Boomerang Open Pit Dewatering Discharge Pipeline Reconnaissance Flora and Fauna Survey

Prepared For Westgold Resources | January 2022

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Stantec

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Executive Summary

ES.1 Project Background

The Reedy North Project consists of the Kurara, Kurara Central and Boomerang open pits, located 47 km south of Meekatharra in Western Australia, which were first mined as a joint venture between Nord Australex and Indian Ocean Ventures commencing in 1987. The three pits are aligned north-south and the voids are now filled with hypersaline water. Westgold Resources Limited (Westgold), operating as Big Bell Gold Operation (BBGO), is proposing to dewater these open pits. To facilitate resource analysis and mining, it is anticipated that pit water will be required to be discharged to Lake Annean, located 5.5 km to the south. Dewatering discharge pipework will be installed across the surface of a previously cleared corridor, extending from the Boomerang Open Pit to the historic Lake Annean discharge outfall (the Survey Area) across a distance of approximately 8 km and located within tenements M51/92 and L51/51. Approximately 5 km of the proposed dewatering discharge pipeline corridor intersects native vegetation which has regrown following previous disturbance, and the final 3 km of vegetation is located within the Lake Annean Environmentally Sensitive Area (ESA). The Survey Area corridor is approximately 100 m in width and completely covered the BBGO miscellaneous tenement L51/51.

Westgold commissioned Stantec Australia Pty Ltd (Stantec) to undertake a reconnaissance flora and vegetation survey (previously referred to as a Level 1 survey) and a basic fauna survey (previously referred to as a Level 1 survey) of the proposed dewatering discharge pipeline corridor ("field survey"). The Survey Area is 84 ha in size, with approximately 75 ha of this area comprising native vegetation, and 5 ha comprising unvegetated salt lake.

ES.2 Objective and Scope

The objective was to assess the flora, vegetation and fauna values of the Survey Area via a desktop assessment and field survey that aligned with the relevant State and Commonwealth guidance. The scope of work was to:

- conduct a desktop assessment prior to the field survey, including database searches and literature review of available contextual and project related resources;
- undertake a reconnaissance flora and vegetation survey and basic fauna survey to:
    - describe and map vegetation types, vegetation condition and fauna habitat types;
    - develop a list of flora and fauna species recorded within the Survey Area;
    - conduct targeted searches for flora, vegetation communities and fauna of significance, including those of local and regional significance that may not be listed on government databases; and
- assess the survey findings in a local and regional context, by comparing the results with available data from other localities within the bioregion.

ES.3 Methods

Eight databases were interrogated and six existing reports containing information on the terrestrial flora, vegetation and fauna in proximity to the Survey Area were reviewed as part of the reconnaissance flora and vegetation and basic fauna survey. A field survey was undertaken in November 2021. Eight relevé (unbounded sample sites) locations were identified in the field in accordance with spatial changes in vegetation and were sampled to compile a representative species list of the Survey Area and to characterise vegetation types. Broad vegetation type mapping was refined on maps in the field, as a result of ground-truthing. Vegetation types were delineated and described from aerial imagery utilising the quadrat and mapping note data. Targeted searches were conducted for significant flora and fauna identified from the desktop assessment. Where flora of significance, or suspected significance, was identified, a record of its occurrence was made and a specimen was collected. The Survey Area was traversed on foot with major fauna habitat types being described and delineated in the field based on landforms and vegetation types. Habitat was also assigned an extent within the landscape and its significance to fauna species.

ES.4 Desktop Assessment

ES.4.1 Flora and Vegetation

A total of 27 significance flora taxa were recorded by the database searches as occurring within 50 km of the Survey Area, including one Threatened flora taxa (T / Cr), four Priority 1 (P1), one P2, 18 P3 and three P4. Two of these 27 species have been recorded during previous surveys within the vicinity of the Survey Area. The literature review indicates that two previous surveys confirmed the presence of two flora species of significance within the vicinity of the Survey Area including *Ptilotus beardii* (P3) and *Tecticornia cymbiformis* P3). A further four taxa with the potential to be significant were also recorded including *Dodonaea ?amplisemina* (P4), *Eremophila* sp. nov

(novel taxon) and potentially two *Tecticornia* sp. nov (novel taxa). Prior to the field survey, seven taxa were considered 'Unlikely' to occur, 11 flora taxa were considered 'Possible' to occur and two species were considered 'Likely' to occur; *Ptilotus beardii* (P3) and *Tecticornia cymbiformis* (P3). It was considered 'Possible' that one Threatened flora taxon may occur within the Survey Area. There were four PECs recorded by the database searches located within 50 km of the Survey Area, with the nearest (Austin Land System; P3) located 7 km away.

ES.4.2 Terrestrial Fauna

Ephemeral wetland habitat and salt lakes are likely to be of significance for fauna within the Murchison region, particularly waterbird species and migratory shorebird species during flooded conditions. A total of 13 fauna habitat types have been previously recorded from the broader area, with the following relevant to the Survey Area; Chenopod Shrubland, Mulga Woodland/Plain, Samphire, Drainage Line and Lake Playa. The desktop assessment identified a total of 241 terrestrial fauna taxa, including introduced species, which have been recorded and/or have the potential to occur within the Survey Area, comprising 17 native mammals, seven introduced mammals, 159 native birds, two introduced birds, 49 native reptiles, five native amphibians and two native arthropods. Of the 241 terrestrial fauna taxa identified by the desktop assessment, 26 species are listed as being of significance, comprising two arthropods, 22 birds, one mammal and one reptile. The remaining taxa comprised five amphibians, 139 birds, 23 mammals (including introduced species) and 48 reptiles. Of the 26 significant terrestrial fauna taxa, two were considered 'Likely' to occur, 18 were considered 'Possible' to occur and six were considered 'Unlikely' to occur.

ES.5 Field Survey

ES.5.1 Flora and Vegetation

A total of 50 flora taxa from 14 families and 27 genera were identified from the Survey Area, including one variant, one possible hybrid and six subspecies. Of the taxa recorded, eight could not be confidently identified to species level due to lack of characteristic features including fruit and flowers. The most represented families were Chenopodiaceae (20) and Fabaceae (10), with the remaining families recording between one and three taxa. One native vascular flora taxon recorded from the Survey Area, *Tecticornia cymbiformis*, is listed as P3. *Tecticornia cymbiformis* was recorded growing on gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (TaffuTibFlAhh vegetation type / Samphire Dune Adjacent to Saline Drainage habitat type). *Tecticornia cymbiformis* (P3) was considered to be locally abundant (>10-<15 plants recorded at relevé BOO1; >50-<100 plants recorded at relevé BOO2) and likely to occur across the broader saline lake margin habitat of Lake Annean, with the desktop assessment recording three specimens from the database searches and one specimen from the literature review.

One native vascular flora taxon recorded from the Survey Area was considered to be of 'other' significance; *Tecticornia* aff. *undulata*. *Tecticornia* aff. *undulata* was recorded growing on red gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (TaffuTibFlAhh vegetation type / Samphire Dune Adjacent to Saline Drainage habitat type). *Tecticornia* aff. *undulata* is likely to be locally abundant and likely to occur across the broader saline lake margin habitat of Lake Annean. One introduced flora species (weed) was recorded from the Survey Area; **Rumex vesicarius* (Ruby Dock), predominantly associated with cleared/degraded areas adjacent to the Boomerang Open Pit and mining area and covered less than 1% of the Survey Area. This taxon is not a declared pest listed under Section 22 of the BAM Act or a WoNS. Following the field survey, and with a greater understanding of the vegetation and habitat types that occur within the Survey Area, one flora taxon of significance recorded by the database searches was considered 'Possible' to occur, and 25 taxa were considered 'Unlikely' to occur.

Six vegetation types were identified and described from the Survey Area, characteristic of vegetation within the vicinity of salt lakes, with samphire shrubland dominating the dunes and riparian zone associated with the lake, and *Acacia* woodland dominating with increasing distance from Lake Annean. The most extensive vegetation type within the Survey Area was *Acacia craspedocarpa*, *Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* open low shrubland (AcA?pEg) which occurred over approximately 63% of the Survey Area. None of the vegetation types within the Survey Area were analogous to any TEC or PEC listed under the BC Act or EPBC Act. Further, the vegetation units described from the Survey Area are not considered to be restricted to the Survey Area and are well represented throughout the subregion and adjoining subregions.

The vegetation condition of the Survey Area ranged from 'Degraded' to 'Excellent', with the majority of the Survey Area (67%) in 'Good' condition, 19% in 'Excellent' condition, 1% in 'Very Good' condition and 7% considered to be 'Degraded'. Some disturbance is associated with the previous clearing, construction and operation of the Boomerang Open Pit dewatering pipeline and interruption of surface water sheetflow. Other historic impacts to vegetation condition across the Survey Area were related to previous ground disturbing activities including mining, tracks and exploration drilling as well as grazing and trampling by livestock. In areas, this has substantial impacted vegetation structure, with few understorey and groundcover species present.

ES.5.2 Terrestrial Fauna

Four broad terrestrial fauna habitats were identified and delineated from fauna habitat assessments conducted across the Survey Area, comprising Mulga Woodland, Samphire Dune Adjacent to Saline Drainage, Inland Sand Dune and Sandy Plain. The Mulga Woodland made up the majority (67%) of the Survey Area, with the remaining three habitats accounting for 12% (Samphire Dune Adjacent to Saline Drainage), 9% (Inland Sand Dune) and 7% (Sandy Plain). Habitat condition ranged from 'Degraded' to 'Excellent', mostly affected by clearing, feral animal grazing and disturbance potentially associated with interruption of surface water sheetflow resulting in death of large areas of vegetation to the east of the existing corridor. The Survey Area contains salt lake habitat and riparian vegetation, which is likely to provide suitable habitat to some species during inundated; however, it is unlikely to provide important habitat for BC Act and/or EPBC Act-listed birds outside of these times.

The field survey recorded a total of 19 species of vertebrate fauna, including five mammals, three reptiles and 11 birds. No species of significance were recorded. Secondary signs of three introduced species were recorded, including the European Rabbit (*Oryctolagus cuniculus*), Wild Dog and European Cattle (*Bos taurus*). A total of 14 waterbird and shorebird species identified during the desktop assessment were considered 'Possible' to occur. However, these species could not be surveyed, and were not detected, during the field survey due to the dry conditions of Lake Annean.

ES.6 Other Fauna

With regard to short-range endemic invertebrate fauna (SREs), it is 'Possible' that certain taxa may occur within the Survey Area. However, the habitat types recorded during the field survey are not considered to be restricted to this area and are widespread throughout the Murchison bioregion more broadly. In the event that SRE taxa are disturbed as a result of clearance of the corridor, it is likely that they will be represented within other similar systems, vegetation types and habitat types. The exception may be the Samphire Dune Adjacent to Saline Drainage habitat type which is considered to be restricted to salt lake, and potentiality peripheral wetland, environments; however, salt lake systems are well represented throughout the bioregion.

With regard to subterranean fauna, it is considered 'Possible' that stygofauna and/or troglofauna may occur within aquifers and/or subsurface geological features. However, it is likely that the subterranean habitat types that occur within, and adjacent to, the Survey Area are not restricted to this area and are widespread throughout the Murchison bioregion more broadly. In addition, aquifers associated with inland salt lakes in Western Australia tend to be hypersaline, which has the potential to reduce the abundance and diversity of subterranean fauna, particularly stygofauna, unless calcrete formations occur, containing fresh to hyposaline/mesosaline water. However, as clearing of the corridor is highly unlikely to result in the excavation of subsurface geological formations and will not directly require abstraction from local aquifers, it is considered unlikely that subterranean fauna will be impacted.

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1. Introduction

1.1. Project Background

The Reedy North Project consists of the Kurara, Kurara Central and Boomerang open pits, located 47 km south of Meekatharra in Western Australia (**Figure 1-1**). The Reedy North Project deposits were first mined as a joint venture between Nord Australex and Indian Ocean Ventures commencing in 1987 (Nord Resources, 1986). The three pits are aligned north-south and the voids are now filled with hypersaline water. Waste rock mineralogy consists of mixed oxide, mafic schists, ultramafic talc carbonate and Banded Iron Formations (BIF). Westgold Resources Limited (Westgold), operating as Big Bell Gold Operation (BBGO), is proposing to dewater the Boomerang, Kurara and Kurara Central pits, with the Boomerang Open Pit located 5.5 km south of Lake Annean (**Figure 1-2**). BBGO owns and operates a conventional carbon-in-leach (CIL) gold processing plant at the Bluebird mine site, approximately 15 km south of Meekatharra (**Figure 1-1**).

BBGO intends to facilitate access to the previously mined Boomerang/Kurara gold deposits to undertake further resource analysis and evaluate recommencement of surface and underground mining operations, consequently requiring dewatering of three pit voids including Boomerang. It is anticipated that pit water will be required to be discharged to Lake Annean as a result. Dewatering discharge pipework will need to be installed and will be laid across the surface of a previously cleared corridor within a 'v drain', and restrained were required, to limit movement. The outflow point will be located on the surface of Lake Annean, avoiding the lake shore, and holes cut into the side of the pipe to allow a diffuse outflow to minimise scouring or erosion of the lake bed.

This corridor extends from the Boomerang Open Pit (Boomerang) to the historic Lake Annean discharge outfall (the Survey Area) across a distance of approximately 8 km and is located within tenements M51/92 and L51/51 (**Figure 1-2**). Approximately 5 km of the proposed dewatering discharge pipeline corridor intersects native vegetation which has regrown following previous disturbance, and the final 3 km of vegetation is located within the Lake Annean Environmentally Sensitive Area (ESA) (**Figure 1-2**). The Survey Area corridor is approximately 100 m in width and completely covered the BBGO miscellaneous tenement L51/51.

Westgold commissioned Stantec Australia Pty Ltd (Stantec) to undertake a reconnaissance flora and vegetation survey (previously referred to as a Level 1 survey) and a basic fauna survey (previously referred to as a Level 1 survey) of the proposed dewatering discharge pipeline corridor ("field survey"). The Survey Area is 84 ha in size, with approximately 75 ha of this area comprising native vegetation, and 5 ha comprising unvegetated salt lake.

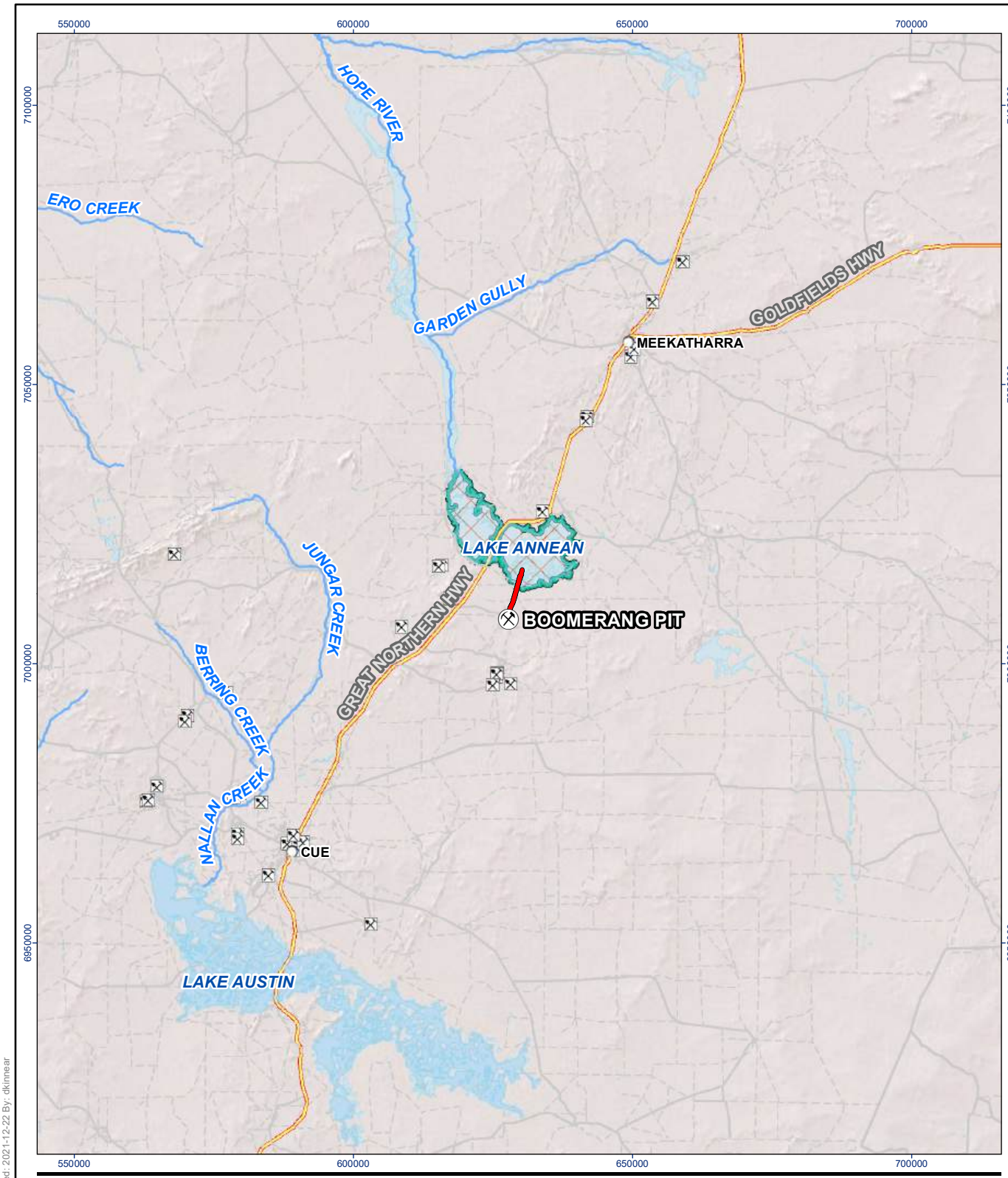
1.2. Objective and Scope

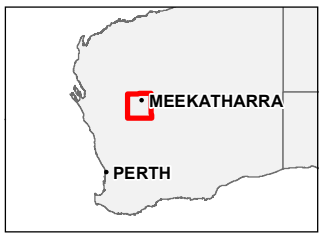
The objective was to assess the flora, vegetation and fauna values of the Survey Area through a desktop assessment and field survey. The scope of works was to:

- conduct a desktop assessment prior to the field survey, including database searches and literature review of available contextual and project related resources;
- undertake a reconnaissance flora and vegetation survey and basic fauna survey to:
    - describe and map vegetation types, vegetation condition and fauna habitat types;
    - develop a list of flora and fauna species recorded within the Survey Area;
    - conduct targeted searches for flora, vegetation communities and fauna of significance, including those of local and regional significance that may not be listed on government databases; and
- assess the survey findings in a local and regional context, by comparing the results with available data from other localities within the bioregion.

The objectives and methods adopted for these surveys are aligned with the following relevant State and Commonwealth guidance:

- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c);
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016d);
- Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (DotE 2020c);
- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016b);
- Sampling Methods for Terrestrial Vertebrate Fauna (DPaW 2016); and
- Matters of National Environmental Significance: Significant impact guidelines 1.1 – *Environment Protection and Biodiversity Conservation Act 1999* (DotE 2013).





Survey Area
Operating Mines
Towns
Directory of Important Wetlands
Environmentally Sensitive Areas
Major Watercourse
Waterbodies
Major Road
Minor Road
Tracks

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Notes
1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021).
3. Background: Copyright:(c) 2014 Esri

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Project Location
Stantec Australia Pty Ltd
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Prepared by FW on 2021-12-09
TR by DK on 2021-12-09
IR by BH on 2021-12-09

Client/Project
boom_ff_2021_01
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title
Regional Location of the Survey Area

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Survey Area
Waterbodies
Major Road
Minor Road
Tracks

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(At original document size of A4)
1:80,000

N

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021).
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

WESTGOLD

Project Location
Stantec Australia Pty Ltd
Perth, Western Australia

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Client/Project
boom_ff_2021_01
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title
Survey Site Location

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2. Existing Environment

2.1. Biogeographic Context

The Interim Biogeographic Regionalisation for Australia (IBRA) is a bioregional framework that divides Australia into 89 biogeographic regions and 419 subregions on the basis of climate, geology, landforms, vegetation, and fauna (Thackway and Cresswell 1995). It was developed through collaboration between State and Territory conservation agencies with coordination by the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (formerly the Department of the Environment, Water, Heritage and the Arts). The bioregions and subregions are the reporting unit for the systematic development of a comprehensive, adequate, and representative National Reserve System.

The Survey Area occurs within the Murchison IBRA bioregion, with the majority located in the West Murchison subregion (MUR2; 87.7%) and the remainder located in the East Murchison subregion (MUR1; 12.3%). The West Murchison subregion is the northern part of the 'Murchison' Terrains of the Yilgarn Craton and is characterised by Mulga low woodlands which are often rich in ephemerals on outcrops, and fine-textured Quaternary alluvial and eluvial surfaces (i.e. extensive hardpan washplains) mantling granite and greenstone strata of the northern part of the Yilgarn Craton. The East Murchison subregion occurs within the northern part of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton and is characterised by internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. The area consists of broad plains of red-brown soils and breakaway complexes as well as red sandplains. Vegetation is dominated by Mulga woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and *Tecticornia* shrublands.

2.2. Land Use

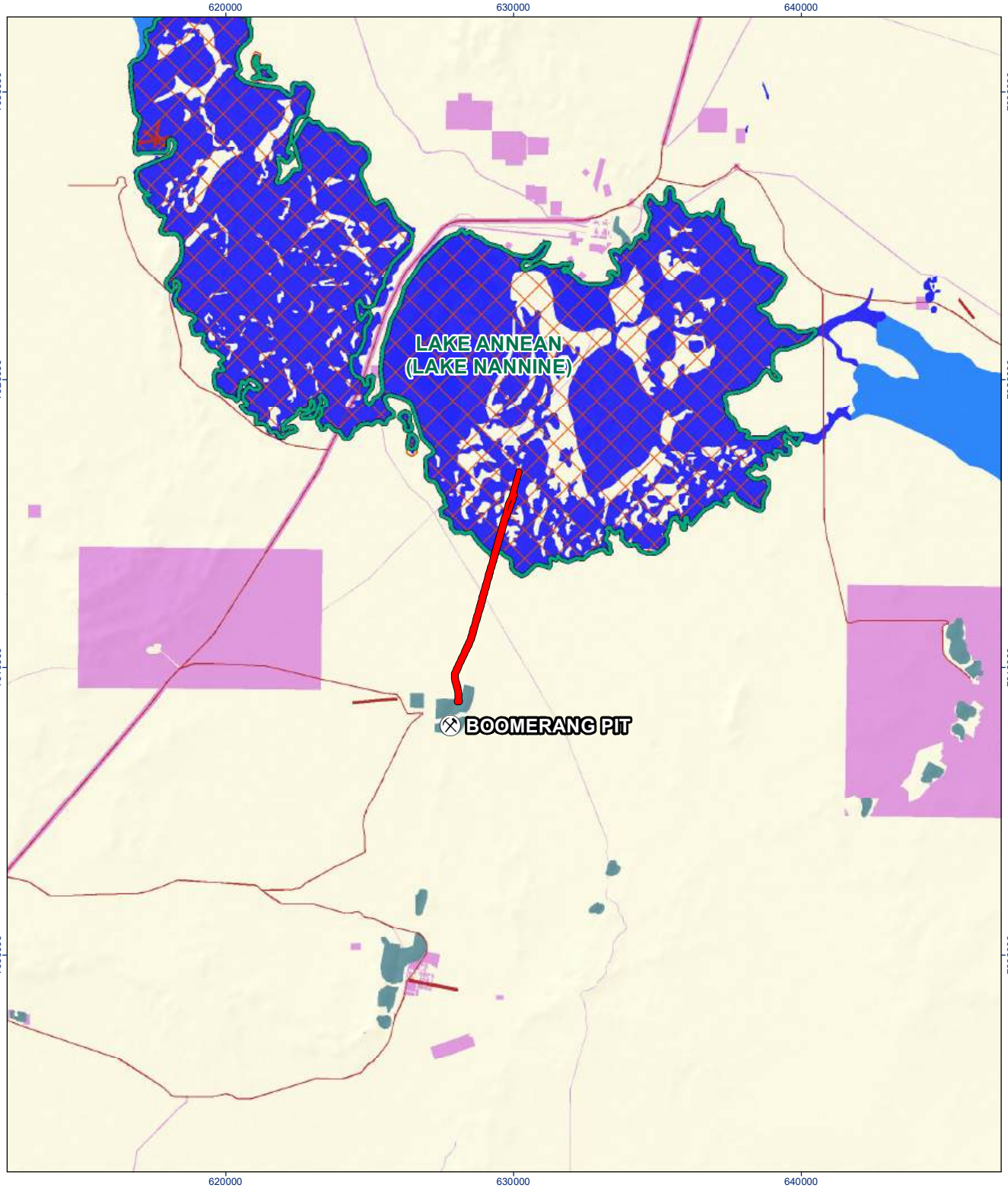
Within the subregions, 85.7% of the East Murchison subregion and 96.2% of the West Murchison subregion has a dominant land use of grazing of native pastures. Within the East Murchison subregion, 11.34% of the land is Unallocated Crown Land (UCL) and Crown Reserves and 1.4% is considered conservation land with the majority of conservation estate in the subregion falling outside the International Union for Conservation of Nature (IUCN) IV categories. The West Murchison subregion mirrors similar land use, with 2.81% falling within UCL and Crown Reserves and 0.06% conservation lands, with a significant proportion of conservation estate in the subregion falling outside the IUCN-IV categories. Mining activity within the region is considerable and dominated by nickel and gold mining such as BBGO (Cowan *et al.* 2001). The Survey Area is located on both Polelle Station (towards Lake Annean) and Annean Station (towards Boomerang Open Pit); both stations are currently stocked.

