fauna Assessment of the Moolyella Pipeline	2020	(Rapallo 2021)	On request
Flora and Vertebrate Fauna Assessment of the Big Schist Pipeline	2021	(Rapallo 2021)	Attachment 7

Investigation/Study	Year	Reference	Appendix
Targeted Bat Assessment, April 2019	2019	(Biologic 2019a)	On request
VHF Bat Foraging Studies 2018	2018	(Biologic 2018c)	On request
VHF Bat Foraging Studies 2019	2019	(Biologic 2019b)	On request
Habitat Assessment and Targeted Vertebrate Fauna Survey	2018-19	(Biologic 2019c)	On request
Significant Species Monitoring Survey Report (June 2019)	2019	(Biologic 2019d)	On request
2. Invertebrate fauna			
Short Range Endemic (SRE) Invertebrate Fauna Survey	2018	(Biologic 2018d)	On request
Subterranean Fauna Survey	2018-19	(Biologic 2019g)	On request
3. Significant fauna impact assessment			
Conservation Significant Bat Species Impact Assessment	2019	(Biologic 2019e)	On request
Conservation Significant Vertebrate Fauna Impact Assessment	2019	(Biologic 2019h)	On request
Assessment of Blasting at the Klondyke Queen for Pilbara Leaf-nosed Bat and Ghost Bat (including 2019 underground mining addendum)	2019	(Blast It Global 2018)	On request
Warrawoona Project – Klondyke Deposit Geotechnical Review of Blasting Report	2019	(Peter O'Bryan and Associates 2019)	On request
Environmental Noise Assessment: Warrawoona Gold Project, Marble Bar	2019	(Lloyd George Acoustics 2019)	On request
Assessment of Dust Emissions	2019	(Environmental Technologies and Analytics 2019)	On request
4. Hydrology and Hydrogeology			
Hydro-Meteorological and Surface Water Management Study	2019	(Groundwater Resource Management 2019a)	On request

Hydrogeological Investigations	2019	(Groundwater Resource Management 2019b)	On request
5. Waste Characterisation and Management			
Characterisation of Mine-Waste and Ore Samples: Implications for Mining-Stream Management	2019	(GCA 2019a)	On request
Characterisation of Mine-Tailings Slurry Sample and Implications for Mining-Stream Management	2019	(GCA 2019b)	On request
Tailings Storage Facility Design Report	2019	(ATC Williams 2019)	On request

Investigation/Study	Year	Reference	Appendix
6. Soils and Landforms			
Soils and landform assessment	2019	(Mine Earth 2019)	On request
7. Flora and vegetation			
Warrawoona Gold Project Flora and Vegetation Survey	2018-2019	(Woodman Environmental 2019a)	On request
Memo of recommendations for referral of Warrawoona Gold Project, assessment against Clearing Principles	2019	(Woodman Environmental 2019b)	On request
Flora and Vertebrate Fauna Assessment of the Moolyella Pipeline	2020	(Rapallo 2021)	On request
Flora and Vertebrate Fauna Assessment of the Big Schist Pipeline	2021	(Rapallo 2021)	Attachment 7
8. Aboriginal Culture and Heritage			
2019 Calidus Warrawoona Gold Project Archaeological Site Avoidance Survey	2019	(Sands CRM 2019)	On request
2018 Calidus Warrawoona Gold Project Ethnographic Site Avoidance Survey	2018	(Sands CRM 2018)	On request

2. PROJECT DESCRIPTION

2.1. Background

2.1.1. Warrawoona Gold Project (WGP)

The WGP is located in the Pilbara region of Western Australia, approximately 20km south of Marble Bar (Attachment 4). The resource is within the Warrawoona greenstone belt, which contains over 200 historic workings (mostly small shafts, stopes, and diggings) that have operated since the late 1800s. It comprises part of the Warrawoona Syncline, which accommodates several quartz lode gold deposits. Mineralisation generally comprises thick sub-vertical shear zones potentially amenable to both open-pit and underground mining, with mineralisation outcropping at surface.

The deposits are hosted within three main shear zones: the Klondyke, Copenhagen and Fielding's Find shear zones. The project is based on resources at the Klondyke deposit, which contains a number of old mine workings, and the Copenhagen deposit, which includes a historic open pit. The Klondyke pit and underground prospect has a current 2012 JORC Code compliant Inferred Resource of 20 Mt at 1.79g/t Au for 1.15 million ounces. The Copenhagen satellite deposit has a current 2012 JORC Code compliant Inferred Resource of 0.3 Mt @ 4.65g/t Au for 39,000 ounces. All approvals have been granted in relation to the WGP, see section 1.2.

2.1.2. NVCP Application - Borefield and roads

This NVCP Application is to seek permission to construct a pipeline and road to access the north-western borefield. It will comprise of 30.07 ha of disturbance within a larger disturbance envelope of 270 ha.

2.2. Land Tenure

The application area is situated within the miscellaneous tenements listed in Table 2.

Table 2. Warrawoona Gold Project tenements

Tenement	Holder(s)	Grant date	End date	Disturbance Footprint (ha)	Disturbance Envelope (ha)
L45/590	Keras (Pilbara) Gold Pty Ltd	23/02/2021	22/02/2042	12.65	113.56
L45/591	Keras (Pilbara) Gold Pty Ltd	29/03/2021	28/03/2042	6.91	62.08
L45/592	Keras (Pilbara) Gold Pty Ltd	23/02/2021	22/02/2042	10.31	92.59
M45/668	Keras (Pilbara) Gold Pty Ltd	29/12/1995	28/12/2037	0.20	1.77

2.3. Application Area

The indicative disturbance footprint for the application area is approximately 30.07ha, as summarised in Table 3 and presented in Attachment 1.

Table 3. Estimated land disturbance

NVCP Application area components	Estimated Total Disturbance Area (ha)
Road and pipeline	29.00
Laydown and hardstand areas (bore locations)	1.07
Total	**30.07ha**

The location of each component considered the following factors:

- Known Heritage sites.
- Presence of conservation significant flora and fauna habitats.
- Locations of watercourses and associated flood zones.
- Potential mineralised areas.
- Landform and topography.
- Distances to other future project elements.
- Separation distances to protect human health.
- Minimising disturbance by using existing pastoral tracks and roads

2.3.1. Construction Camp

Not applicable to this application.

2.3.2. Access Road

Calidus proposes to construct a 25 km pipeline and pipeline access road. This road will be used by light vehicles for construction of the pipeline and for pipeline inspections. The roads will be approximately 10 m wide. This will require the disturbance of 30.07ha of vegetation (Attachment 4).

To minimise clearing, where possible, Calidus will widen existing exploration and pastoral tracks.

2.3.3. Borrow Pits

Not applicable to this application.

2.3.4. Topsoil Stockpiles

Due to the expected short-term nature of the borefields, topsoil will not be collected.

2.3.5. Construction Material Stockpiles

Not applicable to this application.

2.3.6. Mobile Crushing and Screening

Not applicable to this application.

2.3.7. Power

Not applicable to this application.

2.3.8. Construction Water Supply and Storage Infrastructure

Development of the pipeline infrastructure will facilitate mining.

2.3.9. Water Requirements

An Early Works 5C Licence to take water has been approved by DWER (204411(1)) and is supplying water for the initial stages of construction. To facilitate processing operations in early 2022, additional water supply from regional borefields is required. A 5C Licence to take water application that is associated with the pipeline and road described in this native vegetation clearing permit application has been submitted and approved (204411(3)).

2.4. Closure and Rehabilitation

The Project is subject to an approved MCP (Reg ID 90033), prepared in accordance with the *Guidelines for Preparing Mine Closure Plans* (DMP and EPA 2015). The MCP is a dynamic document, which after having identified post-mining land use objectives, is reviewed, and updated regularly, taking into consideration ongoing stakeholder consultation and further studies and research.

The MP and MCP is currently being updated to include the borfield pipeline and road, and will be submitted shortly after this native vegetation clearing permit application.

The integration of rehabilitation and closure planning into operating mine planning will ensure cost-effective measures to reduce liability and risks with mine closure are identified and implemented.

The MCP was submitted to DMIRS as part of the Mining Proposal approval process and includes detailed information relating to key elements of mine closure including:

- Closure specific obligations and commitments;

- Key closure issues and management;
- Stakeholder consultation;
- Site-specific closure implementation plan including closure related tasks, materials required and allows for planned and unplanned scenarios;
- Post-mining land use and closure objectives;
- Site-specific and measurable completion criteria and monitoring program; and Financial costs associated with closure and rehabilitation.

The life of mine for the project is expected to be initially 6 years. Mining of each pit will occur concurrently and consecutively with some areas available for rehabilitation whilst mining is occurring. Rehabilitation will be implemented wherever possible during the operation of the project as areas become available.

3. EXISTING ENVIRONMENT

3.1. Physical Environment

3.1.1. Climate

The Pilbara climate is highly variable and can either be dominated by tropical cyclones or severe drought conditions.

Marble Bar has a desert climate and is one of the hottest towns in Australia. The mean maximum daily temperatures range from 38°C to 42°C in summer and 27°C to 36°C in winter.

Precipitation in the Marble Bar area occurs mainly in the summer months with the peak of the wet season between December and March. Most of the rainfall results from thunderstorms and occasional tropical cyclones that cross the coast intermittently. The average monthly rainfall varies from 0.5 mm to 104 mm, with the mean long-term annual precipitation for the Marble Bar area about 386 mm. The highest average number of rainy days occurs in January (6.9), with the lowest number of rainy days in August (0.2).

An assessment of cyclones in the vicinity of the project area showed that over the last 48-year recording period, 22 cyclones crossed within 100km (approximately one every two or three years) and ten cyclones passed within 50km of the project area (approximately one every five years). In the majority of cases, cyclones bring heavy rainfall, causing runoff to occur in local watercourses (Groundwater Resource Management 2019a).

3.1.2. Geology

The survey area is situated in the Eastern Pilbara Domain of the Archean Pilbara Craton within the Abydos Plains and Hills Zone, north of the Warrawoona Klondyke deposit. The area is dominated by granite-greenstone terrain and subdivided into two major stratigraphic units, the Warrawoona Group and the George Creek Group (Mine Earth 2019). Dominant surface geology varies per land system (Table 4).

3.1.3. Landforms and soils

Approximately two-thirds (172 ha) of the Big Schist survey area is influenced by the Warrawoona Group as per soil unit Gf1, described as steep ranges on basic lavas along with dolomites, tuff, banded iron formations, and dolerite dykes, with some narrow valley plains and high-level gently undulating areas of limited extent. Soils are generally shallow and stony and there are large areas without soil cover: chief soils are brown loams (Um6.23) along with significant areas of earthy loams (Um5.51). (Dr2.33) soils occur on lower slopes, with (Uf6.71) and (Ug5.37) on valley floors (CSIRO Australia 2018).

One third of the survey area (97 ha) falls within the soil unit Fa12 described as gently undulating plain with frequent low granite tors and coalescing pediplains. Chief soils are earthy loams (Um5.51), and coarse sands (Uc5.21) overlying granite. There are considerable areas of red earths (Gn2.12), which may assume dominance in some places; some hard red soils (Dr2) together with coarse (Uc1) soils along creek lines; and minor areas of calcareous loams (Um1) associated with calcrete (kunkar) (CSIRO Australia 2018).

3.1.4. Land systems

The land systems of the Pilbara region are classified according to similarities in landform, soil, vegetation, geology and geomorphology, following van Vreeswyk et al. (2004). Six land systems occur on the survey area, as listed in Table 4.

Table 4. Land systems intersecting the project area (van Vreeswyk et al. 2004)

Land system	Description	Dominant Surface Geology	Area (ha)
Talga Land System	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	Greenstone and chert	109.85
Macroy Land System	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands.	Granite, colluvium	55.52
Rocklea Land System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands	Basalt	47.75
Boolgeeda Land System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	Colluvium	40.97
Capricorn Land System	Hills and ridges of sandstone and dolomite supporting shrubby hard and soft spinifex grasslands.	Sandstone, greywacke	13.46
Granitic Land System	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands.	Granite	2.27

3.1.5. Hydrology

The Warrawoona Range which intersects the survey area is a major feature that impacts hydrology within the local surrounds, forming a local and regional surface water divide (Groundwater Resource Management 2019a). The northwest striking Warrawoona Range forms a local surface water and groundwater divide. Runoff from the range proceeds to the Brockman Creek catchment to the north, which discharges to the Talga River or alternatively to the Camel Creek catchment, which discharges to the Coongan River in a southerly direction (Groundwater Resource Management 2019b). The flowlines proximal to the survey area are tributaries of the Coongan River.

3.2. Biological Environment

3.2.1. Botanical district

The Big Schist pipeline survey area is situated in the Pilbara Botanical District in the Eremaean Botanical Province of Western Australia (Beard 1975).

3.2.2. Vegetation system association

Digital maps (spatial data) of pre-European vegetation communities, based on state-wide mapping by J.S. Beard at 1:250,000 scale, are published by the Department of Primary Industries and Regional Development (DPIRD) (Beard 2018). The survey area is situated within association 93 of the Abydos Plain vegetation system, and association 82 and 587 of the George Ranges system (Table 2)

Three broad vegetation associations are described from the survey area; Abydos Plain (93; Hummock grasslands, shrub steppe; kanji over soft spinifex), George Ranges (82; Hummock grasslands with low tree steppe of snappy gum over *Triodia wiseana*) and Georges Ranges (Mosaic of Hummock grasslands, open low tree-steppe of snappy gum over *Triodia wiseana* and kanji over *Triodia pungens*). This vegetation association is common at the subregional and regional level and widespread through both the Chichester and Hamersley IBRA subregion (Shepherd et al. 2002).

Table 5 Pre-European vegetation within the survey area

System-Association	Structural description	Floristic description	Area (ha)
Abydos Plain 93	Shrub-steppe	Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp	149
George Ranges 82	Low tree-steppe	Hummock grassland with scattered bloodwoods & snappy gum. *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia* (snappy gum)	99
Georges ranges 587	Sparse low tree steppe/ Sparse shrub-steppe	Moasic: Hummock grasslands, open low tree-steppe; snappy gum over Triodia wiseana/ Hummock grasslands, shrub-steppe; kanji over Triodia pungens.	22

Overall findings from vegetation and flora surveys include:

- Flora
  - The survey recorded 123 flora taxa from 30 different families
  - No conservation significant (Priority) flora taxa were recorded.
  - No Threatened taxa, listed under the EPBC Act or Biodiversity Conservation Act 2016.
  - Four introduced taxa were recorded in the survey.
- Vegetation
  - Three vegetation system associations Abydos Plain 93, George Ranges 82 and George Ranges 587, and six land systems were recorded (Macroy, Talga, Rocklea, Boolgeeda, Capricorn and Granitic).
  - No listed Threatened Ecological Communities (TECs) listed under the EPBC Act or BC Act.
  - No Priority Ecological Communities (PECs), as listed by the Department of Biodiversity, Conservation and Attractions (DBCA).
  - Seven Vegetation Types (VT) were recorded.
  - One vegetation type containing localised areas of potentially groundwater-dependent vegetation.

3.2.3. Terrestrial fauna

3.2.3.1. NVCP Application Area

A total of 63 species were recorded during field survey, comprising of 12 mammals, 40 birds, 10 reptiles and 1 amphibian. Four species are conservation significant:

- Pilbara Leaf-nose Bat
- Ghost Bat
- Northern Quoll
- Grey Falcon

Habitat mapping across the WGP area recorded seven fauna habitat types, comprising:

- Stony Plain (43%)
- Sand/Loam Plain (23%)

- Major Drainage 3%)
- Hillcrest/ Hillslope (1%)
- Medium Drainage (7%)
- Hills and Rises (18%)
- Minor Drainage (5%)

Of the 7 broad fauna habitats recorded within the corridor, the Major Drainage habitat and Sand Plain habitat are ranked as high significance for vertebrate fauna due to the potential to provide core habitat for species of conservation significance. The remainder were deemed to be of moderate significance, either due to foraging/dispersal habitats, or habitats known to support priority or migratory species (Table 6).

Table 6. Broad fauna habitats within the NVCP Application area

Habitat	Description	Extent	Photos
Stony Plain Potential Conservation Significant Species ▪ Night parrot (possible foraging/ dispersal) ▪ Ghost bat (foraging/ dispersal) ▪ Pilbara leaf-nosed bat (foraging/ dispersal) ▪ Grey falcon (foraging) ▪ Spectacled hare-wallaby (breeding/ shelter, foraging/ dispersal) ▪ *Ctenotus nigrilineatus* (possible habitat) ▪ Western pebble-mound mouse (breeding/ shelter, foraging/ dispersal) ▪ Potential Ctenotus uber johnstonei habitat Area: 113 hectares Percentage of survey area: 42% **Significance: Moderate**	Flat to undulating stony plain with *Triodia* hummock grasses and scattered shrubland patches gravelly clay loam or skeletal soil. This habitat contains small rocky outcrops.	Stony Plain habitat is common and widespread within the survey area, and more broadly across the Pilbara region. The stony plain habitat is not restricted to the survey area and is represented in conservation estate.	 **Site OPP-45**  **Site OPP-71**

Habitat	Description	Extent	Photos
Sandy/Loam Plain Potential Conservation Significant Species ▪ Night parrot (possible foraging/ dispersal) ▪ Ghost bat (foraging/ dispersal) ▪ Pilbara Leaf-nosed Bat (foraging/ dispersal) ▪ Greater bilby (breeding/foraging/ dispersal) ▪ Brush-tailed mulgara ((breeding/foraging/ dispersal) ▪ Grey falcon (foraging) ▪ Spectacled hare-wallaby (breeding/ shelter, foraging/ dispersal) ▪ Ctenotus nigrilineatus (possible habitat) Area : 63 hectares Percentage of survey area: 23 % **Significance: High**	The Sandy/Loam Plain habitat occurs on flat terrain on both sand/loam plains and alluvial drainage. Vegetation comprises low mixed shrubland dominated by Grevillea pyramidalis and Acacia species, sometimes with emergent Corymbia hamersleyana low trees. The understorey is Triodia hummock grassland. Soils are sandy loams sometimes calcareous and stony and typically associated with medium /major drainage.	The Sandy/Loam Plain habitat is regionally common throughout the Pilbara region. The Sandy Loamy Plain habitat is not restricted to the survey area and is represented in conservation estate.	 **Site S40-GAP06**

Habitat	Description	Extent	Photos
Major Drainage Potential Conservation Significant Species ▪ Ghost bat (foraging/ dispersal) ▪ Pilbara leaf-nosed bat (foraging/ dispersal) ▪ Grey falcon (breeding/ nesting, foraging) ▪ Pilbara olive python (foraging/dispersal) ▪ Northern quoll (foraging/ dispersal) ▪ Northern Brushtail Possum (foraging/ dispersal) ▪ Peregrine falcon (foraging/ dispersal) ▪ Oriental plover (infrequent visitor) ▪ Common greenshank (infrequent visitor) ▪ Wood sandpiper (infrequent visitor) ▪ Glossy ibis (infrequent visitor) ▪ Gane's blind snake (DBCA Priority 1) Area : 9 hectares Percentage of survey area: 3% **Significance: High**	Shallow seasonally fed drainage lines characterised by non-vegetated channels and floodplains with fringing riparian vegetation comprising scattered Eucalyptus victrix open woodland over a patchy understory often dominated by Corymbia hamersleyana and Acacia species, and small ephemerals grasses and herbs. Can contain Melaleuca species in-between major channels. Water can be present in small pools following recent rainfall; however, drainage lines are seasonally dry and dependent on large rainfall events. Contains microhabitat such as leaf litter accumulations, large trees, hollows.	Un-named tributaries of the Coongan River The tributaries are continuous for some distance outside of the survey area and are representative of major drainage habitat occurring across the Pilbara region. The major drainage habitat is not restricted to the survey area and is represented in conservation estate.	 **Site S39-GAP05**

Habitat	Description	Extent	Photos
Medium Drainage Potential Conservation Significant Species ▪ Ghost bat (foraging/ dispersal) ▪ Pilbara leaf-nosed bat (foraging/ dispersal) ▪ Grey falcon (breeding/ nesting, foraging) ▪ Pilbara olive python (foraging/dispersal) ▪ Northern quoll (foraging/ dispersal) ▪ Peregrine falcon (foraging/ dispersal) ▪ Oriental plover (occasional visitor) ▪ Gane's blind snake (DBCA Priority 1) Area : 19 hectares Percentage of survey area: 7% **Significance: Moderate**	Wide gravelly drainage channels lined with Corymbia hamersleyana and tall Acacia trees, typically dissecting the Hillcrest/Hillslope, Hillslopes and Rises or Stony Plain Habitat. Contains microhabitat such as leaf litter accumulations, large trees, hollows. Buffel Grass (**Cenchrus ciliaris*) dominates the understorey in many places.	Predominantly a subset of the major drainage habitat: Medium Drainage Lines – Rocky occurs throughout the Pilbara region due to the topography of the region. The medium drainage habitat is not restricted to the survey area and is represented in conservation estate.	 **Site OPP-50**

Habitat	Description	Extent	Photos
Minor Drainage Potential Conservation Significant Species ▪ Ghost bat (foraging/ dispersal) ▪ Grey falcon (foraging) ▪ Pilbara olive python (foraging/dispersal) ▪ Northern quoll (foraging/dispersal) ▪ Peregrine falcon (foraging/ dispersal) Area : 12 hectares Percentage of survey area: 5% **Significance: Moderate**	The Minor Drainage habitat represents the narrow drainage channels within the Hillcrest / Hillslope, Stony Plain, Hills and rises and Sandy/Loam Plain habitat. Vegetation typically represents that of the surrounding stony or sandy plains but occurring in denser patches of mixed shrubs including Acacias. Substrate is generally gravelly with occasional sandy patches.	The Minor Drainage Line habitat is common throughout the Pilbara bioregion particularly within the Chichester and Hamersley subregions where it is associated with the Stony Plain habitats. The minor drainage habitat is not restricted to the survey area and is represented in conservation estate.	 **Site OPP-46**