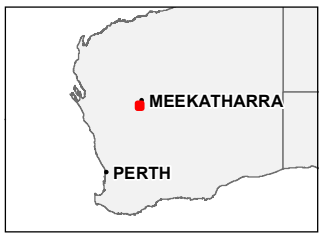
2.3. Conservation Value

The Survey Area does not intersect any conservation reserves, with two unnamed reserves located approximately 6 km to the west and 13 km to the east (**Figure 2-1**). Lake Annean, which occurs within approximately the last 2 km of the Survey Area, is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a nationally important wetland ("Anneen Lake (Lake Nannine)"; WA056). Lake Annean is considered to be a good example of a seasonal/intermittent saline/brackish lake and marsh system, and it is also one of the most important breeding sites for the Gull-billed Tern (*Gelochelidon nilotica*) and the Whiskered Tern (*Chlidonias hybrida*) in Western Australia. The lake is not listed as an important system for Threatened bird species listed under State legislation; however, a number of EPBC Act migratory species have been recorded including the Ruddy Turnstone (*Arenaria interpres*) and the Black-tailed Godwit (*Limosa limosa*), with most known to breed at Lake Annean during suitable conditions. The Black Swan (*Cygnus atratus*), Banded Stilt (*Cladorhynchus leucocephalus*), Australian Shelduck (*Tadorna tadornoides*), Gull-billed Tern and Whiskered Tern are thought to be the most dominant species. A *Biodiversity Conservation Act 2016* (BC Act)-listed aquatic invertebrate, *Branchinella simplex* (a fairy shrimp), has also been recorded from Lake Annean.

2.4. Environmentally Sensitive Areas

Lake Annean is also listed as an Environmentally Sensitive Area (ESA) (**Figure 2-1**) under section 51B of the *Environmental Protection Act 1986* (EP Act) via the Environmental Protection (Environmentally Sensitive Areas) Notice 2005. ESAs aim to protect the degradation of environmental values such as declared rare flora, Threatened ecological communities (TECs) or significant wetlands. The criteria for the declaration of ESAs do not include BC Act-listed Priority ecological communities (PECs). Lake Annean is listed as an ESA as it is a significant wetland.





Notes

1. Coordinate System: GDA 1994 MGA Zone 50
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Survey Area
Directory of Important Wetlands
Environmentally Sensitive Areas

Land Use

Conservation and Natural Environments

Other minimal use

Production from relatively natural environments

Grazing native vegetation

Intensive Uses

Transport and communication
Mining

Water

Lake
River

0 2.5 5 km

(At original document size of A4)
1:200,000

N

Stantec

WESTGOLD

Project Location
Stantec Australia Pty Ltd
Perth, Western Australia

Prepared by FW on 2021-12-09
TR by DK on 2021-12-09
IR by BH on 2021-12-09

Client/Project
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

boom_ff_2021_01

Title

Survey area in relation to Adjacent Land Use

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2.5. Climate

The Murchison bioregion is characterised by an arid climate with predominantly winter rainfall. The subregion is also subject to irregular and unreliable rainfall throughout the year, which may cause substantial flooding of local salt lakes (Barrett 2003). The Meekatharra Airport is the closest active Bureau of Meteorology rainfall station (station number 7045) to the Survey Area, located approximately 45 km north-northeast. It has been operating since 1944 and, based on available records, the mean annual rainfall is 235 mm (BoM 2021). The wettest months of the year are typically between December and April. The hottest months of the year are the summer months (December to March), with daily maximum temperatures regularly exceeding 30°C. The coolest months occur between June and August, with minimum temperatures frequently falling below 15°C, reducing average evaporation.

Over the last 10 years, only four years (2011, 2012, 2013, 2015) have recorded rainfall higher than the long-term annual mean (235 mm), with remaining years recording more than 15 mm below the long-term annual mean (**Figure 2-2**) (BoM 2021). In 2011, rainfall was more than 130 mm greater than the long-term annual mean, and was attributed, in part, to the early onset of the monsoon season in northern Australia moving into the southeast. Rainfall recorded in 2013 and 2015 was only marginally higher (13 mm and 27 mm, respectively) than the long-term annual mean, and 2021 was 59 mm higher (**Figure 2-2**).

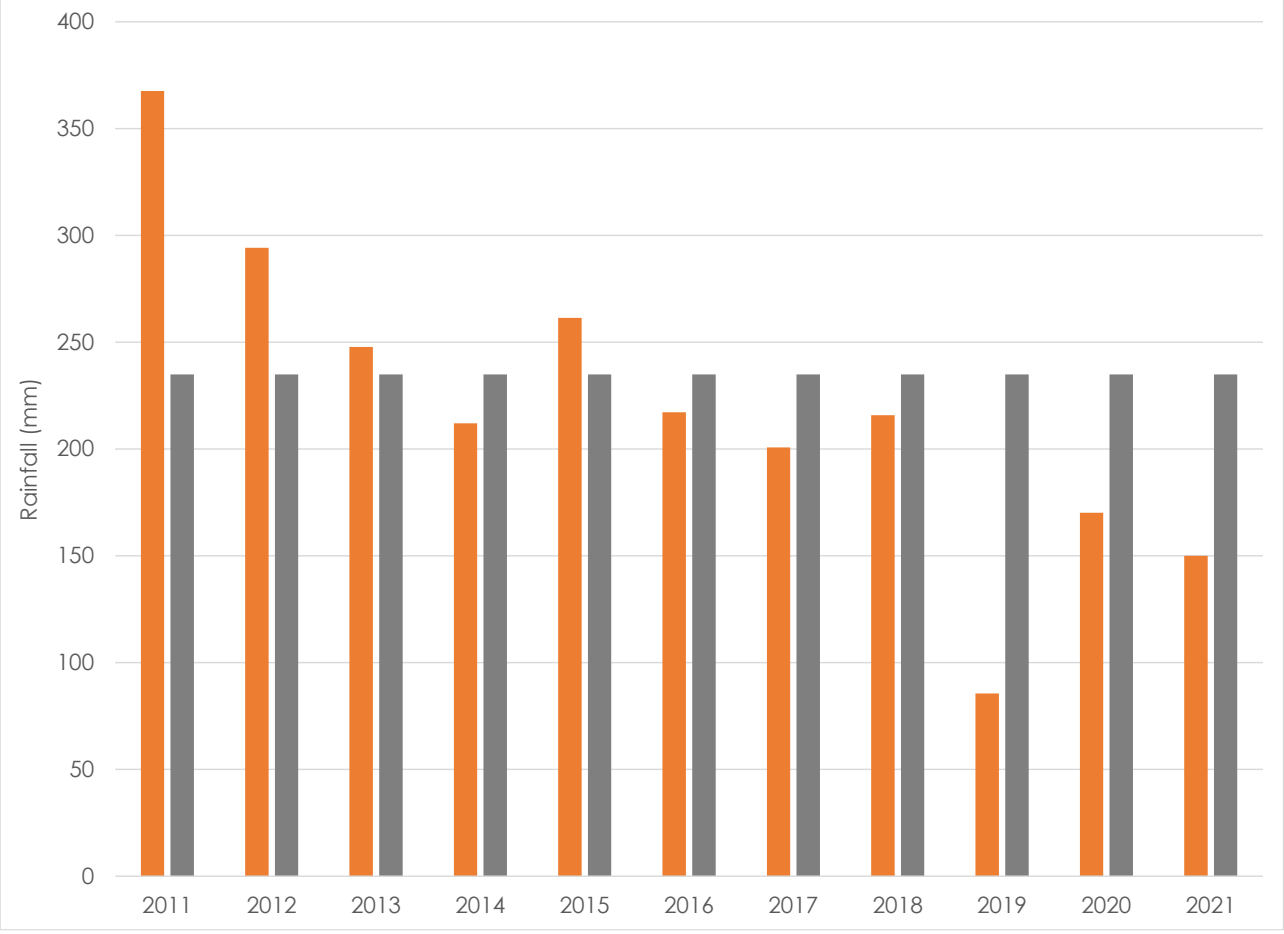


Figure 2-2: Annual rainfall (■) compared to long-term mean annual rainfall (■), 2011-2021.

2.6. Landforms, Geology and Soils

The geology of the Murchison region mainly consists of granite greenstone terrain of the Archean Yilgarn Craton and is characterised by hill ranges separated by large flat colluvial and alluvial plains (Curry *et al.* 1994). Granitic rocks contain quartz veins and dolerite dykes (Tille 2006). The greenstone belts have a north-west orientation, become more common in the east Murchison, and tend to be associated with areas of gneiss (Tille 2006). Soils are typically shallow, sandy and infertile and lie over red-brown siliceous hardpan in lower areas of the Murchison (Curry *et al.* 1994). Tille (2006) describes soils according to:

- Wash plains: red loamy earths and red-brown hardpan shallow loams with some red shallow loams. Red sandy earths and red deep sands occur on sandy banks.
- Sandplains: red sandy earths and red deep sands, with some red loamy earths and calcareous loamy earths occurring in low lying areas. Yellow deep sands occur in the south-west.
- Mesas: dominated by red shallow loam, red shallow sandy duplexes and red shallow sands with some stony soils and red/brown non-cracking clay.
- Hilly terrain: dominated by red shallow loams, stony soils and red shallow sands with some bare rock and red shallow sandy duplexes. Stony Plains are dominated by red shallow loams with red shallow sandy duplexes with red shallow sand on plains over granite. Red-brown hardpan shallow loams, calcareous loamy earths and red loamy earths are also present.
- Valley floors: mainly salt lake soils with some deep red sand with some red deep sandy duplexes, red/brown non-cracking clays, red shallow sandy duplexes and red-brown hardpan shallow loams mainly occurring on north-west floodplains. Calcareous shallow loams occur on calcrete platforms.

The Survey Area comprises three geological units; Cenozoic alluvium (74255), Archean mafic volcanics (76501) and Archean granites (76508) and occurs within soil landscape zone 333 and zone 2423.

2.7. Land Systems

Land systems are defined as an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation (Tille 2006). An assessment of land systems provides an indication of the occurrence and distribution of fauna habitats and vegetation within and surrounding the Survey Area (Purdie et al. 2004). Land systems across the Murchison have been mapped by the Natural Resources Assessment Group of the Department of Primary Industries and Regional Development (DPIRD) (formerly the Department of Agriculture). This mapping provides a comprehensive description of biophysical resources within the area (Purdie et al. 2004). The Survey Area lies within two land systems; the Carnegie System and the Yanganoo System **(Table 2-1**, **Figure 2-3**).

Table 2-1: Land systems and their extent within the Survey Area.

Land System		Description	Extent within Survey Area	
			Area (ha)	Proportion (%)
Yanganoo System	272Yg	Almost flat hardpan wash plains, with or without small wanderrie banks and weak groving; supporting mulga shrublands and wanderrie grasses on banks.	53.70	64
Carnegie System	273Ca	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.	30.67	36
Total			84.27	100

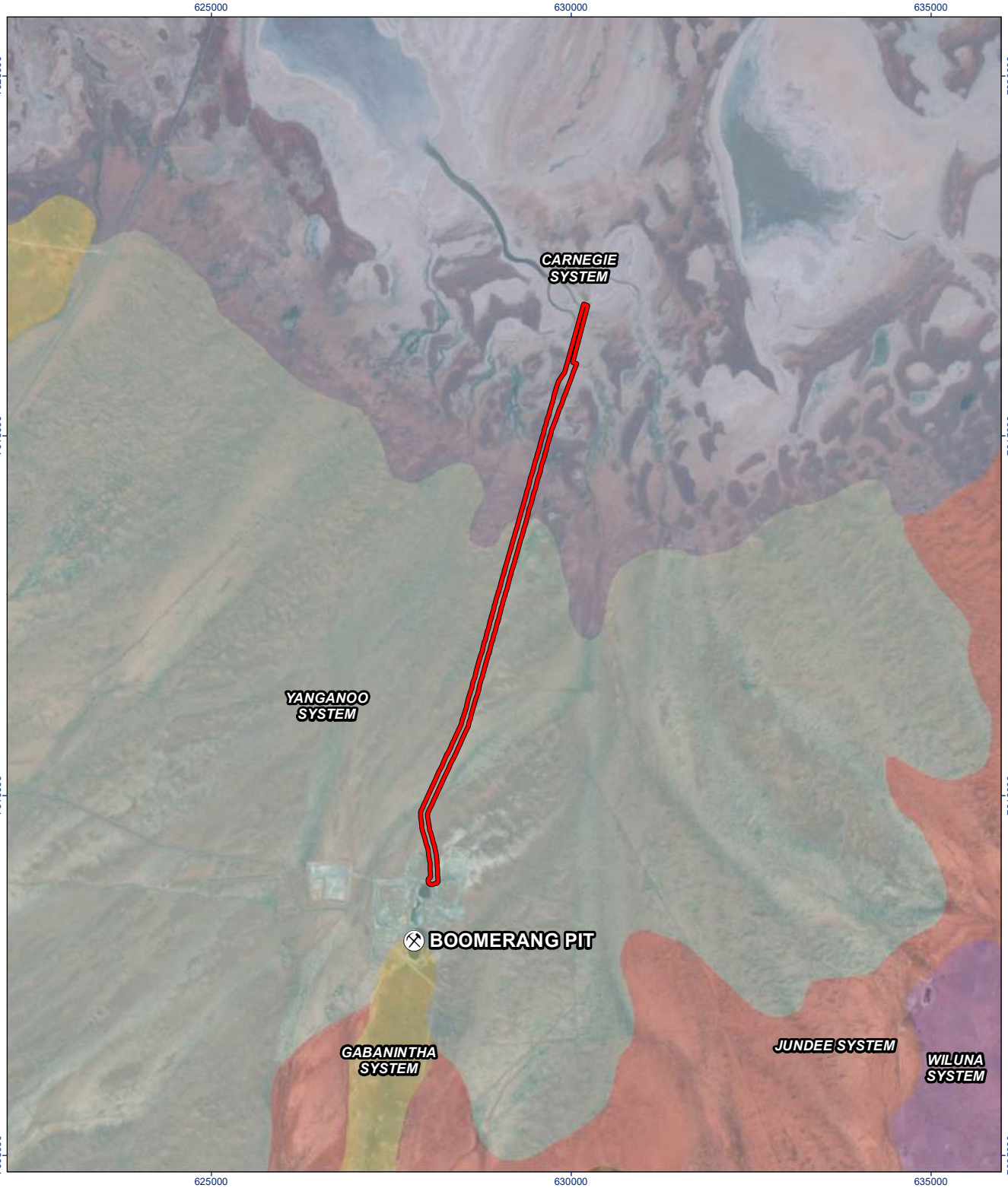
2.8. Pre-European Vegetation

The vegetation of Western Australia was mapped on a broad scale (1:1,000,000 and 1:250,000) by Beard (1975), who characterised and described a state-wide mapping and vegetation classification system based on geographic, geological, soil, climate, structure, life form and vegetation characteristics. Beard's vegetation associations were re-assessed by Shepherd *et al.* (2002) to account for clearing in the intensive land use zone, and to divide some larger vegetation units into smaller units. Vegetation system associations described by Shepherd *et al.* (2002) correspond with that of Beard (1975).

Two vegetation association systems intersect the Survey Area (**Table 2-2**, **Figure 2-4**); Wiluna 18 and Upper Murchison 1128. The Wiluna association comprises low woodland; Mulga (*Acacia aneura*), while the Upper Murchison association comprises a mosaic of succulent steppe with open scrub, scattered *Acacia sclerosperma* and *Acacia ramulosa* over saltbush and bluebush.

Table 2-2: Vegetation system associations and extent within the Survey Area.

System	System Code	Structure Description	Remaining Extent within Survey Area	
			Area (ha)	Area (%)
Wiluna	18	Low woodland, open low woodland or sparse woodland	54.8	65
Upper Murchison	1128	Succulent steppe bluebush and saltbush / samphire	29.47	35
Total			84.27	100



Survey Area

Land Systems

- Carnegie System
- Gabanintha System
- Jundee System
- Wiluna System
- Yanganoo System

0 1,000 2,000 m

(At original document size of A4)
1:80,000

N

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
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3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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IR by BH on 2021-12-09

Client/Project
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

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Title
Land Systems

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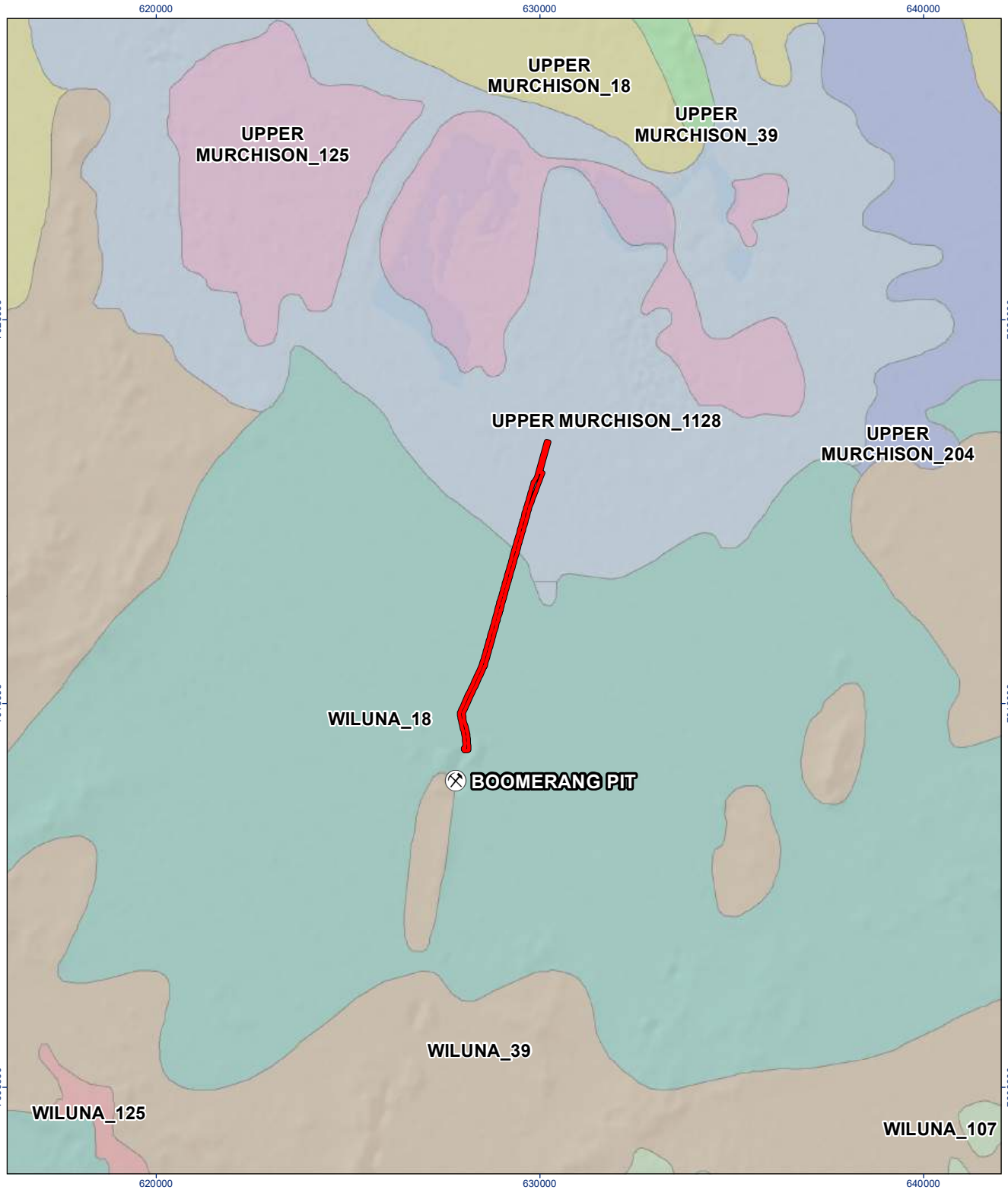

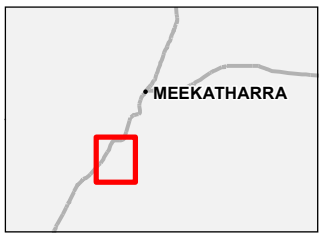

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
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Survey Area

Pre-European Vegetation

- UPPER MURCHISON_1128
- UPPER MURCHISON_125
- UPPER MURCHISON_18
- UPPER MURCHISON_204
- UPPER MURCHISON_39
- WILUNA_107
- WILUNA_125
- WILUNA_18
- WILUNA_39

0 2 4 km

(At original document size of A4)
1:150,000

N

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Level 1 Flora and Fauna Study

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Title
Beard's (Pre-European) Vegetation

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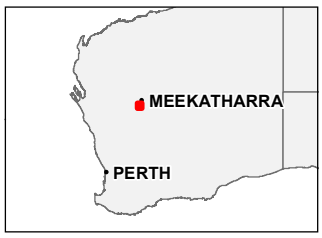
2.9. Surface Water and Hydrology

Drainage within the Murchison bioregion is generally endorheic with surface runoff draining to regional salt lakes and ultimately to the west towards the coast via the Murchison River and Wooramel River (Cowan *et al.* 2001). Boomerang Open Pit is situated within the Murchison River drainage basin which drains a catchment of approximately 104,818 km^2. The Lake Annean sub-catchment is drained by the Hope River which originates within Lake Annean and flows to the northwest when it joins the Yalgar River more than 80 km downstream. The Yalgar River flows into the Tierabb Creek / Ord River for a short distance before joining the Murchison River more than 100 km downstream. Apart from some drainage occurring in this way, a substantial volume of drainage across the subregion generally occurs into salt lakes (Cowan *et al.* 2001).

Numerous ephemeral watercourses and salt lakes occur within proximity to the Boomerang Open Pit, with Lake Annean located approximately 6 km to the north (**Figure 2-5**), and surface runoff from the Boomerang Open Pit draining towards this system via sheet flow and/or minor local waterways. The sub-catchment is characterised by low relief with slow drainage through this salt lake system. Salt lakes are the remnants of Tertiary drainage channels (palaeochannels) that would only function during periods of excessive rainfall, during which time the playas may connect; Lake Annean is part of the Hope Palaeochannel.



Survey Area
Minor Watercourse
Waterbodies

0 2.5 5 km

(At original document size of A4)
1:200,000

N

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Project Location
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Perth, Western Australia

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Client/Project
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Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title

Regional Surface Hydrology

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021).
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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3. Methods

3.1. Desktop Assessment

A desktop assessment, comprising database searches and a literature review, was undertaken to gather contextual information on the Survey Area. The purpose of the desktop assessment was to identify terrestrial flora, vegetation and fauna with the potential to occur within the vicinity of the Survey Area, particularly species of significance. Significance classification and rankings used under the BC Act and/or EPBC Act are defined in **Appendix A**. Aquatic vertebrate fauna, aquatic invertebrate fauna, subterranean fauna, short-range endemic fauna and terrestrial invertebrate fauna, not listed under the BC Act or the EPBC Act, have not been assessed within this report. However, a summary of these results recorded by the desktop assessment have been included in **Appendix B**, as well as a brief summary on their likelihood of occurrence based on habitats present within the Survey Area.

3.1.1. Database Searches

Database searches were undertaken to generate a list of vascular flora, vegetation communities and vertebrate fauna previously recorded within, and in the vicinity of, the Survey Area with an emphasis on species and communities of significance and introduced species. Six databases from three authorities (DAWE; Department of Biodiversity, Conservation and Attractions (DBCA); Birdlife Australia) were interrogated with search area buffers applied as per **Table 3-1**.

Table 3-1: Database searches conducted for the desktop assessment.

Authority	Database	Ecological Group	Reference	Central Coordinates	Buffer (km)
DAWE	Protected Matters Search Tool	Flora and fauna	DoAWE (2020b)	50J 628694 7011540	40
DBCA	NatureMap	Flora and fauna	DBCA (2021c)	50J 628694 7011540	40
	Threatened and Priority Ecological Communities	Vegetation communities of significance	DBCA (2021a)	Survey Area boundary	50
	Threatened and Priority Flora	Significant flora	DBCA (2021d)	Survey Area boundary	50
	Western Australian Herbarium	Significant flora	WAH (2021)	Survey Area boundary	50
	Threatened and Priority Fauna	Significant fauna	DBCA (2021b)	Survey Area boundary	50
BirdLife Australia	Birdata	Fauna (waterbirds)	Birdlife Australia (2018)	50J 606915 7038827 (NW corner) 50J 656065 7008675 (SW corner)	n/a^

Note: ^ indicates a polygon around Lake Annean was searched.

3.1.2. Literature Review

Background information on the Survey Area and surrounds was compiled prior to conducting the field survey. Historic vegetation mapping (Beard 1975, Shepherd *et al.* 2002), soil and landform mapping and characteristics (Curry *et al.* 1994, Pringle *et al.* 1994, Tille 2006) and IBRA classification system information (Cowan *et al.* 2001, Thackway and Cresswell 1995) were reviewed to identify broad contextual information. The literature review also considered previously completed surveys of relevance to the Survey Area, if they were publicly available, recently conducted, and/or located within or in close proximity to the Survey Area.

3.1.3. Likelihood of Occurrence

The likelihood of occurrence of each species of significance that was identified from the database searches was assessed in relation to the Survey Area. Rankings were assigned using the definitions and criteria provided in **Table 3-2**.

Table 3-2: Criteria for assessing the likely presences of significant flora and fauna.

Likelihood: Confirmed
The species has been recorded unambiguously (i.e. during recent assessments of the Survey Area or from reliable records obtained via database searches or from current vouchered specimen at WA Herbarium) in the Survey Area.
Likelihood: Likely
There is a medium to high likelihood that the species occurs in the Survey Area as it occurs within the known distribution of the species, contains suitable habitat (either year-round or intermittently, such as temporary water sources or features that are only relied upon during certain times of the year e.g. breeding caves, for fauna) and the species has been recorded recently nearby.
Likelihood: Possible
There is a potential for the species to occur in the Survey Area, as: The species has been recorded recently nearby; however: • the species may not have been detectable during current or previous studies (e.g. rare, patchily distributed, highly mobile (fauna), non-optimal survey timing). • the species is known to be cryptic and may not have been detectable despite extensive studies. The species has been recorded recently nearby and species presence cannot be ruled out due to factors such as species ecology or distribution; however: • doubt remains over taxonomic identification. • the majority of habitat does not appear suitable. • coordinates are doubtful.
Likelihood: Unlikely
The species is unlikely to occur in the Survey Area as: • the species has not been recorded locally through DBCA database searches; • the Survey Area lacks potential or critical habitat, supporting at best marginally suitable habitat, and/or being severely degraded; • only recorded from a few historic record/s and no other collections in the area; and • the species has not been recorded in the Survey Area despite adequate survey effort, such as a standardised methodology or targeted searching within potentially suitable habitat.

3.2. Field Survey

3.2.1. Survey Timing

The EPA (2016a) recommends that flora and vegetation surveys be undertaken following the season of highest rainfall to optimise the likelihood of encountering flowering and fruiting taxa and capturing ephemeral species. The recommended survey timing for the Eremaean Botanical Province, within which the Survey Area lies, is six to eight weeks following the wet season (March to June). The EPA (2020) provides recommended survey timing for targeted mammal, reptile, amphibian and bird surveys; however, there is no defined period for undertaking basic fauna surveys, although it is acknowledged that surveying for birds should occur following rainfall events. The field survey was undertaken on the 9th and 10th of November 2021, which falls outside of the recommended flora survey season for the region. Further detail on timing relative to climate is provided in Section 2.5.

A total of 168 mm of rainfall was recorded at the Meekatharra Airport in the 12 months preceding the field survey (Figure 3-1) (BoM 2021), with 42 mm recorded in the six months prior to the field survey, with both values more than 50% less than the equivalent long-term mean (BoM 2021). The first significant rainfall event of 2021 occurred in May, seven months prior to the field survey, with 57 mm recorded (Figure 3-1).

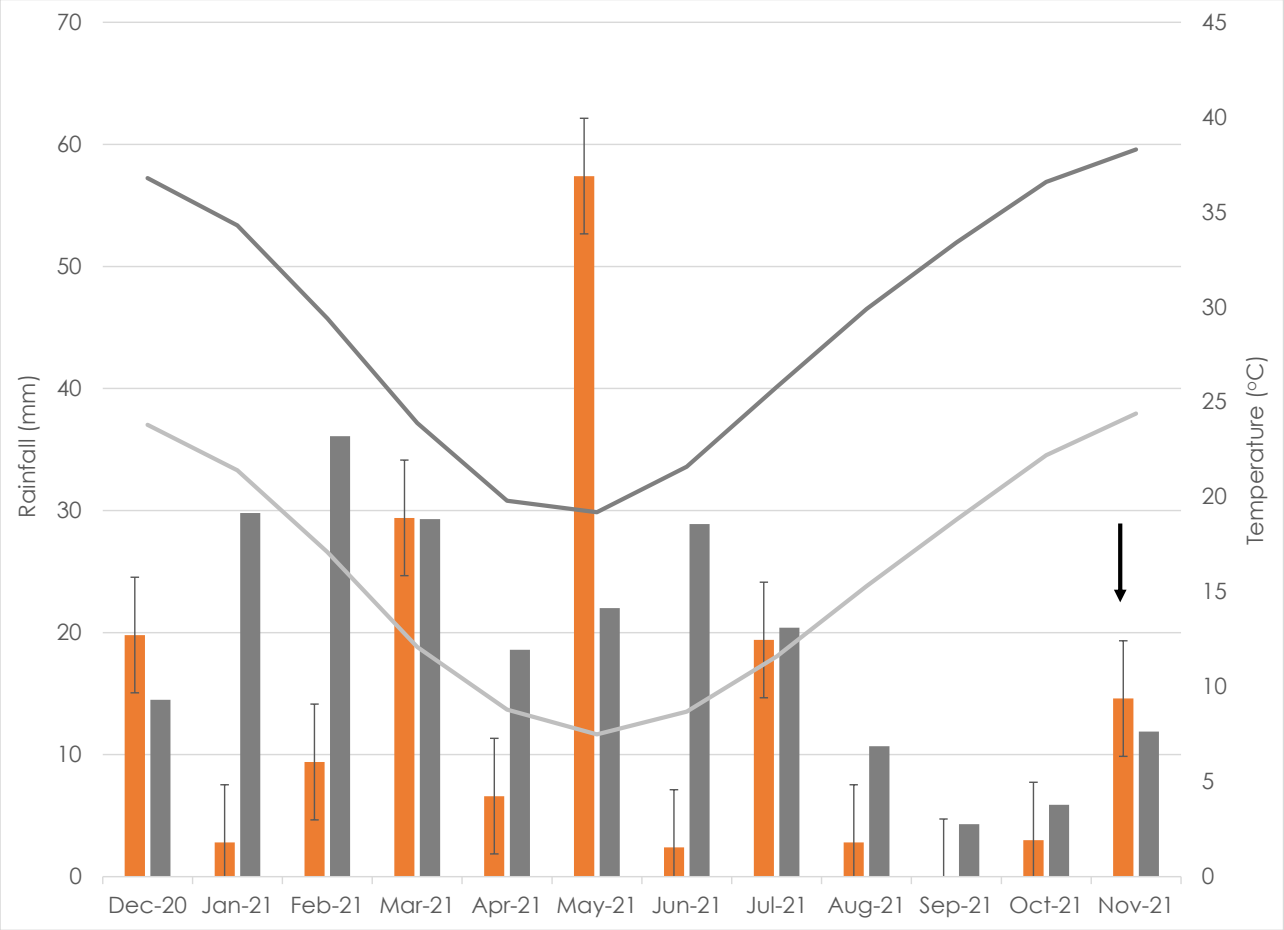

Figure 3-1: Monthly rainfall data ( ) for 12 months prior to the field survey compared to long-term mean monthly rainfall ( ), and long-term mean minimum and maximum temperatures, for the Meekatharra Airport (station number 7045) (Note: arrow indicates timing of the field survey).

3.2.2. Survey Team and Licensing

The field survey was undertaken by Stantec scientists Brooke Hay (Principal Environmental Scientist; 16 years' experience) and Samantha Girvan (Zoologist; 4 years' experience). All plant collections were made under flora collecting permit FB62000382 pursuant to Regulation 62 of the Biodiversity Conservation Regulations 2018. Taxonomic identification of collected vascular flora specimens were undertaken at the Western Australian Herbarium (WAH) by Dr Kelly Shephard (*Tecticornia* specimens) and Senior Taxonomist Sharnya Thomson (all other specimens).

3.2.3. Flora and Vegetation Assessment

Eight relevé (unbounded sample sites) locations were identified in the field in accordance with spatial changes in vegetation. These were sampled to compile a representative species list of the Survey Area and to characterise the vegetation types present. The location of each relevé is shown in **Figure 3-2**, and the raw data from each relevé is presented in **Appendix C**. **Table 3-3** presents the data that was recorded at each relevé.

Table 3-3: Summary of data collected at each relevé.

Parameter	Description
Relevé ID	The unique name that was assigned to the relevé that was sampled
Recorder and Date	The recorder(s) involved in sampling the relevé and date
Coordinates	Measured using a handheld GPS device (in GDA94 format)
Site photograph	At least one landscape photograph taken of the site
Soil description	A description of the soil colour and types based on the guide in the Australian Soil and Land Survey Field Handbook
Geology type	A description of the outcropping geology (if present) and course fragments
Habitat type	A description of the landform type and aspect
Vegetation Condition	Assessed according to the Trudgen vegetation condition scale (**Appendix D**).
Vascular flora species	A record of each flora species present
Height	The average height of each species in meters
Percent Foliar Cover (PFC)	An estimate of the PFC for each species will be recorded
Vegetation structure	A description of the vegetation in accordance with the National Vegetation Information System (NVIS), Level 5 – Association (NVISTWG 2017) based on height and foliar cover of strata (**Appendix E**).
Disturbances	A list of any disturbances in the relevé area, if present.
Time since fire	An estimation of the time since the vegetation was last burnt.

Survey Area

Relevé

0 670 1,340 m

(At original document size of A4)
1:50,000

N

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Notes

1. Coordinate System: GDA 1994 MGA Zone 50

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Project Location
Stantec Australia Pty Ltd
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Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title

Relevé Sampling Sites

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3.2.3.1. Vegetation Type and Condition Mapping

The broad vegetation type mapping that was completed during the desktop assessment was refined on maps in the field, where necessary, as a result of ground-truthing. Vegetation types were delineated and described from aerial imagery utilising the quadrat and mapping note data. The vegetation types have been described to Level V (Vegetation Association) in the NVIS hierarchical structure (ESCAVI 2003) (**Appendix E**). Vegetation condition was assigned based on the six categories described by Trudgen (1988) (**Appendix D**).

3.2.3.2. Targeted Survey

Targeted searches were conducted for significant flora identified from the desktop assessment. Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before the survey and actively searched for them in, and around relevés, and while traversing the Survey Area. Where flora of significance, or suspected significance, was identified, a record of its occurrence was made and a specimen was collected. The information summarised in **Table 3-4** was collected for each population of significant flora identified in the field.

Table 3-4: Summary of data collected for significant flora species encountered.

Parameter	Description
Coordinates	Measured using a handheld GPS device (GDA94 format).
Recorder and Date	The recorder(s) involved in sampling the site and date.
ID of individual or pop	The unique name that was assigned to the individual or population that was sampled.
Species	Species name.
Specimen ID	A unique identifier code will be assigned to any species that cannot be identified in the field.
Abundance	A count of the species in a 50 m x 50 m area; or
	Estimate of density (PFC) within a mapped polygon (for large populations).
Reproductive characteristics	Whether the species is fruiting, flowering, vegetative.
Photograph	A photograph of the species showing reproductive characteristics (if present) and habitat/form.

3.2.4. Terrestrial Fauna Assessment

3.2.4.1. Terrestrial Fauna Habitat Assessment

The Survey Area was traversed on foot with major fauna habitat types being described and delineated in the field based on landforms and vegetation types. Fauna habitat assessments were undertaken within the Survey Area, with the key habitat parameters recorded presented in **Table 3-5**.

Habitat was also assigned an extent within the landscape and its significance to fauna species, according to the following criteria:

- distribution/extent: whether the habitat was widespread and common within the surrounding region, or whether the habitat was categorised as being of limited extent; and
- significance: whether the habitat was considered important to species of significance, or distinct fauna assemblages, or whether the habitat was categorised as being of limited significance.

3.2.4.2. Opportunistic Records

The Survey Area was traversed on foot to detect significant fauna. All opportunistic fauna observations were also recorded to develop a fauna species list for the Survey Area.

Table 3-5: Summary of data collected at each fauna habitat assessment site.

Parameter	Description
Habitat assessment ID	The unique name that was assigned to the site that was sampled.
Recorder and date	The recorder(s) involved in sampling the site and date.
Coordinates	Measured using a handheld GPS device (in GDA94 format).
Site photograph	At least one representative photograph taken of the site.
Tree presence	A comment on any hollow-bearing trees and stag (dead) trees.
Refuges	A comment on the presence of any fauna refuges e.g. burrows.
Substrate	A description of the composition of the substrate and percentage of leaf litter.
Wetland habitat	Whether the site is part of any wetland habitat such as drainage lines, sumplands or floodplain.

3.3. Taxonomy and Nomenclature

The flora taxa that could not be identified in the field were collected and pressed for identification by senior taxonomist and Stantec sub-consultant, Sharnya Thomson. Sharnya has worked extensively in Western Australia and is highly experienced with the flora of the Eremaean Botanical Province. *Tecticornia* specimens were sent to specialist Dr Kelly Shepherd (Senior Research Scientist at the Western Australian Herbarium (WAH)) for identification. Species nomenclature was assigned according to the current listing of scientific names recognised by the WAH. Where specimens lacked diagnostic characteristics or were in poor condition, they were assigned the 'sp.' epithet, indicating that identification could not be confirmed beyond genus level.

Fauna taxonomy is dynamic, due to the ongoing description and revision of new species, and the increased understanding of the relationships between taxa through genetic and morphological studies. The nomenclature and taxonomy of all vertebrate fauna in this report follows the Checklist of the Vertebrates of Western Australia (WAM 2021). Vertebrate fauna species were identified in the field, as required, using standard field guides or scientific publications for:

- mammals (Menkhorst and Knight 2011, van Dyck *et al.* 2013, van Dyck and Strahan 2008);
- birds (Menkhorst *et al.* 2017, Pizzey and Knight 2012);
- reptiles (Wilson and Swan 2013);
- amphibians (Cogger 2014, Tyler and Doughty 2009); and
- scats, tracks and other traces (Moseby *et al.* 2009, Triggs 2004).

4. Results and Discussion

4.1. Desktop Assessment

Six existing reports were available containing information on the terrestrial flora, vegetation and fauna in proximity to the Survey Area, summarised in **Table 4-1**.

Table 4-1: Summary of relevant flora, vegetation and fauna surveys in the vicinity of the Survey Area.

Project	Study Details	Survey Effort		Significant Communities	Significant Species.	
		Flora	Fauna		Flora	Fauna

Nannine Mining Area Reconnaissance Flora and Level 1 Fauna Assessment (Spectrum Ecology 2020b)	Location:
	Nannine 30 km south of Meekatharra
	Survey Type:
	Level 1 Flora and Fauna Survey
	Survey Date:
	19 – 21 April 2020
		• 10 relevés
		• Targeted searches
		• Opportunistic collections
			• 10 fauna habitat assessments
			• Opportunistic records
				• No TECs
				• Two PECs; Polelle Calcrete (P1) and Austin Land System (P3)
				• In proximity to Lake Annean (ESA / nationally important wetland)
					• 68 taxa from 19 families
					• No Threatened or Priority taxa recorded
					• One potential new taxon; *Tecticornia* sp. nov
						• Five broad fauna habitat types
						• 31 fauna species recorded:
						  ○ four mammals
						  ○ 26 birds
						  ○ one reptile

Aladdin Project: Reconnaissance Flora and Fauna Assessment (MWH 2017)	Location:
	33 km south of Meekatharra
	Survey Type:
	Level 1 Flora, Vegetation and Fauna Survey
	Survey Date:
	31 January - 2 February 2017
		• 17 relevés	• Nine fauna habitat assessments
			• Targeted searches
				• No TECs/PECs within the Survey Area
				• One PEC occurs within the Survey Area; small area of buffered Polelle Calcrete PEC partially located across the eastern section in association with Lake Annean
				• In proximity to the Lake Annean ESA / nationally important wetland
					• 105 flora taxa from 50 genera and 24 families
					• One confirmed P3 species; *Tecticornia cymbiformis*
					• One potential P4 species; *Dodonaea ?amplisemina*
					• Two potentially new taxa; *Tecticornia* sp. nov and *Eremophila* sp. nov
						• Five broad fauna habitat types
						• 22 vertebrate fauna species:
						  ○ 6 mammals
						  ○ 12 birds
						  ○ 4 reptiles

Culculli and Paddy Italiano Level 1 Flora, Vegetation and Fauna Assessment (MWH 2016a)	Location:
	50 km south of Meekatharra
	Survey Type:
	Level 1 Flora, Vegetation and Fauna Survey
	Survey Date:
	5 - 8 April 2016
		• 15 relevés	• 16 fauna habitat assessments
			• 20-minute targeted searches at all 16 sites
				• No TECs/PECs
				• In proximity to Lake Annean (ESA / nationally important wetland)
					• 83 taxa from 20 families
					• No Threatened or Priority taxa recorded
						• Three broad fauna habitat types
						• 33 fauna vertebrate species recorded:
						  ○ three mammals
						  ○ 25 birds
						  ○ five reptiles

Gibraltar and Five Mile Well Project Areas Level 1 Flora and Fauna Assessment (MWH 2016b)	Location:
	14 km south-west of Meekatharra
	Survey Type:
	Level 1 Flora, Vegetation and Fauna Survey
	Survey Date:
	13 - 17 June 2016
		• 22 relevés	• 22 fauna habitat assessments
			• Targeted searches
			• Opportunistic records
				• No TECs/PECs within the Survey Area
				• In proximity to the Lake Annean ESA / nationally important wetland
					• 146 flora taxa from 47 genera and 27 families
					• No Threatened or Priority taxa recorded
						• Four broad fauna habitat types
						• 44 vertebrate fauna species:
						  ○ six mammals
						  ○ 35 birds
						  ○ three reptiles

CMGP Reedy Project Dewatering Program - Level 1 Flora and Fauna Survey (MWH 2015a)	Location: 60 km northeast of Cue Survey Type: Level 1 Flora and Fauna Survey Survey Date: 15 - 20 April 2015	• 19 relevés	• Eight fauna habitat assessments • Targeted searches	• No TECs/PECs • In proximity to Lake Annean (ESA / nationally important wetland) • One vegetation unit of local significance (ApEpAk) due to presence of *Ptilotus beardii* (P3)	• 101 flora taxa from 27 families • One P3 species; *Ptilotus beardii* • Three introduced taxa	• Five broad fauna habitat types • No fauna species recorded

Lake Annean Flora and Fauna Assessment (MWH 2015b)	Location:
	35 km south-southwest of Meekatharra
	Survey Type:
	Level 1 Flora and Fauna Survey
	Survey Date:
	14 – 17 July 2015
		• 29 relevés	• Seven fauna habitat assessments
			• Targeted searches
			• Opportunistic records
				• No TECs/PECs
				• In proximity to Lake Annean (ESA / nationally important wetland)
					• 105 flora taxa from 28 families
					• No Threatened or Priority taxa
						• Five broad fauna habitat types
						• One P1 species; Meekatharra Slider (*Lerista eupoda*)
						• 29 vertebrate fauna species:
						  ○ five mammals
						  ○ 17 birds;
						  ○ six reptiles
						  ○ one amphibian

4.1.1. Flora

A total of 27 significance flora taxa were recorded by the database searches as occurring within 50 km of the Survey Area (**Figure 4-1**), including one Threatened flora taxa (T / CR), four Priority 1 (P1), one P2, 18 P3 and three P4 (**Appendix F**). Two of these 27 species have been recorded during previous surveys within the vicinity of the Survey Area. These included one record of *Ptilotus beardii* (P3) from a single location within the Reedy Project area (MWH 2015a) and one record of *Tecticornia cymbiformis* (P3) from the Aladdin Project area (MWH 2017). A further four taxa with the potential to be significant have previously been recorded in the vicinity of the Survey Area (>10 km from the Survey Area) including *Dodonaea ?amplisemina* (P4) (MWH 2017), *Eremophila* sp. nov (novel taxon) (MWH 2017) and potentially two *Tecticornia* sp. nov (novel taxa) (MWH 2017, Spectrum Ecology 2020b).

Prior to the field survey, seven taxa were considered 'Unlikely' to occur, 11 flora taxa were considered 'Possible' to occur and two species were considered 'Likely' to occur (Appendix F); *Ptilotus beardii* (P3) and *Tecticornia cymbiformis* (P3). It was considered 'Possible' that one Threatened flora taxon may occur within the Survey Area (**Appendix F**).

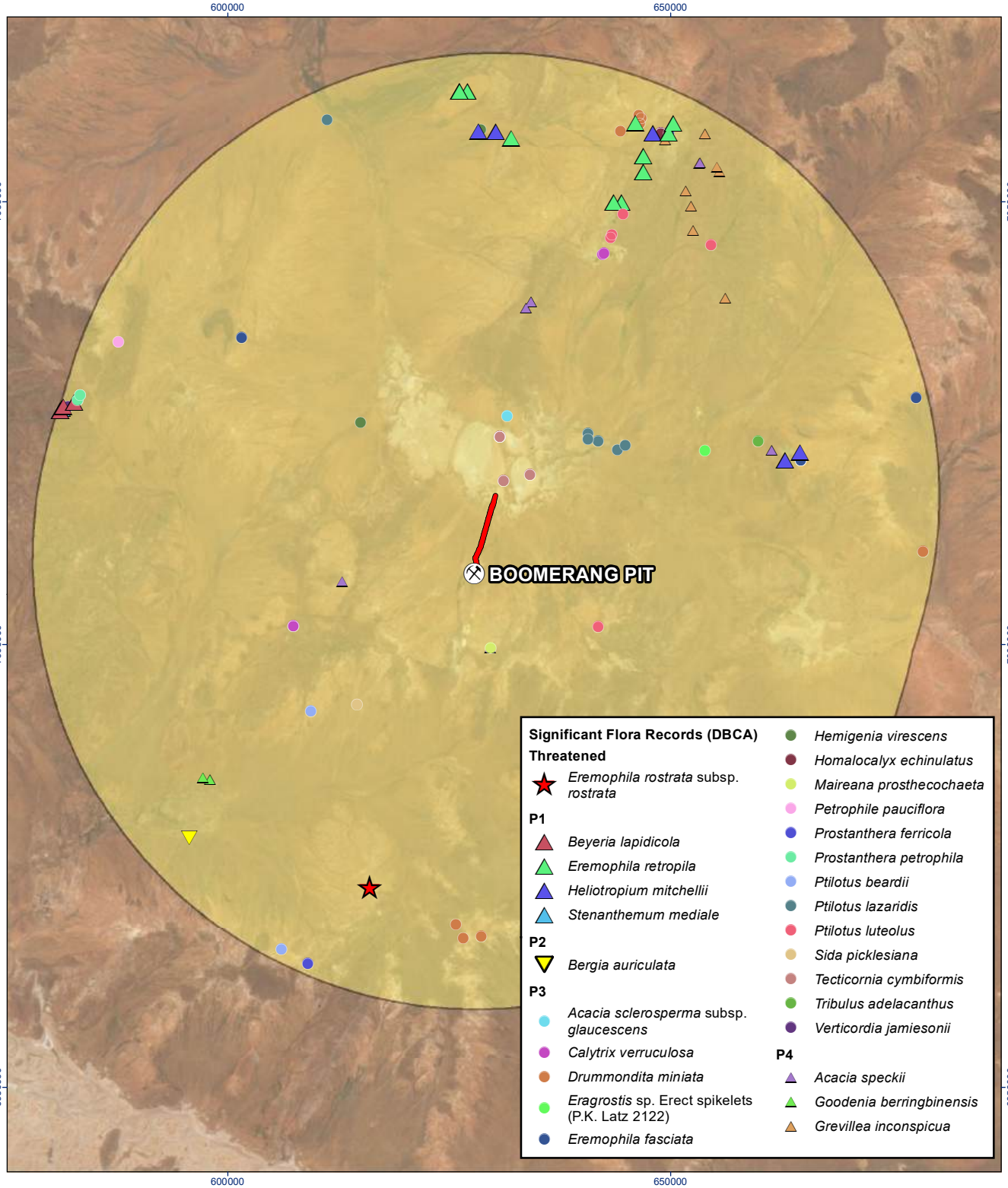
Dodonaea ?amplisemina (P4) could not be confirmed as the specimen was sterile (MWH 2017). *Eremophila* sp. nov may represent a new species more plant material was required to make a formal determination (A. Brown, pers. comm., WAH) (MWH 2017). MWH (2017) and Spectrum Ecology (2020b) and both recorded *Tecticornia* sp. nov which were considered to have affinity with *Tecticornia undulata* and *Tecticornia halocnemoides* with large seed aggregates, respectively (Dr. K. Shepherd, pers. comm., WAH).