Habitat	Description	Extent	Photos
Hills and Rises Potential Conservation Significant Species ▪ Ghost bat (foraging/ dispersal) ▪ Pilbara leaf-nosed bat (foraging/ dispersal) ▪ Northern quoll (foraging/ dispersal) ▪ Western pebble-mound mouse (breeding/ shelter, foraging/ dispersal) ▪ Potential Ctenotus uber johnstonei habitat Area : 43 hectares Percentage of survey area: 18% **Significance: Moderate**	Hills, rises or undulating lower slopes, occasionally isolated areas of rocky outcrop with Triodia spp. grassland and/or sparse open acacia shrubland on gravelly clay loam substrate or skeletal soil, this habitat contains small rocky outcrops, typically not large enough or with enough cracking/crevices to provide shelter for denning species such as Northern quoll. Unlike the Hillcrest/ hillslope habitat this habitat does not typically surround deep gorges or gullies or the rocky breakaway habitat such as that found within the Warrawoona Ranges.	The hills and rises habitat Is distributed across the Pilbara region typically as foothills or lower slopes of the Hillcrest/ hillslope habitat or isolated hills/rises within the stony plain habitat. The Hills and rises habitat is not restricted to the survey area and is represented in conservation estate.	 **Site S19-ET03**

Habitat	Description	Extent	Photos
Hillcrest/Hillslope Potential Conservation Significance Species ▪ Ghost bat (foraging/ dispersal) ▪ Northern quoll (foraging/ dispersal) ▪ Pilbara leaf-nosed bat (foraging/ dispersal) ▪ Western pebble-mound mouse (breeding/ shelter, foraging/ dispersal) ▪ Long-tailed dunnart (breeding, foraging/ dispersal) ▪ Potential Ctenotus uber johnstonei habitat Area : 4 hectares Percentage of survey area: 1 % **Significance: Moderate**	Hillcrest/Hillslope habitat is dominated by varying species of *Triodia* with scattered Eucalypts. Typically, rocky substrate, often with exposed bedrock, and skeletal red soils. This habitat typically does not contain the extensive cracks and crevices of the rocky breakaway habitat.	This habitat corresponds to the slopes of the Warrawoona Range that occurs at the southern end of the survey area. This habitat is broadly represented across the Pilbara region in areas of topography typically the slopes and crests of hills that contain gorges and gullies. This habitat type is represented in conservation estate	 **Site S30-ET13**

4. ASSESSMENT AGAINST CLEARING PRINCIPLES

The proposed clearing of 30.07 ha has been assessed against the ten clearing principles, as provided in Schedule 5 of the EP Act. This assessment is presented Table 7.

Table 7. Assessment against the EP Act's Ten Clearing Principles (Rapallo 2021)

Principle (a) Native vegetation should not be cleared if it comprises a high level of biological diversity	
Assessment	The reconnaissance flora and vegetation survey of the Big Schist pipeline corridor recorded 125 flora taxa from 30 different families. These included 120 native taxa and 5 introduced taxa (weeds). The most well-represented families were Fabaceae (32 taxa), Poaceae (23 taxa) and Malvaceae (9 taxa) (Rapallo 2021a). The vegetation of the corridor comprises a variation of spinifex (*Triodia* spp.) grasslands, mostly on stony or sandy/loam plains or on stony hills and rises, with an overstorey of mixed shrubs and low trees dominated by *Acacia inaequilatera*, *Grevillea wickhamii*, *Grevillea pyramidalis*, and *Corymbia hamersleyana*. Major, medium, and minor creek lines intersect the plains, with the major and medium creek lines supporting a variety of groundwater dependent flora species (Rapallo 2021a). The vegetation of the corridor is not highly diverse with a total of seven vegetation types that are known and can be expected to occur outside of the corridor (Rapallo 2021a). The Pilbara bioregion is not known for a high level of biological diversity, in terms of flora and vegetation in comparison to other parts of Western Australia such as the northern sandplains region in the vicinity of Eneabba.
Outcome	The proposed clearing is not at variance with this principle.
Principle (b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary or the maintenance of, a significant habitat for fauna indigenous to Western Australia	
Assessment	Fauna habitat loss as a direct result of land clearing is a primary impact on terrestrial fauna. Clearing for the pipeline will be low impact and restricted to a narrow corridor, potentially affecting seven broad fauna habitats. All habitats are represented outside of the corridor, throughout the region and in conservation estate. Of the seven broad fauna habitats recorded within the corridor, the Major Drainage habitat and Sandy/Loam Plain habitat are ranked as “High” significance for vertebrate fauna due to the potential to provide core habitat for species of conservation significance. The remainder are of “Moderate” significance, either due to the possibility of foraging/dispersal habitat, or habitats primarily supporting priority or migratory species (Rapallo 2021a). Sandy/Loam Plain Habitat The Sandy/Loam Plain habitat was assessed as “High” significance due to the potential for Greater bilby and Brush-tailed mulgara breeding, foraging and dispersal habitat. The Greater bilby is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and *Biodiversity Conservation Act* 2016 (BC Act). The Brush-tailed mulgara is listed as Priority 4 by the Department of Biodiversity, Conservation and Attractions (DBCA). Both species are rated as “Highly Likely” to occur on the corridor (Rapallo 2021a).

	There are Greater bilby records proximal to the corridor from 2014 in the DBCA threatened species database, however the database does not indicate type of record or source (DBCA 2020). No evidence of Greater bilby was recorded during the current survey; nor was the species detected via targeted searches for the Warrawoona Gold Project (Biologic 2019). Greater bilbies are recorded as having low site fidelity and high mobility (Southgate *et al.* 2007); males regularly move three to five kilometres between burrows on consecutive days; and have been recorded moving up to 15 km in a few weeks (Southgate & Possingham 1995). Brush-tailed mulgara has been recorded from the Sandy Plain habitat of the Warrawoona Gold Project (Biologic 2019). Mulgara can use multiple burrow systems within a home-range and changing these frequently (Körtner *et al.* 2008). Sandy/Loam Plain habitat provides breeding, shelter, foraging, dispersal habitat for the Spectacled hare-wallaby (DBCA Priority 4) and supporting habitat (dispersal and foraging habitat) for Grey falcon (Vulnerable under the BC Act and EPBC Act), Pilbara leaf-nosed bat, and Ghost bat (both listed as vulnerable under the EPBC Act and BC Act). Sandy/Loam Plain habitat contains some suitable areas of habitat for the Night parrot listed as Endangered under the BC Act and EPBC Act. Night parrot was not recorded on the corridor via acoustic recorder) (Rapallo 2021a). Local populations of Greater bilby and Brush-tailed mulgara may be temporarily impacted by clearing of any active burrows. Clearing activities will be managed to avoid burrows to minimise impacts to such species. Neither Greater bilby nor Brush-tailed mulgara would be restricted to the Sandy/Loam Plain habitat of the corridor. A total of 63 ha of the corridor (23%) comprises Sandy/Loam Plain habitat and a substantial amount of Sand Plain habitat is known to occur outside the corridor to the south of the Warrawoona Gold Project (Biologic 2019). The habitat type is widespread in the broader landscape, and not restricted to the corridor (Rapallo 2021a; Biologic 2019). Fauna occurring in the region are therefore unlikely to be substantially impacted by the proposal, from a regional perspective. Major Drainage Habitat The Major Drainage habitat provides a range of microhabitats and a stable source of food and water, within vast landscape of relatively resource-poor spinifex plains (How *et al.* 1991; Rapallo 2021a). More specifically, nectivorous avifauna benefit from the flowering plants and hollow-nesting species make use of the large eucalypts that line the banks (Burbidge *et al.* 2010)). Mammal, reptile and amphibian fauna may also congregate around permanent water pools (How *et al.* 1991). Due to the widespread availability of microhabitats, such as leaf litter accumulations, large trees, hollows, and semi-permanent/permanent water sources, the Major Drainage habitat provides foraging and dispersal habitat for Northern quoll, Pilbara leaf-nosed bat, Pilbara olive python, Peregrine falcon, Northern brushtail possum and potentially where there is sufficient moisture: Gane's blind snake. Grey falcon may utilise the Major Drainage habitat for nesting and foraging (Rapallo 2021a). Until habitat preferences are further defined for Ghost bat it is assumed that the Major Drainage habitat is also utilised in some capacity by Ghost bat (Rapallo 2021a). Northern quoll is listed as Endangered under the EPBC act and the BC Act Pilbara leaf-nosed bat is listed as Vulnerable under the EPBC Act and BC Act Ghost bat is listed as Vulnerable under the EPBC Act and BC Act Grey falcon is listed as Vulnerable under the BC Act Pilbara olive python is listed as Vulnerable under the EPBC Act and BC Act

	Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act Northern Brushtail Possum is listed as Vulnerable under the BC Act Gane's blind snake (DBCA Priority 1) Migratory bird species can use drainage systems as conduits for movement throughout an otherwise arid landscape (Storr 1984, Bamford *et al.* 2008). Due to lack of permanent pools and large artificial water bodies there is limited habitat for migratory birds within the Major Drainage habitat of the Big Schist corridor. Migratory species assessed as "Possible infrequent visitors" on the corridor include: Common greenshank Wood sandpiper Glossy ibis Oriental plover Local populations of Northern quoll, Pilbara leaf-nosed bat, Pilbara olive python, Peregrine falcon, Northern brushtail possum, Gane's blind snake and Grey Falcon are not anticipated to be impacted by the clearing of a narrow corridor of Major Drainage habitat beyond temporary displacement and direct short-term impact from machinery because this habitat does not contain critical or preferred breeding habitat for the majority of these species. Northern quoll, Pilbara olive python and Peregrine falcon breeding habitat is located within the Rocky breakaway habitat of the Warrawoona Gold Project and within ridge lines to the north east and will not be impacted by the proposal. The Rocky breakaway habitat is extensive and predominately intact with only 0.8 ha of this habitat approved for clearance within the Warrawoona Gold Project (EPBC 2019/8584). Both Gane's blind snake and the Northern Brushtail Possum have a patchy distribution and are infrequently recorded (Rapallo 2021a). The Pilbara leaf-nosed bat will potentially forage over most habitats within the corridor with Major Drainage containing most significant foraging habitats due to the small creek line pool and turkeys nest dam at the northern extent of the corridor. However, it is noted that there are other permanent pools and much larger artificial water bodies within the creek lines of the region (Rapallo 2021b). Pilbara leaf-nosed bat breeding habitat is located within the old workings proximal to the Warrawoona Gold project and will not be impacted by the proposal. Ghost bat breeding habitat is located within the old workings proximal to the Warrawoona Gold project and will not be impacted by the proposal. Ghost bat will potentially forage over most habitats of the corridor (Rapallo 2021a). The Grey falcon uses Major Drainage habitats for breeding; however it is noted that this habitat is not restricted to the corridor and the species has not been recorded nesting on the corridor to date. A total of 9 ha of the corridor (3%) comprises Major Drainage habitat. The habitat type is widespread in the broader landscape, and the affected areas are contiguous with surrounding occurrences of Major Drainage habitat (Rapallo 2021a). Fauna occurring within this habitat type are therefore unlikely to be substantially impacted by the proposal. Minor Drainage and Medium Drainage provides potential dispersal and foraging habitat for Pilbara olive python , Ghost bat, Pilbara Leaf-nosed bat, Peregrine falcon, Grey Falcon, Oriental plover (Migratory BC/EPBC Act) and, where there is sufficient moisture, also for Gane's blind snake (Rapallo 2021a). Hillcrest/ Hillslope and Hills and Rises habitat provides supporting habitat (dispersal and foraging habitat) for Ghost bat, Pilbara Leaf-nosed bat and Northern quoll and breeding, shelter, foraging, dispersal habitat for the Long-tailed dunnart (DBCA Priority 4) and

	Western Pebble-mound mouse (DBCA Priority 4). Hillcrest/ Hillslope and Hills and Rises habitat contains potential habitat for *Ctenotus uber johnstonei* (DBCA Priority 2) (Rapallo 2021a). Stony Plain, the dominant habitat within the corridor (113 ha, 42%) provides breeding, shelter, foraging, and dispersal habitat for the priority listed Western Pebble-mound mouse and Spectacled hare-wallaby and supporting habitat (dispersal and foraging habitat) for Grey falcon, Pilbara leaf-nosed bat, and Ghost bat. Stony Plain provides potential *Ctenotus nigrilineatus* habitat (Rapallo 2021a). Stony Plain contains some suitable areas of habitat for the Night parrot listed as Endangered under the BC Act and EPBC Act. Acoustic recorders placed on the corridor did not detect the Night parrot (Rapallo 2021a). Given that the habitats are represented outside of the corridor, throughout the region and in conservation estate, and primarily represent foraging and dispersal habitat of listed threatened species rather than breeding habitat of listed threatened species of high site fidelity; with management, clearing within the corridor is unlikely to be at variance to this clearing principle. Management will include clearing protocols as per Warrawoona Gold Project Environmental Procedures and internal preclearance surveys (Greater bilby and Brush-tailed mulgara) as per the Calidus Significant Species Management Plan referred to in Ministerial Statement 1150.
Outcome	The proposed clearing is not at variance with this principle.
Principle (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	
Assessment	No threatened flora, listed under the EPBC Act or BC Act, have been recorded from the Big Schist pipeline corridor (Rapallo 2021a). None of the threatened flora species listed for the Pilbara are expected to occur within the corridor, due to a lack of suitable habitat and/or a distribution that does not overlap with the corridor. Although not recorded on the corridor four species were assessed as “Highly Likely” to occur on the corridor. These were *Eragrostis crateriformis* (DBCA Priority 3), *Heliotropium murinum* (DBCA Priority 3*), Euphorbia clementii* (DBCA Priority 3), *Ptilotus mollis* (DBCA Priority 4) (Rapallo 2021a). *Eragrostis crateriformis* (DBCA Priority 3) occurs throughout the Warrawoona Gold Project, recorded from minor drainage lines and sheet flow areas of red sandy clay (Woodman 2020) and stony plain habitat (Rapallo 2021). This ephemeral grass occurs over a range of approximately 1,370 km in Western Australia, from near Onslow in the west to near Balgo Hills in the Tanami Desert in the east. It also occurs in the Northern Territory. There are 51 records of this taxon in Western Australia, representing approximately 30 populations. Three of these populations occur in the DBCA managed Millstream-Chichester National Park and DBCA managed Ex Meentheena Station (Woodman 2020, ALA 2021, Western Australian Herbarium 2021,DBCA 2020b). *Eragrostis crateriformis* is not restricted to the habitats of the corridor and removal of individual plants would not alter the local or regional conservation status of this species should the pipeline corridor be unable to avoid individuals. *Heliotropium murinum* (DBCA Priority 3), grows on red sand, plains, or brown light clay or sand over ironstone. *Heliotropium murinum* occurs within the Warrawoona Gold Project and has been recorded from other nearby localities (Woodman 2020, (Rapallo 2021a). The species occurs over a range of approximately 150 km from Woodstock Reserve in the west to DBCA managed Ex Meentheena Station in the east. There are 17 location records of this taxon in Western Australia representing approximately 12 populations (including the

	records from the Warrawoona Gold Project). One population occurs in the DBCA-managed Ex Meentheena Station (Woodman 2020, ALA 2021, Western Australian Herbarium 2021,DBCA 2020b). *Heliotropium murinum* is locally common with 890 plants recorded from 160 point locations within the Warrawoona Gold Project (Woodman 2020). *Heliotropium murinum* is not restricted to the habitats of the corridor, and removal of individual plants will not alter the local or regional conservation status of this species should the pipeline infrastructure be unable to avoid individuals. *Euphorbia clementii* (DBCA Priority 3), grows on gravelly hillsides, stony grounds, and along drainage lines on red, orange sandy loams, or stony areas. The species occurs within the Warrawoona Gold Project and has been recorded from other nearby localities (Woodman 2020, (Rapallo 2021a). This taxon is endemic to Western Australia with the main range of its distribution extending over 190 km from Wodgina in the west to northeast of Marble Bar. There are 35 location records of *Euphorbia clementii* in Western Australia representing approximately 18 populations, none of which occur in DBCA-managed tenure (Woodman 2020, ALA 2021, Western Australian Herbarium 2021,DBCA 2020b). *Euphorbia clementii* was recorded from a long unburnt stony undulating plain of red-brown sandy clay loam on the Warrawoona Gold Project . (Woodman 2020) found this habitat to be atypical for the species as this taxon is typically a fire-responder (and relatively short-lived) but may germinate in response to physical disturbance. Woodman (2020) hypothesised that the record on the Warrawoona Gold Project may have been transported, given the nearby historical disturbance evident in aerial photography and long unburnt nature of the vegetation. The taxon was not observed in more recently burnt areas of typical habitat (sandy or stony plains) (Woodman 2020). *Euphorbia clementii* was not recorded on the recently burnt areas or disturbed areas of the corridor where if present it would have been readily identifiable as it typically occurs in large numbers (Woodman 2020). *Euphorbia clementii* is not restricted to the habitats of the corridor, and removal of individual plants will not alter the local or regional conservation status of this species should the pipeline infrastructure be unable to avoid individuals. *Ptilotus mollis*(DBCA Priority 4) grows on stony hills and screes. The species occurs within the Warrawoona Gold Project on rocky hill tops and slopes of the main range (consisting of granite, chert and mafic schist) or smaller outcroppings of mafic schist immediately adjacent to the main range (to the south) and has been recorded from other nearby localities (Woodman 2020, Rapallo 2021a). *Ptilotus mollis* is endemic to Western Australia occurring over a range of approximately 640 km from Cane River Conservation Park in the west (65 km south-west of Pannawonica) to near Karlamilyi National Park in the east (270 km south-east of Marble Bar). There are 39 location records of this taxon in Western Australia, representing approximately 28 populations (including the records from the Warrawoona Gold Project). Three of these populations occur within DBCA conservation estate, Cane River Conservation Park and Karijini National Park (Woodman 2020, ALA 2021, Western Australian Herbarium 2021,DBCA 2020b). *Ptilotus mollis* is locally common (2534 plants have been recorded from 350 locations within the Warrawoona Gold Project) (Woodman 2020) , and removal of individual plants will not alter the local or regional conservation status of this species should the pipeline infrastructure be unable to avoid individuals. Two species were assessed as “Likely” to occur on the survey area *Josephinia sp.* Woodstock (A.A. Mitchell PRP 989) (DBCA Priority 1)*, Heliotropium muticum* (DBCA Priority 3) (Rapallo 2021a).

	Josephinia sp. Woodstock (DBCA Priority 1) grows on sheet flow or drainage lines, on red sandy (granitic) plains. This taxon is known from seven records across four localities (Ashburton, Chichester, Fortescue and Hamersley IBRA sub-regions) and is not currently known from any DBCA-managed conservation reserves (Woodman 2020, ALA 2021, Western Australian Herbarium 2021,DBCA 2020b). The species has been recorded from the Warrawoona Gold Project from a loamy minor drainage line and despite a comprehensive targeted survey of all potential habitat on the Warrawoona Gold Project, no additional locations have been recorded and the original plant recorded in 2019 could not be relocated despite intensive grid searching of the known location at 5 metre intervals (Woodman 2020). *Josephinia* sp. Woodstock, although rarely recorded is not restricted to the habitats of the corridor, and removal of individual plants would not alter the local or regional conservation status of this species should the pipeline infrastructure be unable to avoid individuals. *Heliotropium muticum* (DBCA - Priority 3) grows on flat terrain, low in the landscape, flood plains and sand plains. Soil types where this species has been recorded included (very gritty) skeletal red brown granitic soil, clay loams, and sand. The species is endemic to the Pilbara and occurs between Port Hedland/Wickham south to Coonarrie Creek and west to Marble Bar (Western Australian Herbarium 1998, Woodman Environmental 2020, Atlas of Living Australia 2021),DBCA 2020b). *Heliotropium muticum* growth is triggered by fire with an estimated population of approximately 1,300 to 2,500 individuals at Pilgangoora (MMWC 2016) and 20 individuals located at North Star (Ecologia 2012). *Heliotropium muticum* is not restricted to the habitats of the corridor, and removal of individual plants would not alter the local or regional conservation status of this species should the pipeline infrastructure be unable to avoid individuals. No flora listed as threatened flora, under the EPBC Act or BC Act will be impacted by clearing for the corridor. Based on habitat, and local records, clearing within the corridor does have the potential to impact several priority taxa however none of these species are recognised as threatened, nor are they restricted to the local area or the region. Given the narrow clearing parcel required for a pipeline, and that much of the clearing involves upgrading existing tracks rather than the establishment of new tracks, clearing activities will not result in the complete loss of these taxa from the local area, and will not impact regional populations.
Outcome	The proposed clearing is not at variance with this Principle.
Principle (d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	
Assessment	Search results of DBCA Threatened and Priority Ecological Community (TEC/PEC) database search (DBCA 2020b) indicates that no TECs are known to occur within or near the corridor. Rapallo (2021a) found no known locations of listed significant vegetation, as listed by the AWE (EPBC Act) or otherwise listed by the DBCA, occurring within 40 km of the corridor (DBCA 2020a; AWE 2020). Only two TECs are known from the *Pilbara* Region (TEC 46 - Themeda Grasslands and TEC 78 Ethel Gorge Aquifer Stygobiont Community DBCA 2018c). Both TECs are associated with the Hamersley Range area, and therefore it is highly unlikely that either of these TECs would occur within the corridor. A review of the published TEC and PEC listings for Western Australia (DBCA 2020a); DBCA 2018c) against the descriptions of the vegetation types in Rapallo (2021a) identified no vegetation types in the corridor representing listed TECs or PECs as listed by DBCA or the AWE.