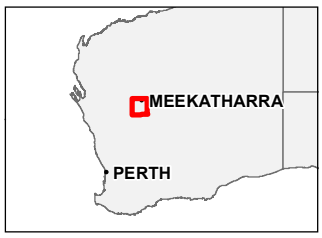
4.1.2. Vegetation

There were four PECs recorded by the database searches located within 50 km of the Survey Area (**Table 4-2**), with the nearest (Austin Land System; P3) located 7 km away from the Survey Area (**Table 4-2**).

Table 4-2: PECs located within 50 km of the Survey Area.

Community	Conservation Status	BC Act	Distance from the Corridor
Weld Range BIF	P1	Weld Range vegetation complexes (banded ironstone formation)	>40 km
Austin Land System	P3	Saline stony plains with low rises and drainage foci supporting low halophytic shrublands with scattered mulga and snakewood.	>7 km
Trillbar Land System	P3	Gently sloping stony plains with low rises of metamorphic rocks and gilgaied drainage foci; supporting shrublands of snakewood, mulga, bluebush, and samphire with patches of tussock grassland	>29 km
Yagahong Land System	P3	Gently sloping stony plains with low rises of metamorphic rocks and gilgaied drainage foci; supporting shrublands of snakewood, mulga, bluebush, and samphire with patches of tussock grassland.	>10 km





Survey Area

50km Buffer of the Survey Area

0 7.5 15 km

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N

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2022).
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

WESTGOLD

Project Location
Stantec Australia Pty Ltd
Perth, Western Australia

Prepared by FW on 2021-12-09
TR by DK on 2021-12-09
IR by BH on 2021-12-09

Client/Project boom_ff_2021_01
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title
Location of Significant Flora Records from the Desktop Assessment

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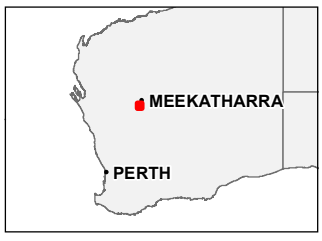

Survey Area

Threatened and Priority Ecological Communities

- Austin Land System (P3)
- Polelle Calcrete (P3)
- Yagahong Land System (P3)

0 2.5 5 km

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Notes

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boom_ff_2021_01

Title

Threatened and Priority Ecological Communities

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4.1.3. Terrestrial Fauna Habitat

Ephemeral wetland habitat and salt lakes are likely to be of significance for fauna within the Murchison region, particularly waterbird species and migratory shorebird species during flooded conditions. In addition to these, samphire communities (salt-tolerant succulent plants) are a key habitat type within the region, providing important foraging and breeding habitat for birds migrating to Lake Annean. Previous surveys of the eastern and western areas of the Murchison bioregion, including the Reedy Project (MWH 2015a), Gibraltar and Five Mile Well Projects (MWH 2016b), Lake Annean Project (MWH 2015b), Nannine Project (Spectrum Ecology 2020b), Culculli and Paddy Italiano Projects (MWH 2016a), and the Aladdin Project (MWH 2017), recorded the following broad habitat types:

- Chenopod Shrubland;
- Drainage Line;
- Dunefield;
- Ironstone Hill;
- Lake Playa;
- Mulga Woodland/Plain;
- Open Eremophila Shrubland;
- Open Plain;
- Quartz Shrubland/Outcrop;
- Rocky Outcrop;
- Samphire;
- Stony Plain; and
- Stony Rise.

4.1.4. Terrestrial Fauna

The desktop assessment identified a total of 241 terrestrial fauna taxa, including introduced species, which have been recorded and/or have the potential to occur within the Survey Area (**Appendix G**). This comprised:

- 17 native mammals;
- seven introduced mammals;
- 159 native birds;
- two introduced birds;
- 49 native reptiles;
- five native amphibians; and
- two native arthropods.

Many of these species are unlikely to occur in the Survey Area as these records have been collected from a large area encompassing a wide range of habitats, many of which do not occur within the narrow Survey Area. Furthermore, some small, common, ground-dwelling reptile and mammal species tend to be patchily distributed even where appropriate habitat is present, and many bird species can occur as migrants, occasional visitors or vagrants.

Of the 241 terrestrial fauna taxa identified by the desktop assessment, 26 species are listed as being of significance, comprising two arthropods, 22 birds, one mammal and one reptile (**Table 4-3**). The remaining taxa comprised five amphibians, 139 birds, 23 mammals (including introduced species) and 48 reptiles (**Appendix G**).

Table 4-3: Significant fauna identified by the desktop assessment.

Common Name	Species	Conservation Status	
		BC Act	EPBC Act
Mammals			
Long-tailed Dunnart	*Sminthopsis longicaudata*	P4	-
Birds			
Curlew Sandpiper	*Calidris ferruginea*	Cr	Cr; Mi
Night Parrot	*Pezoporus occidentalis*	Cr	En
Malleefowl	*Leipoa ocellata*	Vu	Vu
Grey Falcon	*Falco hypoleucos*	Vu	Vu
Blue-billed Duck	*Oxyura australis*	P4	-
Hooded Plover	*Thinornis rubricollis*	P4	-
Peregrine Falcon	*Falco peregrinus*	OS	-
Yellow Wagtail	*Motacilla flava*	Mi	Mi
Grey Wagtail	*Motacilla cinerea*	Mi	Mi

Common Name	Species	Conservation Status	
		BC Act	EPBC Act
Gull-billed Tern	*Gelochelidon nilotica*	Mi	Mi
Fork-tailed Swift	*Apus pacificus*	Mi	Mi
Caspian Tern	*Hydroprogne caspia*	Mi	Mi
Common Sandpiper	*Actitis hypoleucos*	Mi	Mi
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi	Mi
Pectoral Sandpiper	*Calidris melanotos*	Mi	Mi
Red-necked Stint	*Calidris ruficollis*	Mi	Mi
Oriental Plover	*Charadrius veredus*	Mi	Mi
White-winged Black Tern	*Chlidonias leucopterus*	Mi	Mi
Glossy Ibis	*Plegadis falcinellus*	Mi	Mi
Wood Sandpiper	*Tringa glareola*	Mi	Mi
Common Greenshank	*Tringa nebularia*	Mi	Mi
Marsh Sandpiper	*Tringa stagnatilis*	Mi	Mi
Reptiles			
West Coast Mulga Slider	*Lerista eupoda*	P1	-
Arthropods			
Shield-backed Trapdoor Spider	*Idiosoma nigrum*	En	Vu
Northern Shield-backed Trapdoor Spider	*Idiosoma clypeatum*	P3	-

Of the 26 significant terrestrial fauna taxa, two were considered 'Likely' to occur, 18 were considered 'Possible' to occur and six were considered 'Unlikely' to occur with:

- five listed as Cr, En or Vu under the BC Act and/or EPBC Act;
- five listed under the BC Act as Priority fauna;
- one listed under the BC Act as "other specially protected species"; and
- six listed as Migratory under the BC Act and/or the EPBC Act[1].

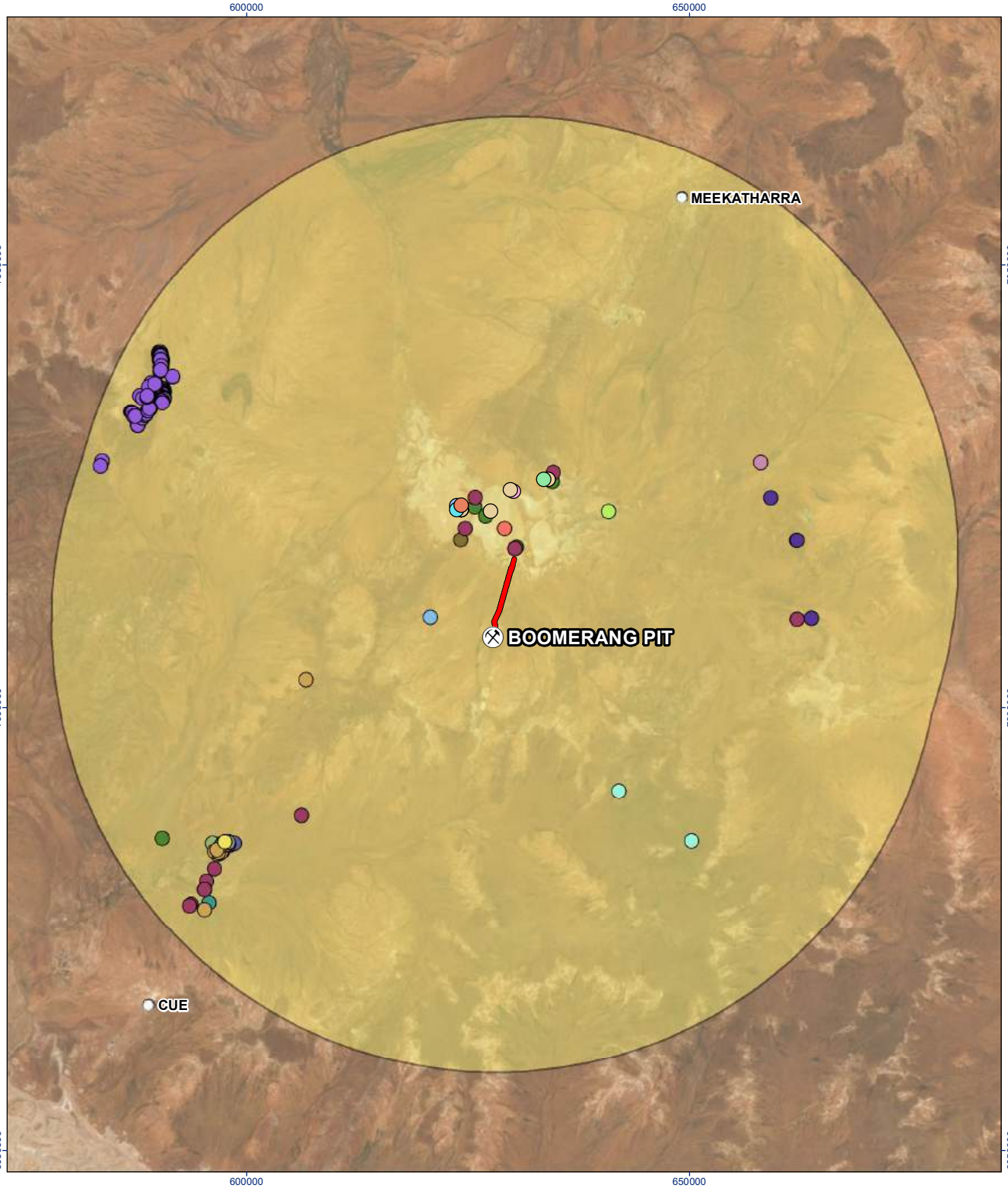
Significant terrestrial fauna species identified as being 'Likely' or 'Possible' to occur within, or immediately adjacent to, the Survey Area, particularly during periods of inundation of Lake Annean, are summarised in **Table 4-4** and include:

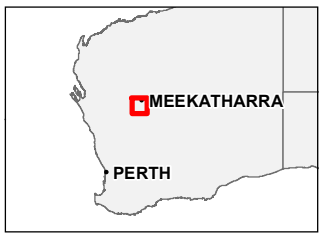
- Likely:
  - Peregrine Falcon; and
  - West Coast Mulga Slider.
- Possible:
  - Long-tailed Dunnart;
  - Curlew Sandpiper;
  - Hooded Plover;
  - Gull-billed Tern;
  - Fork-tailed Swift;
  - Caspian Tern;

[1] The Curlew Sandpiper (*Calidris ferrugnea*) is listed as both Cr and Mi under the EPBC Act.

- Common Sandpiper;
- Pectoral Sandpiper;
- Sharp-tailed Sandpiper;
- Red-necked stint;
- Wood Sandpiper;
- Marsh Sandpiper;
- Oriental Plover;
- Common Greenshank;
- Glossy Ibis;
- Shield-backed Trapdoor Spider; and
- Northern Shield-backed Trapdoor Spider.

While the Burrowing Bettong (*Bettongia lesueur graii*) was included within the NatureMap database search results, due to the presence of secondary signs within the search area likely to be remnants of an old burrow system that was created prior to species extinction, it is listed as Ex under the BC Act and the EPBC Act. Therefore, this species has been excluded from the desktop assessment as it only persists in translocated or island populations in areas with fox and feral cat exclusion (van Dyck and Strahan 2008).





Survey Area

50km Buffer of the Survey Area

Conservation Significant Fauna (DBCA)

- *Actitis hypoleucos* (MI,MI)
- *Apus pacificus* (MI,MI)
- *Branchinella simplex* (P1,)
- *Calidris acuminata* (MI,MI)
- *Calidris ferruginea* (CR,CR)
- *Calidris melanotos* (MI,MI)
- *Calidris ruficollis* (MI,MI)
- *Chlidonias leucopterus* (MI,MI)
- *Falco hypoleucos* (VU,)
- *Falco peregrinus* (OS,)
- *Gelochelidon nilotica* (MI,MI)
- *Hydroprogne caspia* (MI,MI)
- *Idiosoma clypeatum* (P3,)
- *Leipoa ocellata* (VU,VU)
- *Lerista eupoda* (P1,)
- *Oxyura australis* (P4,)
- *Plegadis falcinellus* (MI,MI)
- *Sminthopsis longicaudata* (P4,)
- *Thinornis rubricollis* (P4,)
- *Tringa glareola* (MI,MI)
- *Tringa nebularia* (MI,MI)
- *Tringa stagnatilis* (MI,MI)

0 8 16 km

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Notes

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boom_ff_2021_01
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Level 1 Flora and Fauna Study

Title

Location of Significant Fauna Records from the Desktop Assessment

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Table 4-4: Likelihood of significant fauna occurring within the Survey Area.

Common Name (Scientific Name)	Conservation Status		Key Threats and Reason For Listing	Habitat	Likelihood Of Occurrence and Reason For Likelihood
	BC Act	EPBC Act			
Mammals					
Long-tailed Dunnart (*Sminthopsis longicaudata*)	P4	-	Relatively little is known about the species distribution and biology (van Dyck and Strahan 2008); however, potential threats may include inappropriate fire regimes, habitat alteration by non-native herbivores and predations by Red Foxes and feral cats.	Rocky, hilly areas, occasionally open areas with a stony, rocky mantle on low open Mulga over spinifex and occasionally perennial grasses and cassias (van Dyck and Strahan 2008).	**Possible** The Survey Area is within the species range (van Dyck *et al.* 2013). However, *Triodia* sp., which form the microhabitat needed by Long-tailed Dunnart, were not mapped. Five records occur within 50 km, with the closest record ~30 km east of the Survey Area in 2017. (DBCA 2021b). As such this species is considered possible to occur.
Birds					
Curlew Sandpiper (*Calidris ferruginea*)	Cr	Cr; Mi	In Australia the Curlew Sandpiper's threatening processes include loss or fragmentation of feeding and roosting habitat, human disturbances at roosting and feeding sites, pollution, and climate change (DotE 2020b).	The Curlew Sandpiper ranges down the western and eastern coasts of Australia and are also widespread inland, though in smaller numbers. They occur on tidal flats, freshwater, brackish and saline wetlands, open muddy shores, saltmarshes, salt fields and sewage ponds (Menkhorst *et al.* 2017, Pizzey and Knight 2007, Pizzey and Knight 2012). They breed in Siberia and migrate to Australia in Aug-April (Pizzey and Knight 2012)	**Possible** The Survey Area occurs within the species modelled distribution. The most recent record is from 1980, ~8 km northwest of the Survey Area. The Survey Area comprises suitable habitat with the species occurring on or near water sources such as drainage lines. As such the species is considered possible to occur
Night Parrot (*Pezoporus occidentalis*)	Cr	En	Little is known about potential threats to this species, but suspected threats included reduction of the extent or quality of habitat, increase in numbers of feral predators, increase (or decrease) in grazing pressure, or change in fire regime (DotEE 2016)	Known to inhabit treeless or sparsely wooded long unburnt spinifex hummock plains often interspersed with chenopods (Pyke and Ehrlich 2014).	**Unlikely** The species has not been recorded recently nearby, and the Survey Area does not contain suitable habitat (Pyke and Ehrlich 2014). In addition, the PMST database search results indicate that "species or habitat may occur within the area", making it unlikely that the Night Parrot would occur (DoAWE 2020b, 2021). As such this species is considered unlikely to occur.
Malleefowl (*Leipoa ocellata*)	Vu	Vu	The major threats to the species include habitat clearing, fragmentation and isolation, habitat alteration by non-native herbivores, predation from introduced pests such as foxes and cats, and to a lesser extent, fire and climate change (Benshemesh 2007).	Knowledge of habitat preferences is limited, however, the species tends to inhabit arid or semi-arid shrublands or woodlands dominated by long unburnt mallee, and may also occur in areas dominated by *Acacia sp.*, Wandoo, Marri or Mallet (Benshemesh 2007). Substrates tend to be sandy loams and loamy sands with an abundance of leaf litter for mound construction and may contain gravel or lateritic fragments (Benshemesh 2007, Parsons 2008). A 2008 study indicates that species distribution may be associated with areas of tall vegetation providing canopy cover, shrubs that provide food such as *Acacia* spp. and *Gastrolobium* spp. and reduced sedge cover (Parsons 2008).	**Unlikely** The Survey Area is outside the species current modelled distribution (Pizzey and Knight 2007, Pizzey and Knight 2012). The most recent record within 50 km is from 1981, ~20 km south of the Survey Area (DBCA 2021b). The Survey Area does not contain suitable habitat and is comprised of open areas with minimal leaf litter (Johnstone and Storr 1998). As such this species is considered unlikely to occur.
Grey Falcon (*Falco hypoleucos*)	Vu	-	Threatening processes include land clearing, over grazing and drought which are known to reduce suitable habitat, population persistence and breeding success (Garnett *et al.* 2011, Olsen and Olsen 1986), and their extremely low population, (estimated at less than 1,000) potentially effecting genetic viability of the population (Schoenjahn *et al.* 2020).	Considered rare, the Grey Falcon inhabits lightly treed inland plains, gibber deserts, sand ridges, and timbered watercourses over much of inland arid Australia (Pizzey and Knight 2012).	**Unlikely** The Survey Area occurs within the species modelled distribution (Pizzey and Knight 2012). The species has most recently been recorded within 50 km of the Survey Area in 2003, ~7 km west (DBCA 2021b). The Survey Area does not comprise suitable habitat for this species and as such is considered unlikely to occur.
Blue-billed Duck (*Oxyura australis*)	P4	-	Threatening processes include habitat loss and degradation (in particular aquatic and emergent vegetation), altered drainage, salinisation, lowering of groundwater and lake levels, loss of suitable breeding habitat, livestock grazing and drought.	As an almost wholly aquatic bird, habitat preferences include small, concealed bays within vegetation or communally in large, exposed rafts far from the shore and large, deep open freshwater dams and lakes where they forage for aquatic vegetation and invertebrates (Australian Museum 2020; Birdlife 2022). This species is endemic to Australia and occurs in temperate wetlands of the southeast and southwest parts of Australian (Australian Museum 2020).	**Unlikely** It is anticipated that this species would only occur within Lake Annean during the early stages of flooding when surface water is fresh and deeper water away from the edges of the lake exists. However, it is likely that the Survey Area does not comprise suitable habitat for this species for the majority of the year, and potentially during the majority of flood events, has only been recorded once in the last 21 years. As such, it is considered unlikely to occur.

Common Name (Scientific Name)	Conservation Status		Key Threats and Reason For Listing	Habitat	Likelihood Of Occurrence and Reason For Likelihood
	BC Act	EPBC Act			
Hooded Plover (*Thinornis rubricollis*)	P4	-	Threats to this species include disturbance to nesting birds (including nests and chicks) by humans and disturbance and predation by introduced species, human activity increasing abundance of other native scavengers, egg predation and resultant breeding failure, livestock grazing, flooding, pollution, drought and vegetation clearing. While predation on adults by cats and foxes are also threats, it is unknown as to the degree of population impact this has.	The Hooded Plover inhabits ocean beaches and the edges of inland salt lakes. While the species is considered to be sedentary and locally dispersive (Pizzey and Knight 2007), they move towards coastal areas in summer and return to inland waterways following substantial rainfall. Breeding may occur at inland salt lakes. Juvenile birds are mobile and may move up to 2 km in a day and may also leave their natal territory to traveling hundreds of kilometres. In salt lake environments, the Hooded Plover appears to feed from the surface of the substrate, likely on aquatic invertebrates.	**Possible** It is anticipated that this species would only occur within Lake Annean during flooded conditions, likely earlier in the hydroperiod when water is fresh to hyposaline/mesosaline. The Hooded Plover has been recorded within 50 km of Lake Annean and suitable habitat exists within the northern extent of the Survey Area. However, it is acknowledged that suitable conditions do not occur for the majority of the year. Overall, it is considered possible that this species would occur during substantial flooding events.
Peregrine Falcon (*Falco peregrinus*)	OS	-	The major threat to the species is habitat loss, particularly wooded areas which serve as nesting sites to the species in the absence of cliffs (DotE 2016).	The species occurs along cliffs, gorges, wooded rivers, wetlands, plains and open woodlands, as well as in association with pylons and buildings (Pizzey and Knight 2007). Nests on cliffs, in crevices, large tree hollows or on building ledges (Pizzey and Knight 2007).	**Likely** The Survey Area occurs within the species modelled distribution and contains suitable habitat (Pizzey and Knight 2007). The species has been recorded 10 times within 50 km. With the most recent record being from 2018, ~30 km east-northeast of the Survey Area. The closest record occurred in 2000, ~7 km north of the Survey Area (DBCA 2021b). Due to the frequency of records and the suitable habitat, this species is considered likely to occur.
Two wagtails from the family Motacillidae: • Yellow Wagtail (*Motacilla flava*) • Grey Wagtail (*Motacilla cinerea*)	Mi	Mi	There are no listed threatening processes specific for these species within Australia.	Yellow and Grey Wagtails are listed as rare vagrants to the Australian continent from the North. Inhabit areas associated with water including running water / streams, sewage ponds, swamp margins and saltmarshes and lawns, ploughed fields and airfields (Pizzey and Knight 2012).	**Unlikely** The Survey Area occurs outside the species modelled distribution (Pizzey and Knight 2012). The species hasn't been recorded within 50 km of the Survey Area (DBCA 2021b). As such this species is considered unlikely to occur.
Gull-billed Tern (*Gelochelidon nilotica*)	Mi	Mi	Species migratory between Australia and Siberia, and through much of Asia. Therefore, protected under international agreements CAMBA (Birdlife Australia 2020).	Shallow sheltered seas close to land, estuaries, tidal creeks; and inundated samphire flats, flooded salt lakes, claypans and watercourses in the interior (Johnstone and Storr 1998). Tends to breed on islands in inland lakes (Pizzey and Knight 2012).	**Possible** The Survey Area occurs within the species modelled distribution (Pizzey and Knight 2012). A population of Gull-billed Terns were observed in 1992 <2 km north of the Survey Area. A single and last known observation was again recorded in the same area in 2000 (DBCA 2021b). Further records in Lake Annean are 6 km northwest of the Survey Area in 1999. All observations were recorded between April and August when water within Lake Annean would possibly been present. As such this species is considered possible to occur.
Fork-tailed Swift (*Apus pacificus*)	Mi	Mi	There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DoAWE 2020a).	Species migratory between Australia and much of Asia. Therefore, protected under international agreements CAMBA, JAMBA and ROKAMBA. Aerial species, which forages high above the tree canopy and rarely lower (Johnstone and Storr 1998). Forage in high-flying flocks over a wide range of habitats; however, may be more abundant over inland plains (Menkhorst *et al.* 2019). The species tends to arrive in Australia between October and November, with numbers peaking in late summer, and migrate north in April (Menkhorst *et al.* 2019). Species is occasionally observed during winter (Menkhorst *et al.* 2019).	**Possible** The Survey Area occurs within the species modelled distribution (Pizzey and Knight 2012). The species has only once been recorded within 50 km of the Survey area in 1980, ~12 km northeast (DBCA 2021b). The Survey Area contains suitable habitat in tall open Mulga woodland. As such this species is considered possible to occur.
Caspian Tern (*Hydroprogne caspia*)	Mi	Mi	The Caspian Tern inhabits sheltered coastal and offshore water, beaches, mudflats, estuaries, large rivers and some inland fresh and saline lakes and temporary wetlands in northern, central and eastern Australia (Menkhorst *et al.* 2019). The Caspian Tern forages during the day and can travel up to 60 km from their nesting site to forage. Their diet is varied and consists predominantly of fish, as well as the eggs and young of other birds, carrion, aquatic crustaceans and invertebrates, flying insects and earthworms (DoAWE 2020a)The species breeds in Australia.	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat (Higgins and Davies 1996). They also occur on near coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks (DotE 2020a).	**Possible** The Survey Area occurs outside of the species modelled distribution (Pizzey and Knight 2012). However, the species was recorded in 2013, ~40 km southwest of the Survey Area at Nallan Lake (DBCA 2021b). The Survey Area contains suitable habitat in the form of a saltmarsh and drainage lines that when inundated in the wet season may provide suitable habitat. It is therefore considered possible for this species to occur.

Common Name (Scientific Name)	Conservation Status		Key Threats and Reason For Listing	Habitat	Likelihood Of Occurrence and Reason For Likelihood
	BC Act	EPBC Act			
10 sandpiper, stint, plover, tern, ibis, sandpiper and greenshank species from families; • Scolopacidae; • Charadriidae; • Laridae; and • Threskiornithidae.^	Mi	Mi	Habitat loss and degradation are the largest threats to the species, particularly the availability of foraging and roosting sites required for successful migration and breeding (Bamford *et al.* 2008, DEWHA 2009)	Species migratory between Australia and Siberia, and through much of Asia. Therefore, protected under international agreements CAMBA, JAMBA and ROKAMBA. Small to large sized shore birds inhabit shallow aquatic areas on coasts, mudflats, saltmarshes, estuaries, lake margins and other inland water and bore or grassy plains (Pizzey and Knight 2007).	**Possible** The Survey Area contains a saltmarsh that may when inundated provide suitable habitat to some species, however, information on utilisation and benefit to individual species is limited (Birdlife Australia 2004). The Pectoral Sandpiper was observed within the Lake Annean in 2013, 6 km west of the Survey Area (DBCA 2021b). The Common Greenshank was also recorded in 1980 16 km northwest of the Survey Area. Moreover, a high density of migratory birds has been recorded at Nallan Lake just 40 km south of the Survey Area.
Reptiles					
West Coast Mulga Slider (*Lerista eupoda*)	P1	-	Little is known about potential threats to this cryptic species, but suspected threats included increase in numbers of feral predators, habitat loss from land clearing, increase (or decrease) in grazing pressure, or change in fire regime.	Open Mulga areas on loamy soils in the arid southern interior of WA (Wilson and Swan 2021).	**Likely** The Survey Area occurs within the modelled distribution of the species and contains suitable habitat (Wilson and Swan 2021). The species was recorded during a 2015 Survey at Lake Annean by MWH (MWH 2015b) and has been recorded 29 times within 50 km of the Survey Area (DBCA 2021b). The most recent record occurred in 2017, ~33 km to the east (DBCA 2021b). The closest record occurred in 1991, ~1.7 km to the north (DBCA 2021b). Due to the frequency of records and the occurrence of suitable habitat, this species is considered likely to occur.
Arthropods					
Shield-backed Trapdoor Spider (*Idiosoma nigrum*)	En	Vu	Known threats include land clearing and fragmentation (central and northern Wheatbelt), salinisation (Wheatbelt) and grazing by stock and feral animals, while potential threats include dust pollution and vibration from mine exploration activities (Jack Hills and Weld Range) and altered fire regime (based on *Anidiops villosus* which has similar dispersal patterns).	Clay soils within *Eucalyptus* sp. woodlands and *Acacia* sp. vegetation with abundanct leaf-litter and twigs for burrow constrcution are the species primary habitat witin semi-arid habitats. Its burrows are tubular and approximately 20 cm to 30 cm deep to maintain humidity and cooler temperatures in summer.	**Possible** While the prefered habitat of clay soils within *Acacia* sp. vegetatoin occurs within the Survey Area, there was a lack of abundant leaf litter across the majority of the corridor, although patches do occur. The closest record(s) to the Survey Area come from the Mt Weld Range (~45 km to the northweast of the Surve Area) although the exact locatoin(s) is/are unknown. It is possible that these records are actually *Idiosoma clypeatum* as the *Idiosoma* genus has recently undergone taxonomic revision, meaning that *Idiosoma nigrum* specimens have the potentail to be *Idiosoma clypeatum;* now recognised as a distinct species from *Idiosoma nigrum* (Rix *et al.* 2018). Consequently, it is considered 'Possible' that this species occurs within the Survey Area.
Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*)	P3	-	A P3 fauna listing was recommended due to the widespread occurrence of this species in areas prospective for mining and mineral resources (Rix *et al.* 2018).	Widespread distribution in Western Australia's inland arid zone, principally throughout the Yalgoo and Murchison bioregions where it is the only known species in the genus *Idiosoma*. Distribution seems to be strongly correlated with annual rainfall of less than 250 mm (Rix *et al.* 2018).	**Possible** The Idiosoma genus has recently undergone taxonomic revision. *Idiosoma clypeatum* (formerly known by WAM identification code 'MYG018') is now recognised as a distinct species from *Idiosoma nigrum* (Rix *et al.* 2018). The Survey Area occurs within the known range of *Idiosoma clypeatum*. The species has also been recorded 806 times within 50 km of the Survey Area. All records come from the Mt Weld range ~45 km north-west of the Survey Area (DBCA 2021b). The unknown habitat requirements of this species make assumptions on distribution difficult. However, the abundance of records within close proximity indicate it is possible that this species may occur within the Survey Area.

Note: ^ includes the Common Sandpiper (*Actitis hypoleucos*), White-winged Black Tern (*Chlidonias leucopterus*), Pectoral Sandpiper (*Calidris melanotos*), Sharp-tailed sandpiper (*Calidris acuminata*), Red-necked stint (*Calidris ruficollis*), Wood Sandpiper (*Tringa glareola*), Marsh Sandpiper (*Tringa stagnatilis*), Oriental Plover (*Charadrius veredus*), Common Greenshank (*Tringa nebularia*) and Glossy Ibis (*Plegadis falcinellus*).

4.2. Field Survey Results and Discussion

4.2.1. Reconnaissance Flora and Vegetation Survey

4.2.1.1. Floristic Composition

A total of 50 flora taxa from 14 families and 27 genera were identified from the Survey Area, including one variant, one possible hybrid and six subspecies. Of the taxa recorded, eight could not be confidently identified to species level due to lack of characteristic features including fruit and flowers. The most represented families were Chenopodiaceae (20) and Fabaceae (10), with the remaining families recording between one and three taxa (**Appendix H**).

4.2.1.2. Significant Flora

One native vascular flora taxon recorded from the Survey Area, *Tecticornia cymbiformis*, is listed as P3. *Tecticornia cymbiformis* was recorded growing on gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (**Plate 4-1**, **Figure 4-4**). This taxon was associated with the TaffuTibFlAhh vegetation type associated with the Drainage Line/Open low shrubland habitat type (**Table 4-5**).

Tecticornia cymbiformis tends to be found on saline soils along the edge of creeklines and floodplains, usually associated with spinifex and Mulga or with *Eragrostis falcata*, *Frankenia laxiflora* and *Muellerolimon salicorniaceum*. Within the Survey Area, *Tecticornia cymbiformis* (P3) was found in association with *Tecticornia* aff. *undulata*, *Tecticornia indica* subsp. *bidens*, *Frankenia laxiflora* and / or *Aristida holathera* var. *holathera* (**Table 4-5**). *Tecticornia cymbiformis* (P3) was considered to be locally abundant (>10-<15 plants recorded at relevé BOO1; >50-<100 plants recorded at relevé BOO2) and likely to occur across the broader saline lake margin habitat of Lake Annean, with the desktop assessment recording three specimens from the database searches (**Figure 4-1**) and one specimen from the literature review (**Table 4-1**).

Plate 4-1: *Tecticornia cymbiformis* (P3) at relevé BOO1 within the riparian zone on Lake Annean showing A) typical gypsiferous dune habitat and B) growth form.

4.2.1.3. Flora of Other Significance

The EPA advises that flora species, subspecies, varieties, hybrids and ecotypes may be considered significant for reasons other than listing as a Threatened or Priority flora taxon, and may include the following:

- a keystone role in a particular habitat for Threatened taxa, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status;
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution; and/or
- being poorly reserved.

Based on these parameters, one native vascular flora taxon recorded from the Survey Area was considered to be of 'other' significance; *Tecticornia* aff. *undulata*. This species displayed affinity ('aff.') with a recognised taxon, *Tecticornia undulata*; however, also had characteristics that separated it from the known species. *Tecticornia* aff. *undulata* recorded from Lake Annean appear to have larger vegetative articles and fruits, very distinct apiculate apices to the bracts, and the subtending bract of the inflorescence is wider than the typical *Tecticornia undulata* (Dr. K. Shepherd, pers. comm., WAH). *Tecticornia undulata*, which is not listed under the BC Act or EPBC Act, is widespread throughout Western Australia and tends to be found on saline or gypsiferous soils; however, it was not recorded from the results of the NatureMap database search as occurring within the vicinity of the Survey Area.

Tecticornia aff. *undulata* was recorded growing on red gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (**Figure 4-4**) and was associated with the TaffuTibFlAhh vegetation type associated with the Drainage Line/Open low shrubland habitat type (**Table 4-5**). This species was recorded in association with *Tecticornia cymbiformis*, *Tecticornia indica* subsp. *bidens*, *Frankenia laxiflora* and / or *Aristida holathera* var. *holathera* (**Table 4-5**). *Tecticornia* aff. *undulata* is likely to be locally abundant and likely to occur across the broader saline lake margin habitat of Lake Annean. Specimens of *Tecticornia* aff. *undulata* have also been recorded from Lake Way, approximately 200 km east northeast of the Survey Area; however, the Lake Annean and Lake Way populations are unlikely to represent the same taxa (Dr. K. Shepherd, pers. comm., WAH).

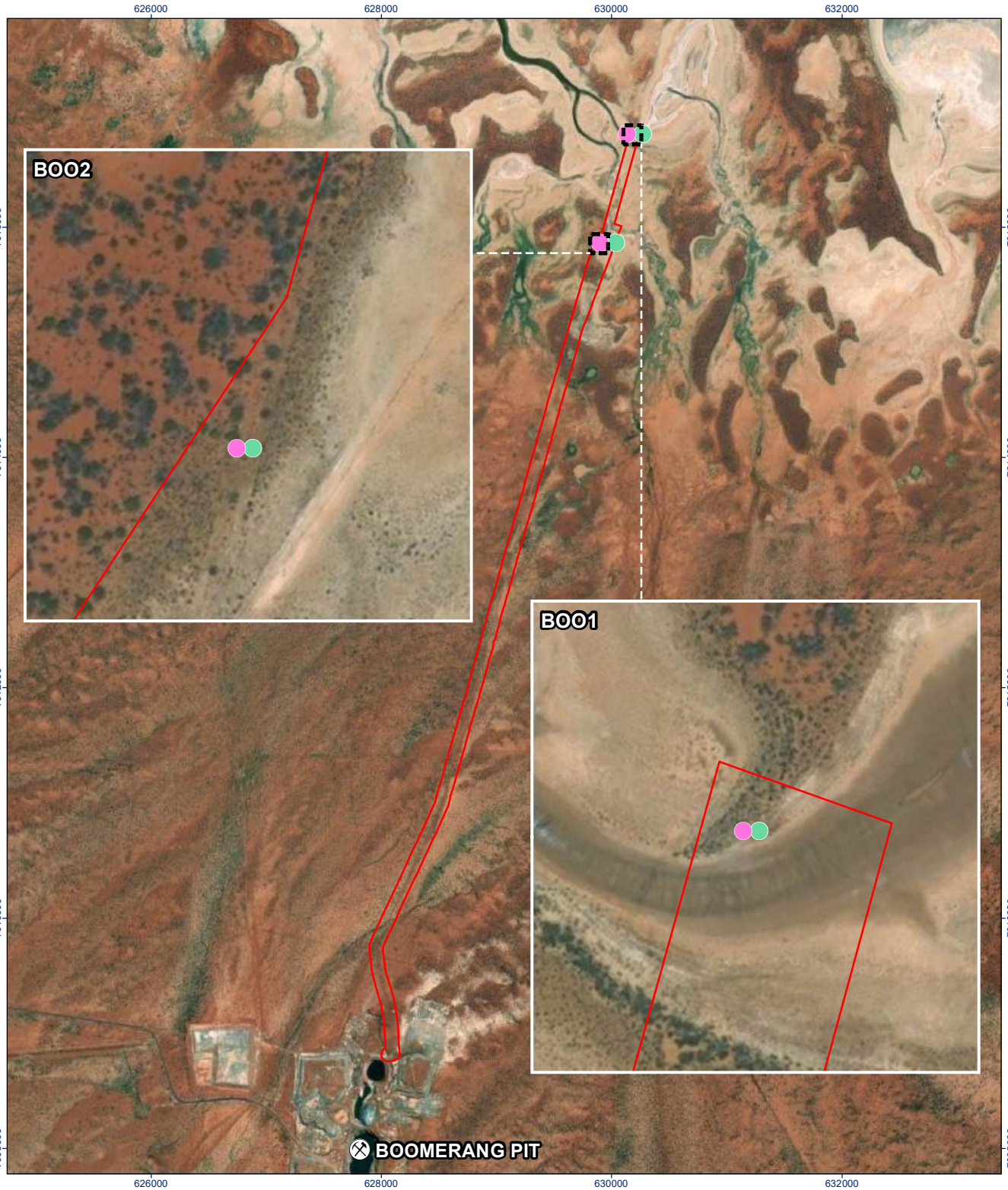
While *Tecticornia halocnemoides* 'large ovate seed aggregate', recorded growing on red gypsiferous dunes on the Lake Annean playa (relevé BOO1), was not highlighted by the WAH as a species of other significance, the desktop assessment indicates that the *Tecticornia halocnemoides* specimens collected as part of the Aladdin Project showed affinities with this species but with large seed aggregates (MWH 2017). *Tecticornia halocnemoides* 'large ovate seed aggregate' has the potential to be the same taxa, and potentially a species of other significance; however, as the WAH did not make specific comment on this taxon, it has not been considered further.

4.2.1.4. Introduced Flora

One introduced flora species (weed) was recorded from the Survey Area; **Rumex vesicarius* (Ruby Dock). This taxon is not a declared pest listed under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or a weed of national significance (WoNS) identified by the Commonwealth Government. **Rumex vesicarius* is considered a widespread weed throughout Western Australia, with a 'high' ecological impact and 'rapid' level of invasiveness according to the Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife Midwest Region Species Prioritisation Process 2014. Within the Survey Area, this weed was predominantly associated with cleared/degraded areas adjacent to the Boomerang Open Pit and mining area and covered less than 1% of the Survey Area.

4.2.1.5. Likelihood of Occurrence Assessment

Following the field survey, and with a greater understanding of the vegetation and habitat types that occur within the Survey Area, one flora taxon of significance recorded by the database searches was considered 'Possible' to occur, and 25 taxa were considered 'Unlikely' to occur (**Appendix F**).



Survey Area

Significant Flora Records

- *Tecticornia* aff. *undulata* (Species of Other Significance - Affinity Species)
- *Tecticornia cymbiformis* (P3)

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Stantec

WESTGOLD

Project Location	Prepared by FW on 2021-12-09
Stantec Australia Pty Ltd	TR by DK on 2021-12-09
Perth, Western Australia	IR by BH on 2021-12-09

Client/Project boom_ff_2021_01

Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title

Significant Flora Records

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2022).
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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4.2.1.6. Vegetation Types

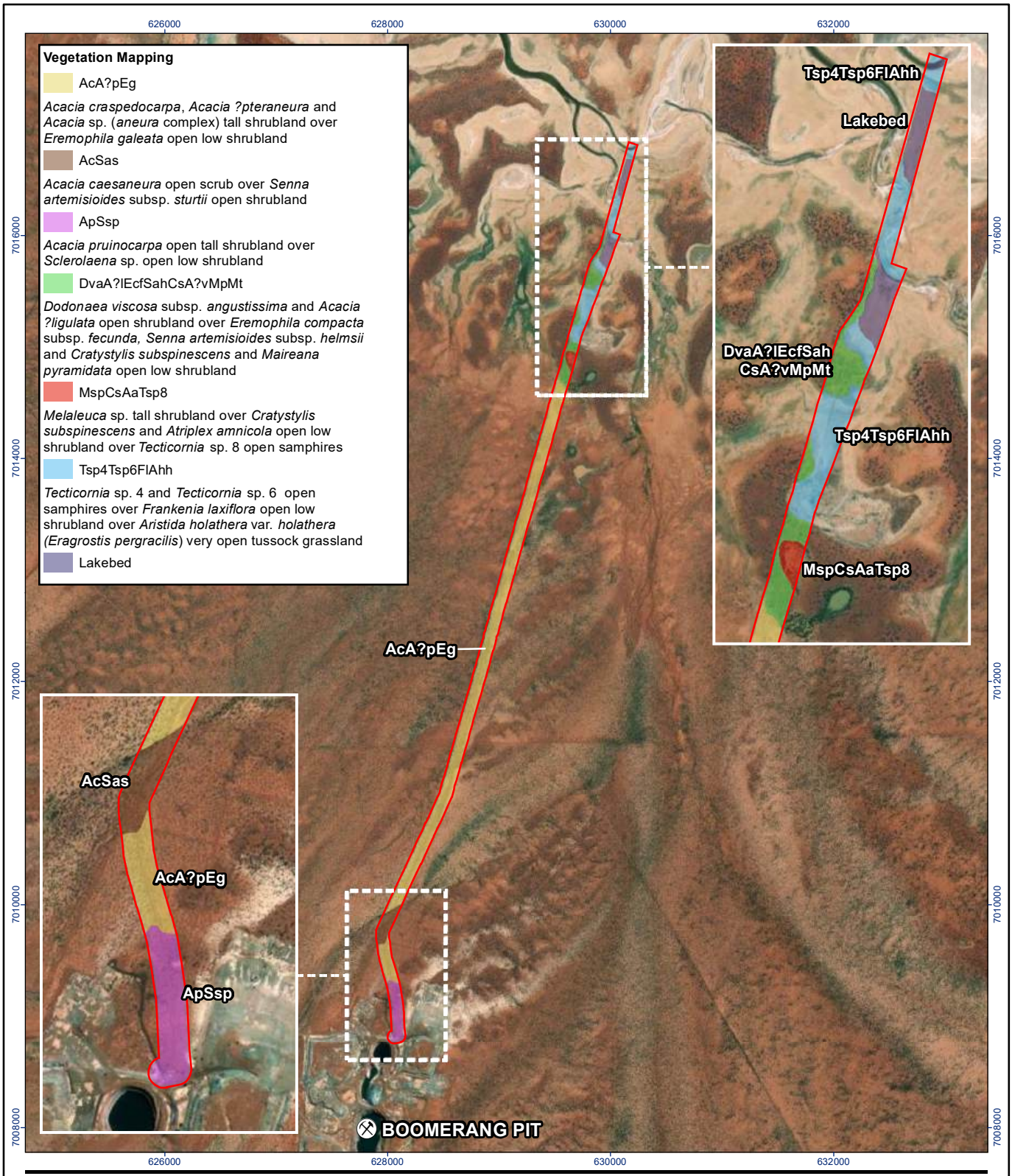
Six vegetation types were identified and described from the Survey Area (Table **4-5**, **Figure 4-5**). The vegetation types recorded within the Survey Area are characteristic of the West Murchison bioregion and East Murchison bioregion, particularly in the vicinity of salt lakes with samphire shrubland dominating the dunes and riparian zone associated with the lake, and *Acacia* woodland dominating with increasing distance from Lake Annean. The most extensive vegetation type within the Survey Area was *Acacia craspedocarpa*, *Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* open low shrubland (AcA?pEg) which occurred over approximately 63% of the Survey Area (**Figure 4-5**).

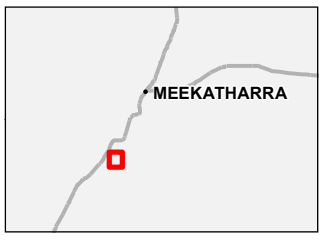
Table 4-5: Vegetation types recorded within the Survey Area.