Outcome	The proposed clearing is not at variance with this Principle.
Principle (e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	
Assessment	Review of the DBCA State-Wide Vegetation Statistics data (DBCA 2018c) showed that all three vegetation system-associations intersected by the survey area (Abydos Plain 93, George Ranges 82, and George Ranges 587) still have more than 99% of their original extent remaining (DBCA 2018d) and would be considered 'least concern' (DER 2014). The corridor is located outside of the 'agricultural area' (Intensive Land Use zone) where remnant vegetation has been extensively cleared DBCA 2018d). The corridor is not located within an significant remnant of native vegetation in an area which has been extensively cleared.
Outcome	The proposed clearing is not at variance with this Principle.
Principle (f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	
Assessment	The corridor crosses tributaries of the Coongan River in five locations. The pipeline corridor design will pass flows across the roadway by means of floodways, culverts or a combination of both to reduce risk of crossing flooding and minimise the time the corridor will be out of commission during a flood event. The presence of these floodways / culverts will ensure that there are minimal impacts to the upstream and downstream flow regimes of these drainage lines. If channel capacities are exceeded, short-term ponding may occur over the corridor with potential scour and road degradation. During a large rainfall event, the background mobilisation of natural sediments in the catchments is expected to be significant, and any increase in sediment loads from the erosion of the corridor would likely be minor in comparison. With management clearing within the corridor is unlikely to alter the hydrological and ecological values of the Coongan River tributaries and ultimately the Coongan River.
Outcome	The proposed clearing is unlikely to be at variance with this Principle.
Principle (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	

Assessment	Because the topography of the corridor is generally flat for much of its length and given much of the clearing involves upgrade to existing tracks, significant land degradation is unlikely to occur. The Macroy, Talga, Granitic, Boolgeeda, Capricorn, and Rocklea land systems are not particularly prone to degradation or erosion. The creeks that the corridor crosses are typically gravelly rather than sandy banked and do not fall within the River land system that is susceptibility to erosion is high or very high if vegetative cover is removed (Van Vreeswyk *et al.* 2004). it is considered that erosion can be managed through appropriate engineering controls and progressive rehabilitation, and appreciable land degradation from clearing for a pipeline is unlikely to occur if such measures are undertaken. There is potential for clearing to result in the establishment and or spread of weeds. Given the extent to which weeds have established in the Pilbara, especially along drainage lines, existing weeds within the corridor and the current pastoral land use, eradication of existing weeds within the corridor is not a feasible option. Effort will be focussed on preventing the establishment of previously unrecorded weeds and reducing the spread of existing weeds as per Warrawoona Gold Project Environmental Procedures.
Outcome	With management, the proposal is unlikely to be at variance with this principle.
Principle (h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	
Assessment	The corridor is located on Eginbah Pastoral lease and unallocated crown land. No conservation areas are located in the immediate vicinity of the corridor.
Outcome	The proposed clearing is not at variance with this Principle.
Principle (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	
Assessment	The creek lines that intersect the Big Schist pipeline are shallow and contain primarily facultative phreatophytic taxa, with only one obligate phreatophyte (*Melaleuca argentea*) recorded. The one pool within Minor Drainage observed in March 2021 after significant summer rainfall was small and unlikely to be permanent. Provided that clearing within creek lines is managed and minimised via the Warrawoona Gold Project Environmental Procedures, clearing of vegetation for a pipeline will not impact the quality of surface or underground water greater than the impacts currently experienced from cattle grazing . There is a low potential for minor impacts to the quality of surface water as a result of sedimentation or the release of hydrocarbons during pipeline construction. However, the likelihood of this occurring and the significance of this impact can be managed utilising the controls and management measures in place via the Warrawoona Gold Project Environmental Procedures.
Outcome	The proposed clearing is not at variance with this Principle.

Principle (j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	
Assessment	The creeks flow intermittently following periods of intense rainfall. Clearing within the corridor would not be expected to cause or increase the frequency or intensity of flooding.
Outcome	The proposed clearing is not at variance with this Principle.

5. RISK ASSESSMENT

5.1. Approach

A risk assessment of the application area has been undertaken of the potential environmental impacts within the application area. The risk assessment approach is based on guidance developed by the Department of Environment Regulation's (DER) *Risk Assessments Part V Division 3 EP Act* (DER 2017), which uses a consequence and likelihood rating system to determine the most appropriate risk rating for each impact. Details of the risk assessment approach are discussed below.

5.1.1. Consequence

Consequence refers to an environmental outcome or impact arising from a risk event occurring. An assessment of consequence will indicate the seriousness of a risk event, which may be expressed in terms of environmental implications (Table 8).

Table 8. Consequence Risk Criteria

Consequence levels	Potential consequences/impacts
Severe	• on-site impacts: catastrophic • off-site impacts local scale: high level or above • off-site impacts wider scale: mid-level or above • Mid to long term or permanent impact to an area of high conservation value or special significance • Specific Consequence Criteria (for environment) are significantly exceeded
Major	• on-site impacts: high level • off-site impacts local scale: mid-level • off-site impacts wider scale: low level • Short term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded

Moderate	• on-site impacts: mid-level • off-site impacts local scale: low level • off-site impacts wider scale: minimal • Specific Consequence Criteria (for environment) are at risk of not being met
Minor	• on-site impacts: low level • off-site impacts local scale: minimal • off-site impacts wider scale: not detectable • Specific Consequence Criteria (for environment) likely to be met
Slight	• on-site impact: minimal • Specific Consequence Criteria (for environment) met

Source: DER (2017)

5.1.2. Likelihood

Likelihood refers to the probability of an environmental risk event occurring. Risks that have a higher likelihood (i.e. frequent occurrences) have a greater chance of an environmental impact occurring (Table 9).

Table 9. Likelihood rankings

Likelihood levels	Frequency of risk events
Almost certain	The risk event is expected to occur in most circumstances
Likely	The risk event will probably occur in most circumstances
Possible	The risk event could occur at some time
Unlikely	The risk event will probably not occur in most circumstances

Rare	The risk event may only occur in exceptional circumstances

Source: DER (2017)

5.1.3. Risk rating determination

The risk rating is determined for a particular risk by combining the consequence level with the likelihood level (Table 10). The results of the risk evaluation process are summarised in a risk matrix table, noting that the main feature is to divide the matrix table into four ratings of risk classifications are:

- Extreme risks: Unacceptable. Risk event will not be tolerated. DWER may refuse application
- High risks: May be acceptable. Subject to multiple regulatory controls. Risk event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
- Medium risk: Acceptable, generally subject to regulatory controls. Risk event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
- Low risk: Acceptable, generally not controlled. Risk event is acceptable and will generally not be subject to regulatory controls.

Table 10. Risk rating matrix

		Consequence				
		Slight	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood	**Almost certain**	Medium	High	High	Extreme	Extreme
	Likely	Medium	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	Extreme
	Unlikely	Low	Medium	Medium	Medium	High
	Rare	Low	Low	Medium	Medium	High

Source: DER (2017)

5.2. Potential Impacts

The potential environmental impacts are based on the preliminary environmental factors assigned to the broader Warrawoona Gold Project as determined by the EPA (Decision to Assess the Proposal, 23 December 2019, EPA Assessment Reference No. 2229). The Four key environmental factors, as identified by the EPA in their referral determination are:

- Flora and Vegetation
- Terrestrial Fauna
- Inland Waters; and
- Subterranean Fauna

This section provides an impact assessment of this NVCP application for each of these key preliminary factors. The potential direct and indirect impacts for each of these key preliminary factors is summarised in Table 11.

Table 11. Potential impacts

Impact type	Potential Impact	Description/ causing factor
Terrestrial Fauna		
Direct	Habitat loss	Direct loss of fauna habitat due to land clearing
Indirect	Habitat fragmentation	Habitat fragmentation from the establishment of infrastructure such as roads and utility corridors can restrict animal movements.
	Death or injury to individuals	Death or injury to individuals as a result of interactions with vehicles, infrastructure, machinery, and the workforce.
	Reduced habitat quality	Habitat modification and reduced habitat quality resulting from an increase in weeds may degrade the condition and resilience of local vegetation.
	Increased predation and competition	Increased predation and competition from introduced species as a result of new road corridors, and generation of food/water resources.

	Altered behaviour	Altered behaviour of native populations and/or individuals may occur as a result of dust emissions, artificial light, or water storage facilities
	Altered fire regimes	Altered fire regimes (e.g., increased frequency, intensity, extent) through uncontrolled or unintentional fires as a result of increased human activity in the area, has the potential to modify, degrade or remove fauna habitat or individuals.
Flora and vegetation		
Direct impacts	Loss of native flora.	Direct loss of conservation significant native flora.
	Vegetation removal	Direct loss of conservation significant vegetation or ecological communities
Indirect impacts	Downstream disturbance	Downstream disturbance/impact to wetlands and/or watercourses
	Reduction in remnant extent	Reduction in overall remnant vegetation extent
	Land degradation	Land degradation and reduction in environmental value of the local area
Inland waters		
Indirect	Loss of catchment area	Loss of catchment area
	Altered water flow	Altered surface water flow downstream
	Contamination	Groundwater and surface water contamination
Subterranean Fauna		
Indirect	Contamination	Groundwater and surface water contamination

5.3. Risk assessment and rating

Overall, the risk assessment process identified 16 potential impacts, 11 rated as Medium and five rated as Low (Table 12). No high or extreme risks were identified. These risks are all considered acceptable, with some level of regulatory control depending on the potential impact.

Table 12. Risk assessment and rating

Ref	Potential Impact	Assessment, mitigation, and comments	Consequence	Likelihood	Risk rating
Terrestrial Fauna					
1	Direct loss of habitat for conservation significant fauna species	Approximately 6.92 ha of high significance Sand/Loam Plain habitat will be disturbed. Sandplain habitat is known to support Brush-tailed Mulgara, and potentially Night Parrot and Greater Bilby (not confirmed from site). Approximately 0.90 ha of high significance Major drainage habitat will be disturbed. Major drainage is known to support foraging activities of the Ghost bat, Pilbara leaf nosed bat and Pilbara olive python. Approximately 22.25 ha of moderate significance habitat will be disturbed, including: • Stony Plain - potential habitat for the Spectacled Hare-Wallaby and Western Pebble-mound Mouse and some suitable areas of potential habitat for the Night Parrot (12.93 ha). • Hill and Rises – potential foraging area for the Ghost bat, Pilbara leaf nosed bat and Western Pebble-mound mouse (5.41 ha) Existing pastoral tracks will be used, where available, thus minimising new disturbance.	Minor	Likely	Medium

2	Habitat fragmentation from the establishment of infrastructure such as roads and utility corridors can restrict animal movements.	The pipeline and associated road plans to establish an infrastructure corridor of approximately 25 km. The majority of which is within moderate significance habitat type (74%). Most species assessed are known to cross road corridors to access habitat. Road corridor does not intersect or lie between core habitat and so movement between habitats on either side of the corridor may be limited. Vast majority of the pipeline and road will be placed along existing pastoral tracks.	Minor	Possible	Medium
3	Death or injury to individuals as a result of interactions with vehicles, infrastructure, machinery and the workforce.	The construction activities will occur during daylight hours and vehicle movement at night will be limited. Many of the species assessed are known to be comfortable crossing roads and corridors. Some species are more susceptible (i.e. Pilbara Olive Python is known to lay still in response to vehicle vibration) than others (i.e. small rodents).	Moderate	Possible	Medium

Ref	Potential Impact	Assessment, mitigation and comments	Consequence	Likelihood	Risk rating
		Individual deaths can affect some very small local populations (i.e. Bilby – although not confirmed from local surveys it may potentially occur), however other species have high fecundity and boom-bust life modes and can easily recover from individual deaths (i.e. Western Pebble-mound Mouse).			