Vegetation Code	Vegetation Type Description	Extent Within Survey Area		Relevé	Vegetation Condition	Representative Photograph
		ha	%			
Playa and islands						
TaffuTibFlAhh	*Tecticornia* aff. *undulata* and *Tecticornia indica* subsp. *bidens* open samphire over *Frankenia laxiflora* open low shrubland over *Aristida holathera* var. *holathera* (*Eragrostis pergracilis*) very open tussock grassland. **Associated species:** *Acacia ?ligulata, Calandrinia sp., Calocephalus multiflorus, Dysphania simulans, Gunniopsis rodwayi, Lawrencia helmsii, Maireana amoena, Maireana lobiflora, Maireana luehmannii, Melaleuca* sp., *Nicotaina* sp., *Pasaplidium basicladum, Salsola australis, Sclerolaena sp., Solanum lasiophyllum, Swainsona affinis,* Tecticornia sp. Dennys Crossing, *Tecticornia cymbiformis, Tecticornia* aff. *undulata, Tecticornia halocnemoides* 'large ovate seed aggregate' and *Tecticornia peltata.*	9.75	12%	BOO1, BOO2	Excellent	
MspCsAaTd	*Melaleuca* sp. tall shrubland over *Cratystylis subspinescens* and *Atriplex amnicola* open low shrubland over *Tecticornia doliiformis* open samphire. **Associated species:** Poaceae sp. (heavily grazed).	1.16	1%	BOO4	Very Good	

Vegetation Code	Vegetation Type Description	Extent Within Survey Area		Relevé	Vegetation Condition	Representative Photograph
		ha	%			
Sandy plains						
DvaA?lEcfSahCsA?vMpMt	*Dodonaea viscosa* subsp. *angustissima* and *Acacia ?ligulata* open shrubland over *Eremophila compacta* subsp. *fecunda*, *Senna artemisioides* subsp. *helmsii and Cratystylis subspinescens* and *Maireana pyramidata* open low shrubland. **Associated species:** *Acacia synchronicia, Aristida holathera var. holathera, Atriplex semilunaris, Atriplex ?vesicaria, Calandrinia* sp., *Calocephalus multiflorus, Enchylaena tomentosa, Eremophila forrestii* subsp. *forrestii, Frankenia laxiflora, Frankenia setosa, Grevillea striata, Maireana triptera, Nicotaina* sp., *Ptilotus obovatus, Sclerolaena cornisheana* and *Solanum lasiophyllum.*	6.21	8%	BOO3	Excellent	
AcA?pEg	*Acacia craspedocarpa, Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* and *Acacia tetragonophylla* open low shrubland. **Associated species:** *Pterocaulon sphacelatum, Ptilotus obovatus, Senna artemisioides subsp. helmsii, Maireana triptera, Solanum lasiophyllum, Cymbopogon ambiguus, ?Eragrostis pergracilis and* Poaceae sp. (heavily grazed).	53.19	63%	BOO5, BOO6	Good	

Vegetation Code	Vegetation Type Description	Extent Within Survey Area		Relevé	Vegetation Condition	Representative Photograph
		ha	%			
AcSas	*Acacia caesaneura, Acacia* sp. (aneura complex), *Acacia craspedocarpa* and *Acacia ?pteraneura* open scrub over *Eremophila galeata, Acacia tetragonophylla* and *Senna artemisioides* subsp. *sturtii* open shrubland. **Associated species:** *Maireana pyramidata*, *Ptilotus obovatus*, *Cymbopogon ambiguus*, *Senna artemisioides* subsp. *helmsii* and *Maireana* spp..	3.30	4%	BOO7	Degraded	
ApSsp	*Acacia pruinocarpa* open tall shrubland over *Eremophila galeata*, *Sclerolaena cornisheana* and *Sclerolaena* sp. open low shrubland. **Associated species:** *Acacia tetragonophylla*, *Acacia ?pteraneura, Acacia* sp. (aneura complex), *Salsola australis, Solanum lasiophyllum, Ptilotus obovatus, Cymbopogon ambiguus, Maireana luehmannii* and **Rumex vesicarius*.	5.66	7%	BOO8	Degraded	





Survey Area

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Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021).
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Stantec

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Prepared by FW on 2021-12-09
TR by DK on 2021-12-09
IR by BH on 2021-12-09

Client/Project
boom_ff_2021_01
Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title
Vegetation Mapping

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4.2.1.7. Vegetation of Conservation Significance

The EPA advises that vegetation may be considered to be of significance for a range of reasons, other than a listing as a TEC or a PEC, including:

- vegetation extent being below a threshold level;
- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for Threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and/or
- a restricted distribution.

None of the vegetation types within the Survey Area were analogous to any TEC or PEC listed under the BC Act or EPBC Act. Further, the vegetation units described from the Survey Area are not considered to be restricted to the Survey Area and are well represented throughout the subregion and adjoining subregions.

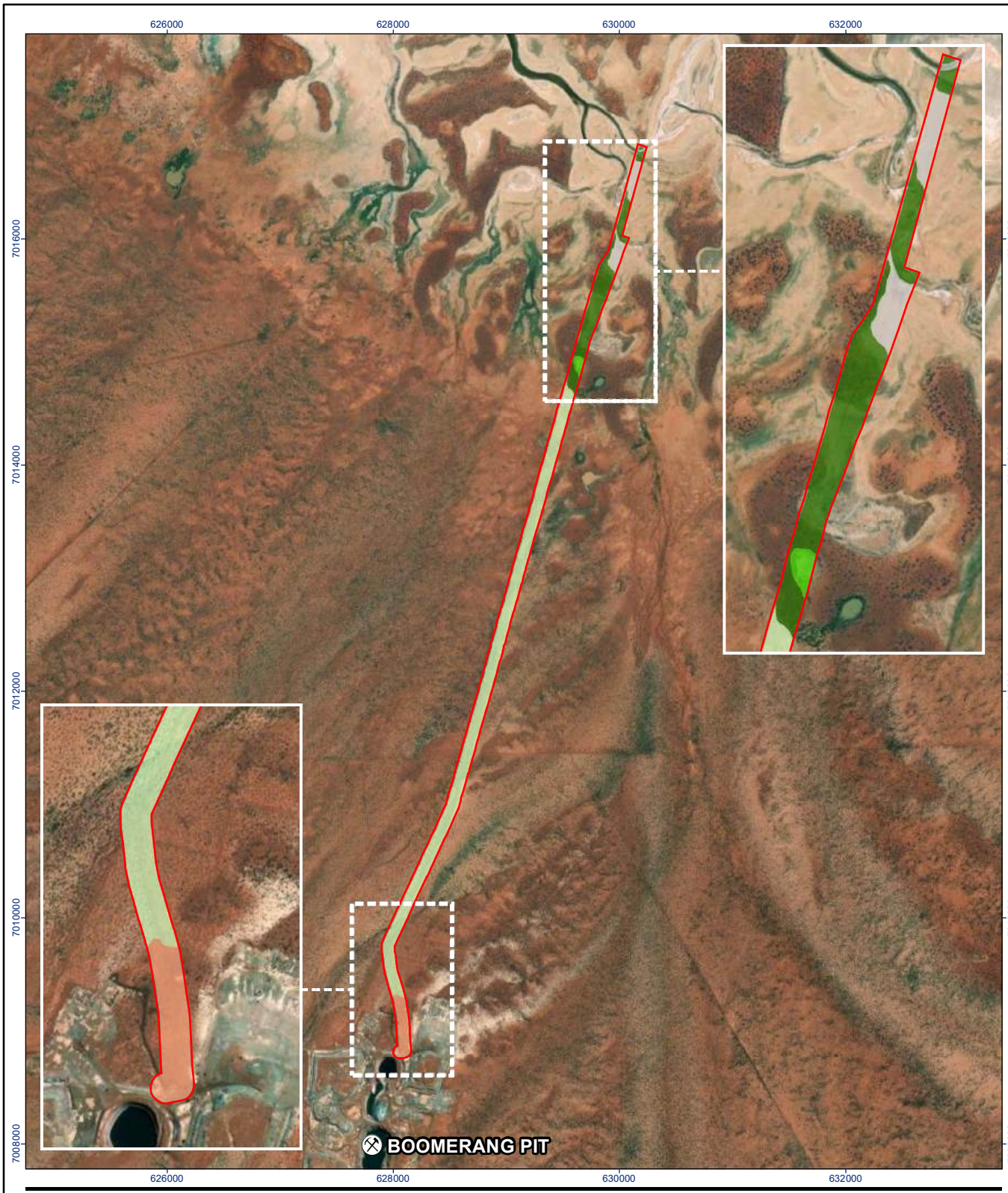
4.2.1.8. Vegetation Condition

The vegetation condition of the Survey Area ranged from 'Degraded' to 'Excellent', with the majority of the Survey Area (67%) in 'Good' condition, 19% in 'Excellent' condition, 1% in 'Very Good' condition and 7% considered to be 'Degraded' (Table 4-6). Some disturbance is associated with the previous clearing, construction and operation of the Boomerang Open Pit dewatering pipeline and interruption of surface water sheetflow. Other historic impacts to vegetation condition across the Survey Area were related to previous ground disturbing activities including mining, tracks and exploration drilling as well as grazing and trampling by livestock. In areas, this has substantial impacted vegetation structure, with few understorey and groundcover species present.

Table 4-6: Vegetation condition across the Survey Area.

Vegetation Condition	Extent Within Survey Area*	
	Hectares (ha)	Proportion (%)
Excellent	15.96	19%
Very Good	1.16	1%
Good	56.48	67%
Degraded	5.66	7%
Total	79.26	94%

Note: areas representing the lake bed have been excluded.



Survey Area

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- N/A

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Notes

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Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title

Vegetation Condition

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4.2.2. Basic Terrestrial Fauna Survey

4.2.2.1. Fauna Habitats

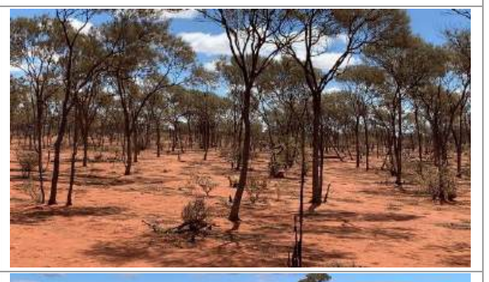
Four broad terrestrial fauna habitats were identified and delineated from fauna habitat assessments conducted across the Survey Area (**Table 4-7**, **Figure 4-7**) These comprised:

- Mulga Woodland;
- Samphire Dune Adjacent to Saline Drainage;
- Inland Sand Dune; and
- Sandy Plain.

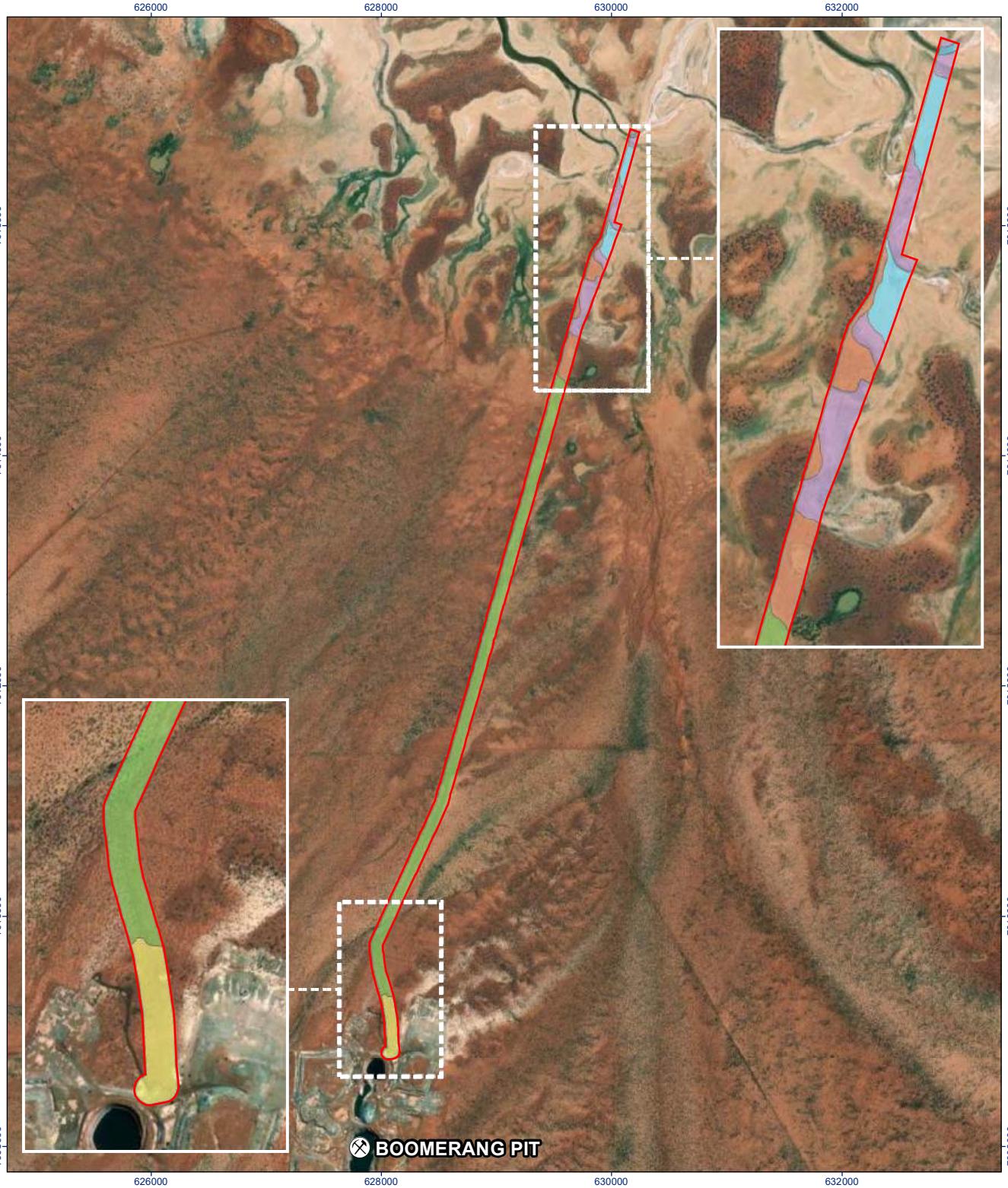
These habitats differed primarily in the composition of their vegetation and structure, in particular vegetation condition and midstorey density. The Mulga Woodland made up the majority (67%) of the Survey Area, with the remaining three habitats accounting for 12% (Samphire Dune Adjacent to Saline Drainage), 9% (Inland Sand Dune) and 7% (Sandy Plain). Habitat condition ranged from 'Degraded' to 'Excellent', mostly affected by clearing, feral animal grazing and disturbance potentially associated with interruption of surface water sheetflow resulting in death of large areas of vegetation to the east of the existing corridor.

The Survey Area contains salt lake habitat and riparian vegetation, which is likely to provide suitable habitat to some species during inundated; however, it is unlikely to provide important habitat for BC Act and/or EPBC Act-listed birds outside of these times.

Table 4-7: Fauna habitats recorded within the Survey Area.

Habitat Type / Extent / Significance	Proportion of Survey Area		Condition	Vegetation Description	Reference Photograph
	ha	%			
Saline Drainage • Limited extent • Limited significance (except during periods of inundation) Samphire Dune • Widespread extent • Limited significance (except during periods of inundation)	9.75	12%	Poor	• *Tecticornia* aff. *undulata* and *Tecticornia indica* subsp. *bidens* open samphire over *Frankenia laxiflora* open low shrubland over *Aristida holathera* var. *holathera* (*Eragrostis pergracilis*) very open tussock grassland. • Drainage Line – Sparse cover of juvenile *Tecticornia* sp. along saline margins of the drainage line. This habitat showed evidence (tracks) of both dog and European Cattle (*Bos taurus*). Sparse leaf little and woody debris indicates habitat unlikely to be important to small reptiles and mammals. No tall shrubs to support bird roosting habitat. However, habitat may become inundated following substantial rainfall events which is likely to support migratory bird species. • Open Low Shrubland – This habitat showed evidence of goanna tracks, European Rabbit (*Oryctolagus cuniculus*) diggings, European Cattle scat, Euro (*Osphranter robustus*) and Red Kangaroo (*Osphranter rufus*) scats. Reptiles were observed in open areas with low lying shrubs. Reptile burrows and unidentified reptile scat were observed throughout the habitat. Several bird species were observed in the open areas including the White-backed Swallow.	
Inland Sand Dune • Limited extent • Limited significance	7.36	9%	Good-Poor	• *Dodonaea viscosa* subsp. *angustissima* and *Acacia ?ligulata* open shrubland over *Eremophila compacta* subsp. *fecunda*, *Senna artemisioides* subsp. *helmsii* and *Cratystylis subspinescens* and *Maireana pyramidata* open low shrubland. • *Melaleuca* sp. tall shrubland over *Cratystylis subspinescens* and *Atriplex amnicola* open low shrubland over *Tecticornia doliiformis* open samphire. • *Acacia craspedocarpa, Acacia ?pteraneura* and *Acacia* sp. (*aneura* complex) tall shrubland over *Eremophila galeata* open low shrubland. • Vegetation varied from areas of dense *Acacia* sp. over relatively dense cover of lower shrubs and few grasses, to areas of mostly dead *Acacia* sp. with little lowerstorey cover. The habitat was impacted by clearing, tracks, feral trampling, and grazing. Densely vegetated areas contained leaf litter and woody debris, which may serve as shelter for mammals and reptiles, and areas with tall shrubs would provide roosting and nesting habitat for birds. This habitat was noted as being the most active for birds and reptiles. However, relatively open and heavily disturbed areas would provide minimal refugia for vertebrate fauna from predators. • Areas of disturbance potentially associated with interruption of surface water sheetflow resulting in death of large areas of vegetation occurred within and to the east of the existing corridor.	
Mulga Woodland • Widespread extent • Limited significance	56.50	67%	Poor	• *Acacia caesaneura* open scrub over *Senna artemisioides* subsp. *sturtii* open shrubland. • The upperstorey largely consists of *Acacia* sp. including *Acacia tetragonophylla*. The lowerstorey of most areas included *Senna artemisioides* subsp. *sturtii*. This habitat was impacted by access tracks and trampling and grazing by European Cattle. Densely vegetated areas contained leaf litter and woody debris, which may serve as shelter for mammals and reptiles. The habitat was also suitable for roosting and nesting birds. However, the relatively open and heavily disturbed areas would provide minimal refugia for vertebrate fauna from predators. • Areas of disturbance potentially associated with interruption of surface water sheetflow resulting in death of large areas of vegetation occurred within and to the east of the existing corridor.	
Sandy Plain • Limited extent • Limited significance	5.66	7%	Degraded	• *Acacia pruinocarpa* open tall shrubland over *Sclerolaena* sp. open low shrubland. • Areas with minimal vegetation, mainly comprising bare plains (e.g. along existing pipeline clearance) or a sparse cover of tall shrubs including *Acacia* spp.. Vegetation was typically over bare stony plains, with minimal woody debris and leaf litter. This habitat showed evidence of European Cattle trampling, clearing, and mining activity. Many of the shrubs were dead close to mine pits/landforms. These open habitats lack shelter and complexity and would provide minimal value to fauna.	

Note: areas representing the lake bed have been excluded.



Survey Area

Fauna Habitat

- Inland Sand Dune
- Lakebed
- Mulga Woodland
- Samphire Dune Adjacent to Saline Drainage
- Sandy Plain

0 670 1,340 m

(At original document size of A4)
1:50,000

N

Notes

1. Coordinate System: GDA 1994 MGA Zone 50
2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021).
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

WESTGOLD

Project Location
Stantec Australia Pty Ltd
Perth, Western Australia

Prepared by FW on 2021-12-09
TR by DK on 2021-12-09
IR by BH on 2021-12-09

Client/Project
boom_ff_2021_01

Westgold Resources
Boomerang Open Pit Dewatering Discharge Pipeline
Level 1 Flora and Fauna Study

Title

Fauna Habitats

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4.2.2.2. Fauna Assemblages

The field survey recorded a total of 19 species of vertebrate fauna, including five mammals, three reptiles and 11 birds (**Table 4-8**). No species of significance were recorded. Secondary signs of three introduced species were recorded, including the European Rabbit, Wild Dog and European Cattle. A total of 14 waterbird and shorebird species identified during the desktop assessment were considered 'Possible' to occur. However, these species could not be surveyed, and were not detected, during the field survey due to the dry conditions of Lake Annean.

Table 4-8: Vertebrate fauna species recorded from the Survey Area during the field survey.

Species	Common Name	Conservation Status	
		BC Act	EPBC Act
Mammals			
Bos taurus	*European Cattle	-	-
Canis dingo	*Dog/Dingo	-	-
Oryctolagus cuniculus	*European Rabbit	-	-
Osphranter robustus	Euro	-	-
Osphranter rufus	Red Kangaroo	-	-
Reptiles			
Ctenophorus salinarum	Claypan Dragon	-	-
Ctenophorus scutulatus	Lozenge-Marked Dragon	-	-
Varanus gouldii	Sand Goanna	-	-
Birds			
Anthus australis	Australasian Pipit	-	-
Artamus cinereus	Black-Faced Woodswallow	-	-
Artamus personatus	Masked Woodswallow	-	-
Cheramoeca leucosternus	White-Backed Swallow	-	-
Epthianura tricolor	Crimson Chat	-	-
Falco cenchroides	Nankeen Kestrel	-	-
Geopelia cuneata	Diamond Dove	-	-
Gerygone fusca	Western Gerygone	-	-
Grallina cyanoleuca	Magpie Lark	-	-
Oreoica gutturalis	Crested Bellbird	-	-
Taeniopygia guttata	Zebra Finch	-	-

*Note: * indicates an introduced species.*

4.3. Survey Limitations and Constraints

There are a number of potential limitations and constraints that can affect the adequacy of flora, vegetation and fauna surveys, summarised for the field survey below (**Table 4-9**).

Table 4-9: Potential field survey limitations and constraints.

Factor	Constraint	Comments
Competency and experience of consultants	No	The field personnel, Brooke Hay and Sam Girvan, had appropriate qualifications and experience to undertake the relevant components of the flora, vegetation and fauna survey. The flora specimen identifications were undertaken by senior taxonomists Sharnya Thomson and Dr Kelly Shepherd, who have extensive experience identifying flora of the Murchison bioregion.
Scope	No	The flora, vegetation, fauna and fauna habitats of the Survey Area were surveyed using standardised and well-established techniques. Relevant databases and previous studies surrounding the Survey Area were also reviewed.
Proportion of species identified	No	The field survey was undertaken in November 2021 which is outside of the recommended timing outlined within EPA (2016) for the Eremaean Botanical Province. However, the majority of specimens were flowering at the time of collection. Of the 50 flora species / specimens recorded / collected, six specimens could not be confidently identified to species level due to a lack of diagnostic characteristics and may represent additional species. However, it is unlikely that any of these six specimens represent species of significance. Most taxonomic groups expected within the Survey Area were represented and the total floristic richness was considered comparable to other survey in the area conducted during similar seasonal conditions. Fauna habitats were assessed at each flora relevés for their importance to accommodate vertebrate fauna and fauna of significance.
Information sources (e.g. historic or recent)	No	Regional contextual information was obtained from the IBRA classification system (Thackway and Cresswell 1995), soil and landform mapping (Mitchell et al. 2002), historic vegetation mapping conducted by Beard (1975) and Shepherd et al. (2002), and six flora, vegetation and fauna surveys previously conducted in the wider region (Spectrum Ecology 2020b)(MWH 2017)(MWH 2016a)(MWH 2016b)(MWH 2015a)(MWH 2015b).
Completeness and intensity	No	Eight relevés were sampled during the two-day field survey within the Survey Area, considered sufficient due to the small size of the corridor. Targeted searches were also conducted throughout the Survey Area for significant flora and fauna species.
Timing / weather / season / cycle	Potential	The field survey took place during November 2021 (late spring), outside of the recommended flora survey season; however, the majority of specimens were flowering at the time of collection, likely due to unseasonal rainfall patterns experienced in recent years. It was noted in the field that the majority of flora observed where flowering at the time of the field survey, with the exception of five collected specimens including *Melaleuca* sp., *Acacia ?pteraneura*, *Acacia* sp. (aneura complex), *Atriplex ?vesicaria* and *Senna ?artemisioides* subsp. *petiolaris*. As there is no recommended season for undertaking a basic fauna survey, it is considered that timing was appropriate for fauna, although it is acknowledged that surveying for birds should occur following rainfall events. Weather was overcast and windy during the majority of the field survey which may have influenced the diversity of observable bird and reptile fauna. Lake Annean was dry at the time of the field survey; therefore, an accurate assessment of use of the Survey Area by significant waterbirds and shorebirds was not able to be made.

Factor	Constraint	Comments
Disturbances	Potential	Disturbances within the Survey Area were associated with previous clearing for mineral exploration, clearing for historic dewatering discharge, and disturbance potentially associated with interruption of surface water sheetflow to the east of the existing corridor.
Resources	No	Resources were adequate to carry out the field survey and the field personnel were competent in the identification of species and/or collection of specimens. WAH specimens, taxonomic guides, and database searches were used to prepare for the field survey and to confirm flora or fauna species where identification was uncertain. Specimen identification was conducted by senior taxonomists.
Remoteness / access problems	No	The Survey Area was easily accessible by vehicle and on foot.

5. Summary

5.1. Desktop Assessment

5.1.1. Flora and Vegetation

A total of 27 significance flora taxa were recorded by the database searches as occurring within 50 km of the Survey Area, including one Threatened flora taxa (T / CR), four Priority 1 (P1), one P2, 18 P3 and three P4. Two of these 27 species have been recorded during previous surveys within the vicinity of the Survey Area. The literature review indicates that two previous surveys confirmed the presence of two flora species of significance within the vicinity of the Survey Area including *Ptilotus beardii* (P3) and *Tecticornia cymbiformis* P3). A further four taxa with the potential to be significant were also recorded including *Dodonaea ?amplisemina* (P4), *Eremophila* sp. nov (novel taxon) and potentially two *Tecticornia* sp. nov (novel taxa). *Dodonaea ?amplisemina* (P4) could not be confirmed as the specimen was sterile, more plant material was required to make a formal determination regarding *Eremophila* sp. nov, and the two *Tecticornia* sp. nov specimens were considered to have affinity with *Tecticornia undulata* and *Tecticornia halocnemoides* 'large seed aggregate', respectively.

Prior to the field survey, seven taxa were considered 'Unlikely' to occur, 11 flora taxa were considered 'Possible' to occur and two species were considered 'Likely' to occur; *Ptilotus beardii* (P3) and *Tecticornia cymbiformis* (P3). It was considered 'Possible' that one Threatened flora taxon may occur within the Survey Area.

There were four PECs recorded by the database searches located within 50 km of the Survey Area, with the nearest (Austin Land System; P3) located 7 km away.

5.1.2. Terrestrial Fauna

Ephemeral wetland habitat and salt lakes are likely to be of significance for fauna within the Murchison region, particularly waterbird species and migratory shorebird species during flooded conditions. A total of 13 fauna habitat types have been previously recorded from the broader area, with the following relevant to the Survey Area; Chenopod Shrubland, Mulga Woodland/Plain, Samphire, Drainage Line and Lake Playa.

The desktop assessment identified a total of 241 terrestrial fauna taxa, including introduced species, which have been recorded and/or have the potential to occur within the Survey Area, comprising 17 native mammals, seven introduced mammals, 159 native birds, two introduced birds, 49 native reptiles, five native amphibians and two native arthropods. Of the 241 terrestrial fauna taxa identified by the desktop assessment, 26 species are listed as being of significance, comprising two arthropods, 22 birds, one mammal and one reptile. The remaining taxa comprised five amphibians, 139 birds, 23 mammals (including introduced species) and 48 reptiles.

Of the 26 significant terrestrial fauna taxa, two were considered 'Likely' to occur, 18 were considered 'Possible' to occur and six were considered 'Unlikely' to occur. The 26 significant terrestrial fauna taxa included five listed as Cr, En or Vu under the BC Act and/or EPBC Act, five listed under the BC Act as Priority fauna, one listed under the BC Act as "other specially protected species", and six listed as Migratory under the BC Act and/or the EPBC Act.

5.2. Field Survey

5.2.1. Flora and Vegetation

A total of 50 flora taxa from 14 families and 27 genera were identified from the Survey Area, including one variant, one possible hybrid and six subspecies. Of the taxa recorded, eight could not be confidently identified to species level due to lack of characteristic features including fruit and flowers. The most represented families were Chenopodiaceae (20) and Fabaceae (10), with the remaining families recording between one and three taxa.

One native vascular flora taxon recorded from the Survey Area, *Tecticornia cymbiformis*, is listed as P3. *Tecticornia cymbiformis* was recorded growing on gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (TaffuTibFlAhh vegetation type / Samphire Dune Adjacent to Saline Drainage habitat type). *Tecticornia cymbiformis* (P3) was considered to be locally abundant (>10-<15 plants recorded at relevé BOO1; >50-<100 plants recorded at relevé BOO2) and likely to occur across the broader saline lake margin habitat of Lake Annean, with the desktop assessment recording three specimens from the database searches and one specimen from the literature review.

One native vascular flora taxon recorded from the Survey Area was considered to be of 'other' significance; *Tecticornia* aff. *undulata*. *Tecticornia* aff. *undulata* was recorded growing on red gypsiferous dunes on the Lake Annean playa (relevé BOO1) as well as within the riparian zone of lake islands (relevé BOO2) (TaffuTibFlAhh vegetation type / Samphire Dune Adjacent to Saline Drainage habitat type). *Tecticornia* aff. *undulata* is likely to be locally abundant and likely to occur across the broader saline lake margin habitat of Lake Annean. This species displayed affinity with a recognised taxon, *Tecticornia undulata*; however, also had characteristics that separated it from the known species. *Tecticornia* aff. *undulata* recorded from Lake Annean appear to have larger vegetative articles and fruits, very distinct apiculate apices to the bracts, and the subtending bract of the inflorescence is wider than the typical *Tecticornia undulata* (Dr. K. Shepherd, pers. comm., WAH). Specimens of *Tecticornia* aff. *undulata* have also been recorded from Lake Way, approximately 200 km east northeast of the Survey Area; however, the Lake Annean and Lake Way populations are unlikely to represent the same taxa (Dr. K. Shepherd, pers. comm., WAH).

One introduced flora species (weed) was recorded from the Survey Area; **Rumex vesicarius* (Ruby Dock), predominantly associated with cleared/degraded areas adjacent to the Boomerang Open Pit and mining area and covered less than 1% of the Survey Area. This taxon is not a declared pest listed under Section 22 of the BAM Act or a WoNS.

Following the field survey, and with a greater understanding of the vegetation and habitat types that occur within the Survey Area, one flora taxon of significance recorded by the database searches was considered 'Possible' to occur, and 25 taxa were considered 'Unlikely' to occur.

Six vegetation types were identified and described from the Survey Area. The vegetation types recorded within the Survey Area are characteristic of the West Murchison bioregion and East Murchison bioregion, particularly in the vicinity of salt lakes with samphire shrubland dominating the dunes and riparian zone associated with the lake, and *Acacia* woodland dominating with increasing distance from Lake Annean. The most extensive vegetation type within the Survey Area was *Acacia craspedocarpa*, *Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* open low shrubland (AcA?pEg) which occurred over approximately 63% of the Survey Area. None of the vegetation types within the Survey Area were analogous to any TEC or PEC listed under the BC Act or EPBC Act. Further, the vegetation units described from the Survey Area are not considered to be restricted to the Survey Area and are well represented throughout the subregion and adjoining subregions.

The vegetation condition of the Survey Area ranged from 'Degraded' to 'Excellent', with the majority of the Survey Area (67%) in 'Good' condition, 19% in 'Excellent' condition, 1% in 'Very Good' condition and 7% considered to be 'Degraded'. Some disturbance is associated with the previous clearing, construction and operation of the Boomerang Open Pit dewatering pipeline and interruption of surface water sheetflow. Other historic impacts to vegetation condition across the Survey Area were related to previous ground disturbing activities including mining, tracks and exploration drilling as well as grazing and trampling by livestock. In areas, this has substantial impacted vegetation structure, with few understorey and groundcover species present.

5.2.2. Terrestrial Fauna

Four broad terrestrial fauna habitats were identified and delineated from fauna habitat assessments conducted across the Survey Area, comprising Mulga Woodland, Samphire Dune Adjacent to Saline Drainage, Inland Sand Dune and Sandy Plain. The Mulga Woodland made up the majority (67%) of the Survey Area, with the remaining three habitats accounting for 12% (Samphire Dune Adjacent to Saline Drainage), 9% (Inland Sand Dune) and 7% (Sandy Plain). Habitat condition ranged from 'Degraded' to 'Excellent', mostly affected by clearing, feral animal grazing and disturbance potentially associated with interruption of surface water sheetflow resulting in death of large areas of vegetation to the east of the existing corridor. The Survey Area contains salt lake habitat and riparian vegetation, which is likely to provide suitable habitat to some species during inundated; however, it is unlikely to provide important habitat for BC Act and/or EPBC Act-listed birds outside of these times.

The field survey recorded a total of 19 species of vertebrate fauna, including five mammals, three reptiles and 11 birds. No species of significance were recorded. Secondary signs of three introduced species were recorded, including the European Rabbit, Wild Dog and European Cattle. A total of 14 waterbird and shorebird species identified during the desktop assessment were considered 'Possible' to occur. However, these species could not be surveyed, and were not detected, during the field survey due to the dry conditions of Lake Annean.

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Appendices

We design with community in mind

Appendix A Codes and Terms Used to Describe Species of Significance

Environmental Factor Guideline: Flora and Vegetation (EPA 2016d) states that flora and vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- Flora: being identified as Threatened or Priority species, locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater-dependent ecosystems), new species or anomalous features that indicate a potential new species, representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range), unusual species, including restricted subspecies, varieties or naturally occurring hybrids, relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.
- Vegetation: being identified as TECs or PECs, restricted distribution, degree of historical impact from threatening processes, a role as a refuge, providing an important function required to maintain ecological integrity of a significant ecosystem.

Environmental Factor Guideline: Terrestrial Fauna (EPA 2016c) states that terrestrial fauna may be significant for a range of reasons including being identified as a Threatened or Priority species, species with restricted distribution, degree of historical impact from threatening processes, and providing an important function required to maintain the ecological integrity of a significant ecosystem (EPA 2016c, d)(EPA 2016b, c).

Those flora, vegetation and fauna defined as Threatened and Priority are protected under the BC Act and/or the EPBC Act. This Appendix presents a summary of the listings used to describe conservation status. Some categories such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not presented here, as the table includes only the information needed to fully understand the codes presented in the preceding report. Refer to the relevant legislation for a full description of all codes in use, as well as their associated criteria.

Conservation Codes used under the BC Act		
Status	Code	Description
Critically Endangered	CR	Taxa rare or likely to become extinct, as critically endangered taxa
Endangered	EN	Taxa rare or likely to become extinct, as endangered taxa
Vulnerable	VU	Taxa rare or likely to become extinct, as vulnerable taxa
Presumed Extinct	EX	Taxa presumed to be extinct
Migratory	Mi	Birds subject to international agreements relating to the protection of migratory birds
Conservation Dependent	CD	Taxa of special conservation need, being species dependent on ongoing conservation intervention
Special Protection	OS	Taxa in need of special protection

Categories used under the EPBC Act		
Status	Code	Description
Critically Endangered	Cr	Taxa considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	En	Taxa considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	Vu	Taxa considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	Mi	Species that migrate to, over and within Australia and its external territories

Priority Flora and Fauna Under the BC Act		
Status	Code	Description
Priority 1: Poorly known Species	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2: Poorly known Species	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3: Poorly known Species	P3	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4: Rare, Near Threatened and other species in need of monitoring	P4	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy.

Definitions, Categories and Criteria for Threatened and Priority Ecological Communities	
General Definitions 1.	
Ecological Community	A naturally occurring biological assemblage that occurs in a particular type of habitat. Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.
Threatened Ecological Community (TEC)	A Threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable". Possible Threatened ecological communities that do not meet survey criteria are added to DBCA's Priority ecological community (PEC) Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the Threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.
Assemblage	An assemblage is a defined group of biological entities.
Habitat	Habitat is defined as the areas in which an organism and/or assemblage of organism's lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.
Occurrence	A discrete example of an ecological community, separated from other examples of the same community by more than 20 m of a different ecological community, an artificial surface or a totally destroyed community. By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.
Adequately Surveyed	An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.
Community structure	The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage (e.g. *Eucalyptus* salmonophloia woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions, Categories and Criteria for Threatened and Priority Ecological Communities	
General Definitions 1.	
Ecological Community	A naturally occurring biological assemblage that occurs in a particular type of habitat. Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.
Threatened Ecological Community (TEC)	A Threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable". Possible Threatened ecological communities that do not meet survey criteria are added to DBCA's Priority ecological community (PEC) Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not Threatened, or meet criteria for Near Threatened, or that have been recently removed from the Threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.
Assemblage	An assemblage is a defined group of biological entities.
Habitat	Habitat is defined as the areas in which an organism and/or assemblage of organism's lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.
Occurrence	A discrete example of an ecological community, separated from other examples of the same community by more than 20 m of a different ecological community, an artificial surface or a totally destroyed community. By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.
Adequately Surveyed	An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.
Community structure	The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage (e.g. *Eucalyptus* salmonophloia woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions and Criteria for Priority Ecological Communities	
Possible Threatened Ecological Communities that do not meet survey criteria or that are not adequately defined are added to the Priority ecological community list under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known and are rare but not Threatened or meet criteria for Near Threatened, or that have been recently removed from the Threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.	
Priority 1 Poorly known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 Poorly known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 Poorly known ecological communities	i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat or habitat destruction or degradation ii) communities known forma few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system bit are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stick, and inappropriate fire regimes Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them
Priority 4 Ecological communities that are adequately known, rare but not Threatened or meet criteria for Near Threatened, or that have been recently removed from the Threatened list. These communities require regular monitoring	a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These communities are usually represented on conservation lands. b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c) Ecological communities that have been removed from the list of Threatened communities during the past five years
Priority 5 Conservation Dependent ecological communities	Ecological communities that are not Threatened but are subject to a specific conservation program, the cessation of which would result int eh community becoming Threatened within five years

Appendix B Aquatic Invertebrate and Non-significant Terrestrial Invertebrate Taxa

B.1 Aquatic Invertebrate and Non-significant Terrestrial Invertebrate Taxa

The desktop assessment identified a total of 12 aquatic vertebrate fauna, aquatic invertebrate fauna, and terrestrial invertebrate fauna not listed under the BC Act or the EPBC Act (Table B-1), comprising:

- two native fish;
- one native aquatic invertebrate;
- one introduced aquatic invertebrate;
- two scorpions; and
- six spiders.

Of these, only one species is listed as being of significance; *Branchinella simplex* (a fairy shrimp) (P1) (Table B-1). It is considered 'Possible' that *Branchinella simplex* (P1) may occur on Lake Annean during the early stages of flooding when surface water is of lower salinity, although only one specimen of this taxon has been recorded during the 1970s (Figure 4-3). The scorpion and spider taxa are also considered 'Possible' to occur within the Study Area; however, none are listed as significant fauna. It is considered 'Possible' that the Murchison River Hardyhead and the Spangled Perch may occur within Lake Annean during the early stages of flooding, similar to *Branchinella simplex* (P1).

With regard to short-range endemic invertebrate fauna (SREs), it is 'Possible' that certain taxa may occur within the Survey Area. However, the habitat types recorded during the field survey are not considered to be restricted to this area and are widespread throughout the Murchison bioregion more broadly. In the event that SRE taxa are disturbed as a result of clearance of the corridor, it is likely that they will be represented within other similar systems, vegetation types and habitat types. The exception may be the Samphire Dune Adjacent to Saline Drainage habitat type which is considered to be restricted to salt lake, and potentiality peripheral wetland, environments; however, salt lake systems are well represented throughout the bioregion.

With regard to subterranean fauna, it is considered 'Possible' that stygofauna and/or troglofauna may occur within aquifers and/or subsurface geological features. However, it is likely that the subterranean habitat types that occur within, and adjacent to, the Survey Area are not restricted to this area and are widespread throughout the Murchison bioregion more broadly. In addition, aquifers associated with inland salt lakes in Western Australia tend to be hypersaline, which has the potential to reduce the abundance and diversity of subterranean fauna, particularly stygofauna, unless calcrete formations occur, containing fresh to hyposaline/mesosaline water. However, as clearing of the corridor is highly unlikely to result in the excavation of subsurface geological formations and will not directly require abstraction from local aquifers, it is considered unlikely that subterranean fauna will be impacted.

Table B-1: Other aquatic and terrestrial vertebrate and invertebrate fauna identified by the desktop assessment.

Scientific Name	Common Name	Conservation Status		Database		
		BC Act	EPBC Act	A	B	C
Fish						
Craterocephalus cuneiceps	Murchison River Hardyhead			*	-	-
Leiopotherapon unicolor	Spangled Perch			*	-	-
Crustacean						
Branchinella simplex	-	P1		*	-	*
Cherax destructor	Common Yabby			*	-	-
Scorpion						
Urodacus armatus	-			*	-	-
Urodacus hoplurus	-			*	-	-
Spider						
Aname mainae	-			*	-	-
Hoggicosa bicolor	-			*	-	-
Nomindra leeuweni	-			*	-	-
Notsodipus meedo	-			*	-	-
Storena sinuosa	-			*	-	-
Trichocyclus nigropunctatus	-			*	-	-

Appendix C Floristic Data – Flora Sampling Sites

Boomerang Open Pit Dewatering Discharge Corridor – BOO1

Site Details:	
Described By: BH	Date: 09/11/2021
MGA Zone: 50J 630159 7016710	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Salt Lake / Dune	Slope: Low (1-20º)
Aspect: South	Water Present: No; however, likely present during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site Coverage: Cryptogams 0-2%, leaf litter cover = few small patches, logs/woody debris = rare
Soil Colour: Grey/white/yellow	Size: Negligible
Rock Type: Calcrete and/or gypsum	Outcropping: Negligible (<5%)
Flora and Vegetation Data	
Description: *Tecticornia* aff. *undulata* and *Tecticornia indica* subsp. *bidens* open samphire over *Frankenia laxiflora* open low shrubland over *Aristida holathera* var. *holathera (Eragrostis pergracilis)* very open tussock grassland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor, historic dewatering discharge
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Medium coverage of dead *Tecticornia* plants; however, juvenile *Tecticornia* plants along saline margins, substantial coverage of either dead or senescencing vegetation, site also includes area of lake/swale behind main saline drainage.	

Species List

Species	Height	Cover
Acacia ?ligulata		
Aristida holathera var. holathera		
Calandrinia sp.		
Calocephalus multiflorus		
Dysphania simulans		
(Eragrostis pergracilis)		
Frankenia laxiflora		
Gunniopsis rodwayi		
Lawrencia helmsii		
Maireana amoena		
Maireana lobiflora		
Maireana luehmannii		
Melaleuca sp.		
Nicotaina sp.		
Pasaplidium basicladum		
Salsola australis		
Sclerolaena sp.		
Solanum lasiophyllum		
Swainsona affinis		
Tecticornia aff. undulata		
Tecticornia cymbiformis		
Tecticornia halocnemoides 'large ovate seed aggregate'		
Tecticornia indica subsp. bidens		
Tecticornia peltata		
Tecticornia sp. Dennys Crossing		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO2

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 629969 7015868	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Salt Lake	Slope: Flat (0º)
Aspect: South	Water Present: No; however, likely present during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site Coverage: Leaf litter cover = few small patches, logs/woody debris = rare
Soil Colour: Grey/white/yellow	Size: Negligible
Rock Type: Calcrete and/or gypsum	Outcropping: Negligible (<5%)
Flora and Vegetation Data	
Description: *Tecticornia* aff. *undulata* and *Tecticornia indica* subsp. *bidens* open samphire over *Frankenia laxiflora* open low shrubland over *Aristida holathera* var. *holathera (Eragrostis pergracilis)* very open tussock grassland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor, historic dewatering discharge
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Poor condition due, in part, to livestock impact, low-lying peripheral wetland area behind main saline drainage, .some higher areas of low red dune/islands adjacent	

Species List

Species	Height	Cover
Acacia ?ligulata		
Aristida holathera var. holathera		
Calandrinia sp.		
Calocephalus multiflorus		
Dysphania simulans		
(Eragrostis pergracilis)		
Frankenia laxiflora		
Gunniopsis rodwayi		
Lawrencia helmsii		
Maireana amoena		
Maireana lobiflora		
Maireana luehmannii		
Melaleuca sp.		
Nicotaina sp.		
Pasaplidium basicladum		
Salsola australis		
Sclerolaena sp.		

Species	Height	Cover
Solanum lasiophyllum		
Swainsona affinis		
Tecticornia aff. undulata		
Tecticornia cymbiformis		
*Tecticornia halocnemoides^*		
Tecticornia indica subsp. bidens		
Tecticornia peltata		
Tecticornia sp. Dennys Crossing		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO3

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 629830 7015608	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Low Red Dune	Slope: Low (1-20°)
Aspect: North	Water Present: No; however, sheetflow likely during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site coverage: Leaf litter cover = few small patches, logs/woody debris = rare
Soil Colour: Red	Size: n/a
Rock Type: None discernible	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Dodonaea viscosa* subsp. *angustissima* and *Acacia ?ligulata* open shrubland over *Eremophila compacta* subsp. *fecunda, Senna artemisioides* subsp. *helmsii* and *Cratystylis subspinescens* and *Maireana pyramidata* open low shrubland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Red low sandy dune between areas of white saline dune/lake complex, terrestrial rather than riparian.	

Species List

Species	Height	Cover
Acacia ?ligulata		
Acacia synchronicia		
Aristida holathera var. holathera		
Atriplex ?vesicaria		
Atriplex semilunaris		
Calandrinia sp.		
Calocephalus multiflorus		
Cratystylis subspinescens		
Dodonaea viscosa subsp. angustissima		
Enchylaena tomentosa		
Eremophila compacta subsp. fecunda		
Eremophila forrestii subsp. forrestii		
Frankenia laxiflora		
Frankenia setosa		
Grevillea striata		

Species	Height	Cover
Maireana pyramidata open low shrubland		
Maireana triptera		
Nicotaina sp.		
Ptilotus obovatus		
Sclerolaena cornisheana		
Senna artemisioides subsp. helmsii		
Solanum lasiophyllum		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO4

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 629632 7014902	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Claypan	Slope: Low (1-20°)
Aspect: North	Water Present: No; however, likely present during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Clayey sand	Site Coverage: Leaf litter cover = few small patches, logs/woody debris = rare
Soil Colour: Grey/yellow	Size: Negligible
Rock Type: Calcrete and/or gypsum	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Melaleuca* sp. tall shrubland over *Cratystylis subspinescens* and *Atriplex amnicola* open low shrubland over *Tecticornia doliiformis* open samphire	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Claypan located on the periphery of Lake Annean, subject to heavy grazing.	

Species List

Species	Height	Cover
Atriplex amnicola		
Cratystylis subspinescens		
Melaleuca sp.		
Poaceae sp.		
Tecticornia doliiformis		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO5

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 629216 7013450	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Red Sand Plain	Slope: Flat (0°)
Aspect: South	Water Present: No; however, sheetflow likely during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site Coverage: Cryptogams 0-2%, leaf litter cover = few large patches, logs/woody debris = moderate
Soil Colour: Red/brown	Size: Negligible
Rock Type: Ironstone	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Acacia craspedocarpa, Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* open low shrubland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Previously disturbed corridor associated with historic Boomerang Open Pit pipeline.	

Species List

Species	Height	Cover
Acacia ?pteraneura		
Acacia craspedocarpa		
Acacia sp. (aneura complex		
Acacia tetragonophylla		
?Cymbopogon ambiguus		
?Eragrostis pergracilis		
Eremophila galeata		
Maireana triptera		
Poaceae sp.		
Pterocaulon sphacelatum		
Ptilotus obovatus		
Senna artemisioides subsp. helmsii		
Solanum lasiophyllum		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO6

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 628529 7010986	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Red Sand Plain	Slope: Flat (0°)
Aspect: South	Water Present: No; however, sheetflow likely during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site coverage: Leaf litter cover = few small patches, logs/woody debris = rare
Soil Colour: Red/brown	Size: Negligible
Rock Type: Ironstone	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Acacia craspedocarpa, Acacia ?pteraneura* and *Acacia* sp. (aneura complex) tall shrubland over *Eremophila galeata* open low shrubland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Previously disturbed corridor associated with historic Boomerang Open Pit pipeline.	

Species List

Species	Height	Cover
Acacia ?pteraneura		
Acacia craspedocarpa		
Acacia sp. (aneura complex)		
Acacia tetragonophylla		
?Cymbopogon ambiguus		
?Eragrostis pergracilis		
Eremophila galeata		
Maireana triptera		
Poaceae sp.		
Pterocaulon sphacelatum		
Ptilotus obovatus		
Senna artemisioides subsp. sturtii		
Solanum lasiophyllum		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO7

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 627969 7009769	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Red Sand Plain	Slope: Flat (0°)
Aspect: South	Water Present: No; however, sheetflow likely during flood
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site coverage: Leaf litter cover = many large patches, logs/woody debris = common
Soil Colour: Red/brown	Size: n/a
Rock Type: None discernible	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Acacia caesaneura* open scrub over *Senna artemisioides* subsp. *sturtii* open shrubland	
Veg Condition: Poor	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: No	Fire Notes: No evidence
Observations: Previously disturbed corridor associated with historic Boomerang Open Pit pipeline.	

Species List

Species	Height	Cover
Acacia ?pteraneura		
Acacia caesaneura		
Acacia craspedocarpa		
Acacia sp. (aneura complex)		
Acacia tetragonophylla		
Cymbopogon ambiguus		
Eremophila galeata		
Maireana pyramidata		
Maireana spp.		
Ptilotus obovatus		
Senna artemisioides subsp. helmsii		
Senna artemisioides subsp. sturtii		

Relevé Photograph

Boomerang Open Pit Dewatering Discharge Corridor – BOO8

Site Details:	
Described By: BH	Date: 10/11/2021
MGA Zone: 50J 628117 7008810	Type: Relevé (Unbounded)
Environmental Variables:	
Landform: Red Sand Plain / Mining Infrastructure	Slope: Flat (0°)
Aspect: North	Water Present: No
Land Surface/Soils:	**Coarse Surface Particles:**
Soil Type: Sandy loam	Site Coverage: Moderate coverage of ironstone/quartz
Soil Colour: Red/brown	Size: Negligible
Rock Type: Ironstone	Outcropping: Negligible (<5%)
Flora And Vegetation Data	
Description: *Acacia pruinocarpa* open tall shrubland over *Sclerolaena* sp. open low shrubland	
Veg Condition: Completely Degraded	Disturbance Type: Grazing, access tracks, historic dewatering discharge corridor, mining operation (Boomerang Open Pit)
Disturbance Fauna: European Cattle	Fire Age: No evidence
Weeds: Ruby Dock	Fire Notes: No evidence
Observations: Degraded sandy plain adjacent to Boomerang Open Pit and associated mining infrastructure.	