		The road corridor does not intersect (or lie between) core habitat for conservation significant species and so movement between habitats and via road crossings may be limited. Speed restrictions and hours of operation will apply. Site personnel will be made aware of this issue through inductions and fauna management procedures.			
4	Habitat modification and reduced habitat quality resulting from an increase in weeds may degrade the condition and resilience of local vegetation.	Cleared areas will not be left undeveloped for long, rather, areas will be developed (road or camp construction) soon after clearing. No introduced taxa listed as Weeds of National Significance (as listed under AWC 2019 and four introduced taxa. Hygiene management and weed control procedures will be implemented	Minor	Unlikely	Medium
5	Increased predation and competition from introduced species as a result of new road corridors, and generation of food/water resources.	Feral predators have already been recorded on site, in part due to existing (historic) mining tracks and disturbance workings across the local area. Camp waste hygiene practices will be implemented, and site personnel will be made aware of feral animals and be required to avoid and report any interactions via inductions and fauna management procedures. Feral animal control measures will be implemented opportunistically.	Moderate	Possible	Medium

6	Altered behaviour of native populations and/or individuals may occur as a result of dust emissions, artificial light or water/waste storage facilities	Some native animals are known to reside or frequent mine camps and infrastructure if resources (i.e. water, waste food, shelter etc) are available to them. Dust impacts will be limited as small clearing areas will be developed immediately and dust management procedures will be implemented. Light design will consider light impacts towards the Warrawoona Range (for potential light impacts on bats). Activities will not occur during night hours so prolonged and intense lighting will not be required.	Minor	Possible	Medium

Ref	Potential Impact	Assessment, mitigation and comments	Consequence	Likelihood	Risk rating
		Site personnel will be made aware of animal interaction issues via fauna management procedures and inductions.			
7	Altered fire regimes through uncontrolled or unintentional fires as a result of increased human activity.	Fire is a regular occurrence in the Pilbara, predominantly as a result planned controlled burning activities or unplanned events such as lightning storms. Site personnel will be inducted in fire management procedures to prevent fires from starting within the application area and to control and contain unplanned and unintentional fires in and around the application area to avoid fie spread.	Moderate	Unlikely	Medium
Vegetation and Flora					

8	Direct loss of conservation significant native flora.	No Threatened flora, listed under the EPBC Act or BC Act, will be impacted in the application area	Minor	Likely	Medium
9	Direct loss of conservation significant vegetation or ecological communities	The proposed clearing footprint comprises approximately 30.07 ha of native vegetation. No State or Commonwealth listed Threatened Ecological Communities (TECs) occur within the proposed area. No DBCA listed priority Ecological Communities (PECs) were inferred by Rapallo (2021). Seven vegetation types occur within the applications area, all of which are widespread throughout the Pilbara region.	Minor	Likely	Medium
10	Downstream disturbance/impact	There are no Nationally Important Wetlands or RAMSAR wetlands located within the application area, with the closest National Important Wetland, the De Grey River, located approximately 70km to the north of the application area (DoEE 2018).	Moderate	Rare	Low

Ref	Potential Impact	Assessment, mitigation and comments	Consequence	Likelihood	Risk rating

	to wetlands and/or watercourses	There are no permanent pools in the vicinity for the proposed development. There are some minor ephemeral outwash plains and drainage lines within the application area.			
11	Reduction in overall remnant vegetation extent	Disturbance will occur over a very small footprint (30.07ha). The proposed clearing footprint occurs within a large contiguous of remnant vegetation. This NVCP application is represented by three vegetation associations (Abydos Plain 93, George Ranges 82 and George Ranges 587) (Table 5), all of which occur over very large areas of the Pilbara (432,038ha, 316,855 and 103,452 ha respectively) and have been subject to very limited clearing (less than 1 %) since European settlement.	Moderate	Unlikely	Medium
12	Land degradation and reduction in environmental value of the local area	Cleared areas will not be left undeveloped for long, rather, areas will be developed (road or camp construction) soon after clearing. Dust management and topsoil stockpile management procedures will be implemented. Infrastructure will be engineered to manage surface water flows and consider and implement water erosion measures in all surface water design. No introduced taxa listed as Weeds of National Significance (as listed under AWC 2019) and four introduced taxa were found. Hygiene management and weed control procedures will be implemented	Minor	Unlikely	Medium
Inland Waters					

13	Loss of catchment area	The proposed development is located within the Coongan River Catchment (7,080km^2). Based on soil, habitat and vegetation mapping within the application area, approximately 3.1ha of the application area that will be cleared is represented by either minor or medium drainage lines or outwash plains, within the 7,080km^2 Coongan River Catchment. The total area of disturbance (approximately 30.07ha) represents 0.004% of the total Coongan River Catchment area.	Slight	Possible	Low

Ref	Potential Impact	Assessment, mitigation and comments	Consequence	Likelihood	Risk rating
14	Altered surface water flow downstream	The proposed development crosses over several outwash plains and minor drainage lines. The pipeline will be buried in these locations so as not to inhibit surface water flows. The proposed development is located the broader Coongan River Catchment (7,080km^2). The total area of disturbance (approximately 30.07ha) represents 0.004% of the total Coongan River Catchment area. Tropical cyclones in the Pilbara occur relatively frequently and are therefore considered in the design of infrastructure and surface water management measures throughout all developments in the region.	Slight	Unlikely	Low
15	Groundwater and surface water contamination	Best practice Hydrocarbon management and handling procedures will be implemented.	Slight	Unlikely	Low
Subterranean Fauna					

16	Groundwater and surface water contamination	Best practice Hydrocarbon management and handling procedures will be implemented.	Slight	Unlikely	Low

6. ENVIRONMENTAL MANAGMENT

6.1. Management Approach

Calidus has developed a number of procedures to help manage and mitigate potential impacts from the broader WGP. Procedures most relevant to managing impacts resulting from this NVCP application are summarised in Table 13 and key actions from these procedures is further provided in the following section (Section 6.2, Key Management Actions).

Table 13. Key environmental management documentation relevant to terrestrial fauna

Environmental Management Document	Calidus Reference
Environmental Management	
Environmental Management Standard	CRL-ENV-STA-001-19
Fauna management	
Significant Species Management Plan	CRL-ENV-PLN-006-19
Fauna Management Procedure	CRL-ENV-PRO-007-19
Introduced Fauna Control Procedure	CRL-ENV-PRO-009-19
Ground Disturbance Permit Procedure	CRL-ENV-PRO-002-19
Water Management	
Surface Water Monitoring Procedure	CRL-ENV-PRO-020-19
Groundwater Monitoring Procedure	CRL-ENV-PRO-021-19

6.2. Key Management Actions

6.2.1. Avoid harm to individuals through fauna protection measures

- Include fauna protection specifications in all construction related contracts and sub-contracts, including no barbed wire fencing at the project area and measures to prevent accidental entrapment of fauna such as the Northern Quoll
- Induct workforce on fauna identification and encounter (including physical interaction, littering, feeding, approaching and unexpected encounters) and educate the mine site personnel about the fauna of conservation significance within the project area.
- During construction, any trenches that remain open overnight must follow trench management procedures, including a provision for ramps to assist trapped fauna and to relocate trapped fauna unable to escape (using trained fauna handlers).

6.2.2. Adaptive monitoring and management measures

- Implement the Significant Species Management Plan (CRL-ENV-PLN-006-19), which contains specific management and monitoring targets for fauna of conservation significance, to be reviewed on a regular basis. Key monitoring components of the Significant Species Management Plan include:
    - Significant bats. Bat monitoring will include: 1) prior to project implementation, ongoing surveys at significant roosts; 2) prior to project implementation, bat activity at the existing Copenhagen mine pit lake across all seasons; 3) during operations, monitoring bat activity at impact and non-impact (control) sites, including the mining exclusion zone; 4) during operations, activity levels near night infrastructure (i.e. plant site), as well as bat activity during key project development milestones (e.g. blasting for the first time, blasting at significantly closer locations, first outflow of TSF or when pooling starts etc).
    - Other conservation significant species (Northern Quoll, Pilbara Olive Python, Bilby). Monitoring will include pre-clearance surveys for key species using approved DBCA methodology, targeted surveys of suitable habitat adjacent the mine areas and monitor population changes over time.
- Monitor groundwater levels and quality and adjust modelling accordingly.

6.2.3. Measures to reduce impacts from habitat removal, fragmentation, and modification

- Implement Ground Disturbance Permitting Procedure (CRL-ENV-PRO-002-19) to ensure disturbance remains within authorised boundaries.
- Prevent unauthorised access to habitats of conservation significance, including the mining exclusion zone.
- Develop and implement rehabilitation and mine closure principles and procedures that include aims to rehabilitate self-sustaining fauna habitat.

- Maintain natural drainage flows where practicable and prevent ponding of water.

6.2.4. Measures to reduce impacts from light and general operational noise/vibration

- During both construction and operation stages, design artificial lighting to illuminate work areas and limit illumination of the surrounding landscape, such as water sources and substantial rocky outcrops. Directing lights inwards towards work activities will minimise lighting effects on fauna in adjacent areas.
- Implement best available technology to minimise noise emissions from mining operations.
- Reduce traffic and equipment usage at night to minimise noise disruption.
- Mine and infrastructure planning has considered the location and position of the accommodation village, to minimise artificial lighting of the bat roost entrances.

6.2.5. Measures to reduce impacts from vehicle strike

- Investigate strategies to reduce impacts on fauna from all construction traffic, especially for nocturnal species or those prone to vehicle collisions, including speed limits, signage, fences or barriers.
- Prevent unauthorised off-track driving.
- Report and record any incident that results in the injury or death of a fauna species from vehicle strike.

6.2.6. Measures to reduce impacts from introduced species

- Conduct opportunistic monitoring and control of feral animals and implement measures to reduce the abundance of feral species in the project area
- Employ housekeeping measures such as covering up landfill and bin management.
- Implement quarantine and hygiene controls to prevent the inadvertent introduction of Cane Toads and other introduced species (including weeds).

6.2.7. Measures to reduce impacts from dust

- Prepare and implement dust management procedures to reduce the effects of dust on nearby vegetation and fauna habitats, including management of vehicle speed on unsealed roads, dust suppression measures (spray trucks) and proximity of habitats to blasting and excavation.
- Implement standard dust suppression measures across the WGP area during construction and operation

6.2.8. Measures to reduce impacts from changed fire regimes

- Prepare and implement best practice fire control strategies to manage unplanned fires, including educating and training staff on equipment and procedures.

- Control and manage weeds as they contribute to an increased fuel load and fire risk.

7. CONCLUSION

Baseline studies since 2016 have contributed significantly to the scientific understanding of environmental significance of the broader WGP and allowed Calidus to design the project in a way that identifies, prevents and minimises adverse environmental impacts.

The wider investigations of the WGP have relied on the technical skills and experience of over 25 specialised consultants and covered a range of environmental factors and aspects relevant to the project, including terrestrial and subterranean fauna; flora and vegetation; air quality (dust); noise; vibration/blasting; geotechnical and geochemical analysis of soils and waste; hydrogeology and hydrology; and ethnographic and archaeological investigations.

The results of these investigations, consultations and risk assessments have all been taken into account in developing the project, including the proposal presented in this document.

As part of an adaptive management approach, Calidus will continue to work closely with technical experts across a range of environmental factors (i.e. bat and other fauna specialists, hydrologists, botanists) to better understand the issues and to refine/adapt management measures accordingly.

An assessment of the impacts of this NVCP application against the ten clearing principles has determined that the clearing is not at variance or is unlikely to be at variance with these principles.

8. REFERENCES

Armstrong, K. (2001) The distribution and roost habitat of the Orange Leaf -nosed Bat, Rhinonicteris aurantius, in the Pilbara region of Western Australia. Wildlife Research **28**, 95–104.

Armstrong, K.N. and Anstee, S.D. (2000) The Ghost Bat in the Pilbara: 100 years on. Australian Mammalogy **22**, 93–101.

ATC Williams (2019) Tailings Storage Facility Design Report - Feasibility.

Beard, J.S. (1975) The vegetation survey of Western Australia. Vegetation.

Biologic (2017a) Pilbara Ghost Bat Genetic Project 2017 (Unpublished report prepared for the BHP Billiton Iron Ore Pty Ltd).

Biologic (2017b) Warrawoona Level 1 Vertebrate Fauna, and Desktop SRE and Subterranean Assessment. Report prepared for Calidus Resources Limited.

Biologic (2018a) Warrawoona Targeted Bat Assessment - September 2017. Report prepared for Calidus Resources Limited. February 2018.

Biologic (2018b) Warrawoona Targeted Bat Assessment - July 2018. Report prepared for Calidus Resources Limited. September 2018.

Biologic (2018c) Warrawoona Gold Project: VHF Bat Foraging Studies. Report prepared for Calidus Resources Limited. July 2018.

Biologic (2018d) Warrawoona Gold Project. SRE Invertebrate Fauna Survey. Calidus Resources Limited.

Biologic (2018e) Warrawoona Level 1 Fauna Assessment. Report prepared for Calidus Resources Limited. February 2018.

Biologic (2019a) Warrawoona Targeted Bat Assessment - April 2019. Report prepared for Calidus Resources Limited. May 2019.

Biologic (2019b) Warrawoona Gold Project: VHF Bat Foraging Studies. Report prepared for Calidus Resources Limited. March 2019.

Biologic (2019c) Warrawoona Gold Project: Habitat Assessment and Targeted Vertebrate Fauna Survey. Report prepared for Calidus Resources Limited, 22 February 2019.

Biologic (2019d) Warrawoona Gold Project: 2019 Significant Species Survey. June 2019. Prepared for Calidus.

Biologic (2019e) Warrawoona Gold Project: Conservation Significant Bat Species Impact Assessment (Impact assessment Report).

Biologic (2019f) Warrawoona Gold Project. Conservation Significant Vertebrate Fauna Impact Assessment.

Biologic (2019g) Warrawoona Gold Project: Subterranean Fauna Survey. Draft report in prep. for Calidus Resources.

Biologic (2019h) Warrawoona Gold Project: Conservation Significant Vertebrate Fauna Impact Assessment. Report to Calidus Resources.

Blast It Global (2018) Assessment of blasting on the Klondyke Queen. A roost site for Pilbara Leaf-nosed Bat and Ghost Bat. Report prepared for Calidus Resources. 4 July 2018.

Boles, W. (1999) Avian prey of the Australian Ghost Bat Macroderma gigas (Microchiroptera: Megadermatidae): prey characteristics and damage from predation. Australian Zoologist.

Braithwaite, R.W. and Griffiths, A.D. (1994) Demographic variation and range contraction in the northern quoll, *Dasyurus hallucatus* (Marsupialia: Dasyuridae). Wildlife Research **21**, 203–217.

Bullen, R.D. (2013) Pilbara leaf-nosed bat (Rhinonicteris aurantia); summary of current data on distribution, energetics, threats. Paper presented at the Pilbara leaf-nosed bat workshop. Kensington WA.

Burbidge, A.A. (2004) Threatened Animals of Western Australia. Department of Conservation and Land Management, Kensington, Western Australia.

Burbidge, A.A., McKenzie, N.L. and Fuller, P.J. (2008) Long-tailed Dunnart (*Sminthopsis longicaudata*)., in: Mammals of Australia. Reed New Holland., Sydney, New South Wales:, pp. 148–150.

Bush, B. and Maryan, B. (2011) Field Guide to Snakes of the Pilbara, Western Australia. Western Australian Museum, Perth, Western Australia.

Calidus (2019) Warrawoona Gold Project, EPA Supplementary Information Report. Report submitted with EPA Referral. 29 October 2019. Calidus Resources Limited.

Churchill, S.K. (1991) Distribution, abundance and roost selection of the Orange Horseshoe-bat, Rhinonycteris aurantius, a tropical cave-dweller. Wildlife Research. **18**, 343–353.

Churchill, S.K. (1994) Diet, prey selection and foraging behaviour of the Orange Horseshore-bat, Rhinonycteris aurantius. Wildlife Research. **21**, 115–130.

Churchill, S.K. (2008) Australian Bats., Second Edition ed. ed. Allen and Unwin, New South Wales, Crow's Nest.

Churchill, S.K., Helman, P.M. and Hall, L.S. (1988) Distribution, populations and status of the orange horseshoe bat, Rhinonicteris aurantius (Chiroptera: Hipposideridae). Australian Mammalogy **11**, 27–33.

DAA (2013) Aboriginal Heritage Due Diligence Guidelines. Department of Planning, Lands and Heritage (Department of Aboriginal Affairs).

Davis and Metcalf (2008) The Night Parrot (Pezoporus occidentalis) in northern Western Australia: a recent sighting from the Pilbara region. Emu **108**, 233–236.

Department of Environment (2016) Threatened Species Scientific Committee. Conservation Advice: Pezoporus occidentalis, Night Parrot.Commonwealth of Australia, Canberra, Australian Capital Territory. http://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice15072016.pdf

Department of Environmental Regulation (2017) Guidance Statement. Risk Assessments, Part V, Division 3, Environmental Protection Act 1986. Government of Western Australia. February 2017.

Department of Environment Water Heritage and the Arts (2008) Approved Conservation Advice for Liasis olivaceus barroni (Olive Python - Pilbara subspecies). Commonwealth of Australia, Canberra.

Department of Parks and Wildlife (2017) Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia.

Department of Sustainability, Environment, Water, Population and Communities (2011) Survey Guidelines for Australia's Threatened mammals. EPBC Act survey guidelines 6.5, EPBC Act survey guidelines 6.5. Australian Government, Canberra, ACT.

Department of Sustainability, Environment, Water, Population and Communities (2012) Macrotis lagotis - Greater Bilby.

Species Profiles and Threats Database (SPRAT). http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=282

Department of the Environment (2016) EPBC Act referral guideline for the endangered Northern Quoll *Dasyurus hallucatus*. (EPBC Act Policy Statement). Commonwealth of Australia, Canberra, Australian Capital Territory.

DER (2014) Assessment and management of contaminated sites. Contaminated sites guidelines. Department of Environment Regulation. December 2014.

DEWHA (2010) Survey Guidelines for Australia's Threatened Bats;

DEWHA (2017) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act.

DMP & EPA (2015) Guidelines for Preparing Mine Closure Plans: http://www.dmp.wa.gov.au/Documents/ Environment/ENV-MEB-121.pdf.

DoEE (2013) Matters of National Significance. Significant Guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999. Department of Environment and Energy. Australian Government.

DoIIS (2016) Preventing acid and metalliferous drainage – Leading practice sustainable development program for the mining industry. Commonwealth Department of Industry Innovation and Science.

Donato, D. (1999) Bird Usage Patterns on Northern Territory Mining Water Tailings and their Management to Reduce Mortalities. Department of Mines and Energy, Darwin NT.

Douglas, A.M. (1967) The natural history of the Ghost Bat Macroderma gigas (Microchiroptera, Megasermatidae). The Western Australian Naturalist, in Western Australia. **10**, 125–137.

DoW (2007) WQPN 83: Infrastructure corridors near sensitive water resources. Department of Water.

DoW (2009) WQPN 51: Industrial wastewater management and disposal. Department of Water.

DoW (2010) WQPN 52: Stormwater management at industrial sites. Department of Water.

DoW (2013a) Western Australian water in mining guideline, Report No 12, Department of Water.

DoW (2013b) WQPN 15: Extractive industries near sensitive water resources. Department of Water.

DPaW (2017) Department of Parks and Wildlife. Interim guideline for the preliminary surveys of Night Parrot (Pezoporus occidentalis) in Western Australia. Kensington, Western Australia.

DSEWPC (2011) Survey Guidelines for Australia's Threatened Reptiles (Department of Sustainability, Environment, Water, Population and Communities, 2011).

Dziminski, M. and Carpenter, F. (2017) The conservation and management of the bilby (Macrotis lagotis) in the Pilbara: Progress Report 2017. Perth, Western Australia:

Environmental Technologies and Analytics (2019) Warrawoona Gold Project - Assessment of Dust Emissions. Report prepared for Calidus Resources Limited. September 2019 (No. 1084).

EPA (2016a) Environmental Factor Guideline: Terrestrial Fauna.

EPA (2016b) Technical Guidance: Terrestrial fauna surveys.

EPA (2016c) Technical Guidance: Sampling methods for terrestrial vertebrate fauna.

EPA (2016d) Technical Guidance - Sampling of short range endemic invertebrate fauna.

EPA (2016e) Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016.

EPA (2016f) Environmental Factor Guideline: Inland Waters.

EPA (2016g) Environmental Factor Guideline – Social Surroundings.

EPA (2016h) Environmental Factor Guideline – Subterranean Fauna.

EPA (2016i) Technical Guidance – Subterranean Fauna survey.

EPA (2016j) Technical Guidance: Sampling Methods for Subterranean Fauna.

EPA (2016k) Environmental Factor Guideline – Air Quality.

EPA (2018a) Instructions for the referral of a Proposal to the EPA under Section 38 of the Environmental Protection Act 1986.

EPA (2018b) Statement of Environmental Principles, Factors and Objectives.

GCA (2019a) Warrawoona Gold Project: Characterisation of Mine-Waste and Ore Samples: Implications for MiningStream Management.

GCA (2019b) Characterisation of Mine-Tailings Slurry Sample and Implications for Mining-Stream Management.

Gibson, L.A. and McKenzie, N.L. (2009) Environmental associations of small ground -dwelling mammals in the Pilbara region, Western Australia. Records of the Western Australian Museum Supplement **78**, 91–122.

Groundwater Resource Management (2019a) Hydro-Meteorological and Surface Water Management Study. Warrawoona Gold Project. Pre-Feasibility Study. Prepared for Calidus Resources Ltd.

Groundwater Resource Management (2019b) Warrawoona Gold Project Pre-Feasibility Hydrogeological Investigations Report. Prepared for Calidus Resources Limited.

Hall, L., Richards, G., McKenzie, N. and Dunlop, N. (1997) The importance of abandoned mines as habitat for bats. In P. Hale & D. Lamb (Eds.), Conservation Outside Nature Reserves. St Lucia, Queensland: Centre for Conservation Biology, University of Queensland. 326–333.

Harvey, M.S. (2002) Short-range endemism amongst the Australian fauna: some examples from non-marine environments. Invertebrate Systematics **16**, 555–570.

Hill, B. and Ward, S. (2010) National recovery plan for the Northern Quoll *Dasyurus hallucatus*. Northern Territory Department of Natural Resources, Environment and the Arts.

Hutson, A.M., Mickelburgh, S.P. and Racet, P.A. (2001) Microchiropteran Bats: Global Status Survey and Conservation Action Plan.

ICMM (2019) Planning for integrated mine closure: toolkit. International council on mining and metals. International Council on Mining and Metals.

Ingleby, S. and Westoby, M. (1992) Habitat requirements of the Spectacled Hare-wallaby (*Lagorchestes conspicillatus*) in the Northern Territory and Western Australia. Wildlife Research **19**, 721–741.

Jackett, N., Greatwich, B., Swann, G. and Boyle, A. (2017) A nesting record and vocalisations of the Night Parrot Pezoporus occidentalis from the East Murchison, Western Australia. Australian Field Ornithology, 34, 144-150.

Johnstone, R.E. and Storr, G.M. (1998) Handbook of Western Australian birds. Volume I: Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth, W.A.

Körtner, G., Pavey, C.R. and Geiser, F. (2007) Spatial ecology of the mulgara in arid Australia: impact of fire history on home range size and burrow use. Journal of Zoology **273**, 350–357.

Lloyd George Acoustics (2019) Environmental Noise Assessment Warrawoona Gold Project, Marble Bar. Prepared for: Calidus Keras (Pilbara) Gold Pty Ltd.

Martin, D. (2012) Scientific Evaluation of Fauna Sensitivity to Blasting.

McGilp, J. (1931) Geopsittacus occidentalis, Night-Parrot. South Australian Ornithologist, 11, 68-70.

Mine Earth (2019) Warrawoona Gold Project: Soils and landform assessment.

Minerals Council of Australia (2016) Rush, Australia's 21st Century Gold Industry. A Minerals Council of Australia and Chamber of Minerals and Energy of Western Australia publication.

Minerals Council of Australia (2019) .

Murphy, S., Austin, J., Murphy, R., Silcock, J.L., Joseph, L., Garnett, S.T. and Burbidge, A.H. (2017) Observations on breeding Night Parrots (Pezoporus occidentalis) in western Queensland. Emu - Austral Ornithology, 117(2), 107-113. (https://doi.org/10.1080/01584197.2017.1292404).

Murphy, S., Silcock, J.L., Murphy, R., Reid, J. and Austin, J. (2017) Movements and habitat use of the night parrot Pezoporus occidentalis in south-western Queensland. Austral Ecology, 42(7), 858-868. doi:https://doi.org/10.1111/aec.12508.

National Committee on Soil and Terrain (2009) The Australian soil and land survey handbook. Third Edition.

10.1071/9780643097117. ISBN (PDF): 978-0-643-09711-7.

NEMP (2016) National Environment Protection (Ambient Air Quality) Measure.

NEPM (2013) National Environment Protection Assessment of Site Contamination) Measure. National Environment Protection Council.

Night Parrot Recovery Team (2017) Leading Night Parrot Conservation. Retrieved from https://nightparrot.com.au/.

North, A. (1898) List of birds collected by the Calvert Exploring Expedition in Western Australia. Transactions of the Royal Society of South Australia, 22, 125-192.

Olsen, P.D. and Olsen, J. (1986) Distribution, Status, Movements and Breeding of the Grey Falcon, *Falco hypoleucos*. Emu **86**, 47–51.

Palaszczuk, A. and Miles, S. (2017) New night parrot community discovered in central west Queensland. Available from:

http://statements.qld.gov.au/Statement/2017/3/22/new-night-parrot-community-discovered-in-centralwest-queensland.

Pavey, C.R. (2006) National Recovery Plan for the Greater Bilby *Macrotis lagotis*. Northern Territory Department of Natural Resources, Environment and the Arts.

Pavey, C.R., Nano, C.E., Cooper, S.J., Cole, J.R. and McDonald, P.J. (2012) Habitat use, population dynamics and species identification of mulgara, *Dasycercus blythi* and *D. cristicauda*, in a zone of sympatry in central Australia. Australian Journal of Zoology **59**, 156–169.

Pearson (1993) Distribution, status and conservation of Pythons in Western Australia, in: D. Lunney, D. Ayers (Eds.), Herpetology in Australia, a Diverse Discipline. Surrey Beatty & Sons, pp. 383–395.

Peter O'Bryan & Associates (2019) Warrawoona Project - Klondyke Deposit Geotechnical Review of Blasting Report.

Rapallo (2021) Flora and Vertebrate Fauna Assessment of the Moolyella Pipeline, September 2020

Richards, G.C., Hand, S., Armstrong, K.N. and Hall, L.S. (2008) Ghost Bat. In S. Van Dyck & R. Strahan (Eds.)., Mammals of Australia 3rd Edition. ed. Sydney: Reed New Holland.

Sands CRM (2018) 2018 Calidus Warrawoona Gold Project Ethnographic Site Avoidance Survey.

Sands CRM (2019) Calidus Warrawoona Gold Project Archaeological Site Avoidance Survey. September 2019. Prepared for Calidus.

Southgate, R., Paltridge, R., Masters, P. and Carthew, S. (2007) Bilby distribution and fire: a test of alternative models of habitat suitability in the Tanami Desert, Australia. Ecography, 30(6), 759-776. doi:10.1111/j.2007.09067590.04956.x.

Southgate, R. and Possingham, H. (1995) Modelling the reintroduction of the Greater Bilby Macrotis lagotis using the metapopulation model analysis of the likelihood of extinction (ALEX). Biological Conservation, 73, 151-160.

Southgate, R.I. (1990) Distribution and abundance of the greater bilby *Macrotis lagotis*., in: Seebeck, J., Brown, P., Wallis, R., Kemper, C. (Eds.), Bandicoots and Bilbies. Surrey Beatty & Sons, Sydney, pp. 293–302.

Specialised Zoological (2017a) Monitoring bats of conservation significance near Marble Bar, WA. November 2016. Report for Keras Resources PLC and Rapallo Pty Ltd. March 2017.

Specialised Zoological (2017b) Monitoring bats of conservation significance near Marble Bar, WA April 2017. Report for Keras Resources PLC and Rapallo Pty Ltd. 22 August 2017.

Start, A., Ansee, S. and Endersby, M. (2000) A review of the biology and conservation status of the Ngadji, Pseudomys chapmani Kitchener, 1980 (Rodentia: Muridae). CALMScience, 3(2), 125-147.

Thompson, G. and Thompson, S. (2007) Shape and Spatial Distribution of Mulgara (Dasycercus Cristicauda) Burrows, with Comments on Their Presence in a Burnt Habitat and a Translocation Protocol. Journal of the Royal Society of Western Australia, 90, 195-202.

Threatened Species Scientific Commitee (2005) Conservation Advice on Northern Quoll (Dasyurus hallucatus).

Threatened Species Scientific Committee (2016a) Conservation Advice: Macroderma gigas, Ghost Bat. TSSC, Threatened Species Scientific Committee, Canberra, Australian Capital Territory.

Threatened Species Scientific Committee (2016b) Conservation Advice Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat. Produced by the Threatened Species Scientific Committee under the Environment Protection and Biodiversity Conservation Act 1999.

Threatened Species Scientific Committee (2016c) Conservation Advice Macroderma gigas, Ghost Bat. Produced by the Threatened Species Scientific Committee under the Environment Protection and Biodiversity Conservation Act 1999.

Tidemann, C.R., Priddel, D.M., Nelson, J.E. and Pettigrew, J.D. (1985) Foraging behaviour of the Australian ghost bat, Macroderma gigas (Microchiroptera: Megadermatidae). Australian journal of zoology **33**, 705–713.

Trajectory (2019) Metalliferous Drainage Management Procedure. Warrawoona Gold Project (CRL-ENV-PRO-022-19). 29 September 2019.

Van Dyck, S. and Strahan, R. (2008a) Mammals of Australia., Third Edition ed. ed. Australian Museum., Sydney, New South Wales.

Van Dyck, S. and Strahan, R. (2008b) The mammals of Australia. New Holland Publishers, Sydney.

Van Vreeswyk, A.M.E., Payne, A.L., Leighton, K.A. and Hennig, P. (2004) Inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture and Food, Western Australia, Perth, W.A.

Whitlock, F. (1924) Journey to central Australia in search of the Night Parrot. Emu, 23, 248-281.

Wilson, H. (1937) Notes on the Night Parrot, with references to recent occurrences. 37, 79-87.

Woinarski, J.C.Z., Oakwood, M., Winter, J., Burnett, S., Milne, D., Foster, P., Myles, H. and Holmes, B. (2008) Surviving the toads: patterns of persistence of the northern quoll Dasyurus hallucatus in Queensland. Department of Natural Resources, Environment and the Arts, Darwin.

Woodman Environmental (2018) Warrawoona Gold Project Flora and Vegetation Survey. Report prepared for Calidus Resources Limited. October 2018.

Woodman Environmental (2019a) Warrawoona Gold Project Flora and Vegetation Survey. Report prepared for Calidus.

Woodman Environmental (2019b) Memo of recommendations for referral of Warrawoona Gold Project, assessment against Clearing Principles. Report prepared for Calidus. September 2019.

Woolley, P.A. (2006) Studies on the crest-tailed mulgara *Dasycercus cristicauda* and the brush-tailed mulgara *Dasycercus blythi* (Marsupialia: Dasyuridae). Australian Mammalogy **28**, 117–120.

Worthington-Wilmer, J., Moritz, C., Hall, L. and Troop, J. (1994) Extreme population structuring in the threatened ghost bat, Macroderma gigas: evidence from mitochondrial DNA. Proceeding of the Royal Society of London B. **257**, 193–198.