Species List

Species	Height	Cover
Acacia ?pteraneura		
Acacia pruinocarpa		
Acacia sp. (aneura complex)		
Acacia tetragonophylla		
Cymbopogon ambiguus		
Eremophila galeata		
Maireana luehmannii		
Ptilotus obovatus		
**Rumex vesicarius*		
Salsola australis		
Sclerolaena cornisheana		
Sclerolaena sp.		
Solanum lasiophyllum		

Relevé Photograph

Appendix D Vegetation Condition Scale: Eremaean Botanical Province

Code	Description
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires, or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix E NVIS Vegetation Structural Classification

Stratum	Canopy Cover (%)				
	70-100%	30-70%	10-30%	2-10%	<2%
Trees > 30 m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland	Scattered Tall Trees
Trees 10-30 m	Closed Forest	Open Forest	Woodland	Open Woodland	Scattered Trees
Trees <10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland	Scattered Low Trees
Shrubs >2 m	Tall Closed Scrub	Tall Open Scrub	Tall Shrubland	Tall open Shrubland	Scattered Tall Shrubs
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland	Scattered Shrubs
Shrubs <1 m	Low Closed Heath	Low Open Heath	Low Shrubland	Low Open Shrubland	Scattered Low Shrubs
Hummock Grasses	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland	Scattered Hummock Grasses
Grasses, Sedges, Herbs	Closed Tussock Grassland / Bunch Grassland / Sedgeland / Herbland	Tussock Grassland / Bunch Grassland / Sedgeland / Herbland	Open Tussock Grassland / Bunch Grassland / Sedgeland / Herbland	Very Open Tussock Grassland / Bunch Grassland / Sedgeland / Herbland	Scattered Tussock Grasses / Bunch Grasses / Sedges / Herbs

Based on the Muir (1977), and Aplin (1979) modification of the vegetation classification system of Specht (1970); Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). Environment and Science. University of Western Australia Press; Muir B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve. Records of the Western Australian Museum, Suppl. No. 3; Specht R.L. (1970). Vegetation. In: The Australian Environment. 4th edn (Ed. G.W. Leeper). Melbourne.

Appendix F Likelihood of Occurrence of Significant Flora in the Survey Area

Table E-1: Likelihood of occurrence of significant flora in the Survey Area.

Taxon	Data Source			Sign. Status		Flowering Time	Habitat	Murchison IBRA Subregion(s)	Pre-survey likelihood of occurrence in Survey Area	Post-survey likelihood of occurrence in Survey Area
	NatureMap	DBCA	WAH	BC Act	EPBC Act					
Eremophila rostrata subsp. *rostrata*	-	*	*	T^	Cr	June to July	Saline quartzite loams. Hills and flats.	Eastern Murchison	Possible: The Survey Area is likely to contain loam soil, saline soil and/or quartz and this species has been recorded to within 35 km of the Survey Area.	Unlikely: No unidentified *Eremophila* specimens were observed within the narrow Survey Area during the field survey.
Beyeria lapidicola	-	*	*	P1	-	July	Floodplain, outcrops and drainage lines. Sandy clay, red/orange soil, ironstone. Weld Range BIF PEC.+	Eastern Murchison, Western Murchison	Unlikely: Records of this species are recorded to within 50 km from the Survey Area in association with the Weld Range banded ironstone formation vegetation complexes PEC, and the Survey Area is considered unlikely to contain banded ironstone formation.	Unlikely: This taxon was not recorded during the field survey and the Survey Area does not provide the habitat requirements suitable to support this species.
Eremophila retropila	-	*	*	P1	-	August to September	Gravelly loam. Stony flats.	Western Murchison	Unlikely: Records of this species occur within 50 km of the Survey area; however, it is unlikely that suitable habitat is represented within the Survey Area.	Unlikely: No unidentified *Eremophila* specimens were observed within the narrow Survey Area during the field survey.
Heliotropium mitchellii	-	-	*	P1	-	May to June	Sandstone uplands and cliffs.	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.
Stenanthemum mediale	-	-	*	P1	-	April to August	Red clayey sand.	Eastern Murchison, Western Murchison	Possible: The Survey Area is likely to contain red clayed sand; however, records of this species are found within the Weld Range approximately 50 km away from the Survey Area.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Bergia auriculata	-	-	*	P2	-	(flowering time unknown)	Clay soils. Mud flats.	Eastern Murchison, Western Murchison	Possible: The Survey Area is likely to contain clayey soil and "mud flats", and this species is recorded to within 45 km of the Survey Area.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Acacia sclerosperma subsp. *glaucescens*	*	-	*	P3	-	July to August	Sand, sandy loam, stony soils.	Western Murchison	Possible: The Survey Area is likely to contain sand and sandy loam soil but is unlikely to contain stony soil, although this species has been recorded to within 10 km of the Survey Area.	Possible: No specimens of this genus were observed within the narrow Survey Area during the field survey; however, suitable habitat was observed.
Calytrix verruculosa	*	*	*	P3	-	August or October	Sandy clay.	Eastern Murchison, Western Murchison	Possible: The Survey Area is likely to contain sandy clay soil, and this species is recorded to within 22 km of the Survey Area.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Drummondita miniata	-	-	*	P3	-	July to August	Laterite. Breakaways.	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey, and the Survey Area does not provide the habitat requirements suitable to support this species.
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	*	-	*	P3	-	(flowering time unknown)	Calcrete +	Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.
Eremophila fasciata (Spaghetti Eremophila)	*	-	*	P3	-	August	Hillside, gullies. Brown/red ironstone gravel.+	Eastern Murchison, Western Murchison	Unlikely: Records of this species occur within 50 km of the Survey area; however, it is unlikely that suitable habitat is represented within the Survey Area.	Unlikely: No unidentified *Eremophila* specimens were observed within the narrow Survey Area during the field survey.
Hemigenia virescens	*	-	*	P3	-	July, August or December	Sand banks+	Western Murchison	Possible: Sandy habitat may be available; however, there is limited information on preferred habitat or the context of the sand banks.	Unlikely: No unidentified *Hemigenia* specimens were observed within the narrow Survey Area during the field survey.

Taxon	Data Source			Sign. Status		Flowering Time	Habitat	Murchison IBRA Subregion(s)	Pre-survey likelihood of occurrence in Survey Area	Post-survey likelihood of occurrence in Survey Area
	NatureMap	DBCA	WAH	BC Act	EPBC Act					
									Records of this species are recorded to within 20 km of the Survey Area.	
Homalocalyx echinulatus	-	-	*	P3	-	June to September	Laterite. Breakaways, sandstone hills.	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey, and the Survey Area does not provide the habitat requirements suitable to support this species.
Maireana prosthecochaeta	-	-	*	P3	-	July	Laterite. Hills, salty places.	Eastern Murchison, Western Murchison	Unlikely: While there are records of the species within 10 km of the Survey Area, it is unlikely that laterite breakaways and/or hillslopes will occur within the Survey Area.	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.
Petrophile pauciflora	-	*	*	P3	-	September	Decaying and dissected granite breakaways.	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey, and the Survey Area does not provide the habitat requirements suitable to support this species.
Prostanthera ferricola	-	-	*	P3	-	July or August	Shallow red-brown skeletal sandy loam on banded ironstone, laterite, basalt or quartz. Gently inclined mid to upper slopes of hills, rocky crests, outcrops.	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey, and the Survey Area does not provide the habitat requirements suitable to support this species.
Prostanthera petrophila	-	*	*	P3	-	August or September	Lateritic soils.	Eastern Murchison, Western Murchison	Possible: It is possible that the Survey Area contains lateritic soil, and this species is recorded to within 50 km of the Survey Area.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Ptilotus beardii (Low Mulla Mulla)	*	-	*	P3	-	August to October	Clayey soils. Saline flats, low breakaways.	Eastern Murchison, Western Murchison	Likely: The Survey Area is likely to contain clayey soil and saline flats and records of this species occur within 11 km of the Survey Area.	Unlikely: No specimens were observed within the narrow Survey Area during the field survey.
Ptilotus lazaridis	*	*	*	P3	-	July or October	Clay loam. Floodplains.	Western Murchison	Possible: The Survey Area is likely to contain clayey soil and floodplain habitat, and this species is recorded to within 12 km of the Survey Area.	Unlikely: No unidentified *Ptilotus* specimens were observed within the narrow Survey Area during the field survey.
Ptilotus luteolus	*	*	*	P3	-	(flowering time unknown)	Minor rocky drainage line+	Eastern Murchison, Western Murchison	Possible: Minor drainage is likely to occur although it is unlikely to be rocky; however, there is limited information on preferred habitat or the context of the rocky drainage. Records of this species are recorded to within 20 km of the Survey Area.	Unlikely: No unidentified *Ptilotus* specimens were observed within the narrow Survey Area during the field survey.
Sida picklesiana	*	-	*	P3	-	April, August or November	Breakaway scree slope+	Eastern Murchison	Unlikely: Records of this species occur to within 20 km of the Survey Area within breakaway scree slope habitat which is unlikely to occur within the Study Arwa.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey, and the Survey Area does not provide the habitat requirements suitable to support this species. The field survey was undertaken during optimal flowering season.
Tecticornia cymbiformis	*	-	*	P3	-	November# (flowering timing unknown, most likely rainfall dependant)	Saline soils. Along the edge of creeklines.	Eastern Murchison, Western Murchison	Likely: The Survey Area is likely to contain saline soil and waterways, and this species is recorded to within 11 km of the Survey Area.	Confirmed: This species was recorded from the riparian zone of Lake Annean.
Tribulus adelacanthus	*	-	*	P3	-	(flowering time unknown)	Rocky hills and hillslopes with rocky soils over granite+	Eastern Murchison, Western Murchison	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.

Taxon	Data Source			Sign. Status		Flowering Time	Habitat	Murchison IBRA Subregion(s)	Pre-survey likelihood of occurrence in Survey Area	Post-survey likelihood of occurrence in Survey Area
	NatureMap	DBCA	WAH	BC Act	EPBC Act					
Verticordia jamiesonii	-	-	*	P3	-	September to October	Sandy clay soils. Lateritic breakaways.	Eastern Murchison, Western Murchison	Possible: The Survey Area is likely to contain sandy clay soil but unlikely to contain breakaways. Species is recorded to within 50 km of the Survey Area within the Weld Range.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Acacia speckii	*	-	*	P4	-	(flowering time unknown)	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	Eastern Murchison, Western Murchison	Unlikely: Although this species has been recorded to within 15 km of the Survey Area, it is unlikely to contain sufficient rocky habitat, hills or rises to support this species.	Unlikely: The Survey Area does not provide the habitat requirements suitable to support this species.
Goodenia berringbinensis	-	*	*	P4	-	October	Red sandy loam. Along watercourses.	Eastern Murchison, Western Murchison	Possible: The Survey Area is likely to contain red sandy loam; however, is unlikely to contain defined waterways. This species is recorded to within 40 km of the Survey Area.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.
Grevillea inconspicua (Cue Grevillea)	*	*	*	P4	-	June to August	Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Eastern Murchison, Western Murchison	Unlikely: Although this species has been recorded to within 50 km of the Survey Area and the Survey Area is likely to contain loam and some gravel, it is unlikely to contain sufficient rocky outcrops and defined waterways to support this species.	Unlikely: No specimens of this genus were observed within the narrow Survey Area during the field survey.

Note: ^ indicates that taxa retain their 'Threatened' status until a new name has been officially endorsed and appears in the Gazettal Notice; # indicates flowering times based on field observations during the field survey; + indicates description obtained from DBCA and/or WAH database record information.

Appendix G Vertebrate Fauna Identified by the Desktop Assessment

Legend:

Database searches:

A NatureMap (2021) Mapping Western Australia's Biodiversity (custom search)

B DotEE (2021) Protected Matters Search Tool (custom search)

C DBCA (2021) Threatened and Priority Fauna Database (custom search)

D Birdlife Australia (2018) Birdata: Custom Atlas Bird List

Literature review:

E Spectrum Ecology (2020a)

F MWH (2015b)

G MWH (2016a)

H MWH (2016b)

I MWH (2017)

This survey:

J Stantec (2022)

Table G-1: Vertebrate fauna identified by the desktop assessment.

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Amphibia													
Cyclorana maini	Sheep Frog	-	-	x									
Cyclorana occidentalis	Western Water-holding Frog	-	-	x									
Litoria rubella	Little Red Tree Frog	-	-	x					x				
Neobatrachus sutor	Shoemaker Frog	-	-	x									
Platyplectrum spenceri	Centralian Burrowing Frog	-	-	x									
Arthropoda													
Idiosoma nigrum	Shield-backed Trapdoor Spider	En	Vu		x								
Idiosoma clypeatum	Northern Shield-backed Trapdoor Spider	P3	-			x							
Aves													
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	-	x			x	x			x		
Acanthiza apicalis	Inland Thornbill	-	-	x			x	x		x	x		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	x			x						
Acanthiza robustirostris	Slaty-backed Thornbill	-	-	x				x		x	x		
Acanthiza uropygialis	Chestnut-rumped Thornbill	-	-	x			x			x	x		
Accipiter cirrocephalus	Collared Sparrowhawk	-	-	x			x						
Accipiter fasciatus	Brown Goshawk	-	-	x			x						
Actitis hypoleucos	Common Sandpiper	IA	Mi	x	x	x							
Aegotheles cristatus	Australian Owlet-nightjar	-	-	x			x						
Anas gracilis	Grey Teal	-	-	x			x	x					

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Anas superciliosa	Pacific Black Duck	-	-	x			x						
Anthus australis	Australian Pipit	-	-	x			x		x	x	x		x
Aphelocephala leucopsis	Southern Whiteface	-	-	x			x						
Aphelocephala nigricincta	Banded Whiteface	-	-	x									
Apus pacificus	Fork-tailed Swift	IA	Mi	x	x	x							
Aquila audax	Wedge-tailed Eagle	-	-	x			x	x				x	
Ardea alba	Great Egret	-	-	x			x						
Ardea pacifica	White-necked Heron	-	-	x			x						
Ardeotis australis	Australian Bustard	-	-	x			x						
Artamus cinereus	Black-faced Woodswallow	-	-	x			x			x	x		x
Artamus cyanopterus	Dusky Woodswallow	-	-	x			x						
Artamus minor	Little Woodswallow	-	-	x							x	x	
Artamus personatus	Masked Woodswallow	-	-	x			x						x
Artamus superciliosus	White-browed Woodswallow	-	-	x									
Aythya australis	Hardhead	-	-	x			x						
Barnardius zonarius	Australian Ringneck	-	-	x			x					x	
Biziura lobata	Musk Duck	-	-	x			x	x					
Burhinus grallarius	Bush Stone-curlew	-	-	x									
Cacatua sanguinea	Little Corella	-	-	x			x						
Calamanthus campestris subsp. *montanellus*	Western Fieldwren	-	-	x									
Calidris acuminata	Sharp-tailed Sandpiper	IA	Mi	x	x	x							

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Calidris ferruginea	Curlew Sandpiper	Cr	Cr; Mi	x	x	x							
Calidris melanotos	Pectoral Sandpiper	IA	Mi	x	x	x	x						
Calidris ruficollis	Red-necked Stint	IA	Mi			x							
Certhionyx variegatus	Pied Honeyeater	-	-	x			x						
Chalcites basalis	Horsfield's Bronze Cuckoo	-	-	x			x						
Charadrius melanops	Black-fronted Dotterel	-	-	x			x						
Charadrius ruficapillus	Red-capped Plover	-	-	x			x		x				
Charadrius veredus	Oriental Plover	IA	Mi	x	x								
Chenonetta jubata	Australian Wood Duck	-	-	x			x						
Cheramoeca leucosternus	White-backed Swallow	-	-	x			x				x		x
Childonias lecopterus	White-Winged Black Tern	-	-			x							
Chlamydera guttata	Western Bowerbird	-	-	x			x			x			
Chlidonias hybrida	Whiskered Tern	-	-	x			x						
Chlidonias leucopterus	White-winged Black Tern	IA	Mi			x							
Cinclosoma clarum	Western Chestnut Quail-thrush	-	-	x						x			
Cinclosoma marginatum	Western Quail-thrush	-	-	x			x						
Circus approximans	Swamp Harrier	-	-	x			x						
Circus assimilis	Spotted Harrier	-	-	x			x						
Cladorhynchus leucocephalus	Banded Stilt	-	-	x			x						
Colluricincla harmonica	Grey Shrike-thrush	-	-	x			x				x		
Columba livia	*Domestic Pigeon	-	-	x	x								

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Coracina maxima	Ground Cuckoo-shrike	-	-	x							x		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	x			x						
Corvus bennetti	Little Crow	-	-	x			x			x	x		
Corvus orru	Torresian Crow	-	-	x			x		x				
Coturnix pectoralis	Stubble Quail	-	-	x									
Cracticus nigrogularis	Pied Butcherbird	-	-	x			x	x		x	x		
Cracticus torquatus	Grey Butcherbird	-	-	x			x						
Cygnus atratus	Black Swan	-	-	x			x	x	x				
Daphoenositta chrysoptera	Varied Sittella	-	-	x						x			
Dicaeum hirundinaceum	Mistletoebird	-	-	x			x				x		
Dromaius novaehollandiae	Emu	-	-	x			x	x	x			x	
Egretta novaehollandiae	White-faced Heron	-	-	x			x						
Elanus axillaris	Black-shouldered Kite	-	-	x			x						
Eolophus roseicapilla	Galah	-	-	x			x						
Epthianura aurifrons	Orange Chat	-	-	x			x		x				
Epthianura tricolor	Crimson Chat	-	-	x			x				x		x
Erythrogonys cinctus	Red-kneed Dotterel	-	-	x			x						
Eurostopodus argus	Spotted Nightjar	-	-	x			x			x			
Falco berigora	Brown Falcon	-	-	x			x	x			x		
Falco cenchroides	Australian Kestrel	-	-	x			x		x		x		x
Falco hypoleucos	Grey Falcon	Vu	Vu	x	x	x	x						

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Falco longipennis	Australian Hobby	-	-	x			x						
Falco peregrinus	Peregrine Falcon	OS	-	x		x	x						
Fulica atra	Eurasian Coot	-	-	x			x						
Gavicalis virescens	Singing Honeyeater	-	-	x			x	x	x	x	x	x	
Gelochelidon nilotica	Gull-billed Tern	IA	Mi	x		x	x						
Geopelia cuneata	Diamond Dove	-	-	x			x						x
Geopelia striata	Peaceful Dove	-	-	x			x						
Gerygone fusca	Western Gerygone	-	-	x			x						x
Grallina cyanoleuca	Magpie-lark	-	-	x			x				x		x
Gymnorhina tibicen	Australian Magpie	-	-	x			x			x	x		
Haliastur sphenurus	Whistling Kite	-	-	x			x	x			x		
Hamirostra isura	Square-tailed Kite	-	-	x									
Hamirostra melanosternon	Black-breasted Buzzard	-	-	x			x						
Heteroscenes pallidus	Pallid Cuckoo	-	-	x			x						
Hieraaetus morphnoides	Little Eagle	-	-	x									
Himantopus	Black-winged Stilt	-	-	x			x						
Hirundo neoxena	Welcome Swallow	-	-	x			x	x	x	x	x		
Hydroprogne caspia	Caspian Tern	IA	Mi			x							
Lalage tricolor	White-winged Triller	-	-	x			x						
Larus novaehollandiae	Silver Gull	-	-	x			x						
Leipoa ocellata	Malleefowl	Vu	Vu	x	x	x							

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Lichmera indistincta	Brown Honeyeater	-	-	x			x						
Malacorhynchus membranaceus	Pink-eared Duck	-	-	x			x						
Malurus lamberti	Variegated Fairy-wren	-	-	x			x						
Malurus leucopterus	White-winged Fairy-wren	-	-	x			x		x			x	
Malurus splendens	Splendid Fairy-wren	-	-	x			x	x			x		
Manorina flavigula	Yellow-throated Miner	-	-	x			x			x	x	x	
Megalurus cruralis	Brown Songlark	-	-				x						
Megalurus mathewsi	Rufous Songlark	-	-				x						
Melanodryas cucullata	Hooded Robin	-	-	x			x			x	x		
Melopsittacus undulatus	Budgerigar	-	-	x			x						
Merops ornatus	Rainbow Bee-eater	-	-	x									
Microcarbo melanoleucos	Little Pied Cormorant	-	-				x						
Microeca fascinans	Jacky Winter	-	-	x						x	x		
Milvus migrans	Black Kite	-	-	x			x						
Motacilla cinerea	Grey Wagtail	IA	Mi	x	x								
Motacilla flava	Yellow Wagtail	IA	Mi	x	x								
Neophema elegans	Elegant Parrot	-	-	x									
Neopsephotus bourkii	Bourke's Parrot	-	-	x			x						
Nymphicus hollandicus	Cockatiel	-	-	x			x	x					
Ocyphaps lophotes	Crested Pigeon	-	-	x			x				x	x	
Oreoica gutturalis	Crested Bellbird	-	-	x			x	x	x	x	x	x	x

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Oxyura australis	Blue-billed Duck	P4	-			x							
Pachycephala rufiventris	Rufous Whistler	-	-	x			x	x		x	x		
Pardalotus rubricatus	Red-browed Pardalote	-	-	x									
Pardalotus striatus	Striated Pardalote	-	-	x			x						
Pelecanus conspicillatus	Australian Pelican	-	-	x			x		x				
Peltohyas australis	Inland Dotterel	-	-	x									
Petrochelidon ariel	Fairy Martin	-	-	x			x						
Petrochelidon nigricans	Tree Martin	-	-	x			x						
Petroica goodenovii	Red-capped Robin	-	-	x			x	x		x	x		
Pezoporus occidentalis	Night Parrot	Cr	En	x	x								
Phalacrocorax sulcirostris	Little Black Cormorant	-	-	x			x						
Phaps chalcoptera	Common Bronzewing	-	-	x			x						
Platalea flavipes	Yellow-billed Spoonbill	-	-	x			x						
Plegadis falcinellus	Glossy Ibis	IA	Mi			x							
Podargus strigoides	Tawny Frogmouth	-	-	x									
Podiceps cristatus	Great Crested Grebe	-	-	x									
Poliocephalus	Hoary-headed Grebe	-	-	x			x		x				
Pomatostomus superciliosus	White-browed Babbler	-	-	x			x			x	x	x	
Pomatostomus temporalis	Grey-crowned Babbler	-	-	x			x	x			x		
Psephotellus varius	Mulga Parrot	-	-	x			x			x	x		
Psophodes occidentalis	Western Wedgebill	-	-	x						x			

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Ptilotula penicillatus	White-plumed Honeyeater	-	-				x				x		
Purnella albifrons	White-fronted Honeyeater	-	-	x			x						
Pyrrholaemus brunneus	Redthroat	-	-	x			x						
Recurvirostra novaehollandiae	Red-necked Avocet	-	-	x			x						
Rhipidura albiscapa	Grey Fantail	-	-	x			x						
Rhipidura leucophrys	Willie Wagtail	-	-	x			x		x	x	x	x	
Spatula rhynchotis	Australasian Shoveler	-	-	x			x						
Stictonetta naevosa	Freckled Duck	-	-	x			x						
Streptopelia senegalensis	*Laughing Turtle-dove	-	-	x	x								
Sugomel niger	Black Honeyeater	-	-				x						
Tachybaptus novaehollandiae	Australasian Grebe	-	-	x			x						
Tadorna tadornoides	Australian Shelduck	-	-	x			x	x	x				
Taeniopygia guttata	Zebra Finch	-	-	x			x	x	x	x	x	x	x
Thinornis rubricollis	Hooded Plover	P4	-		x	x							
Threskiornis molucca	Australian White Ibis	-	-				x						
Threskiornis spinicollis	Straw-necked Ibis	-	-	x			x						
Todiramphus pyrrhopygius	Red-backed Kingfisher	-	-	x			x						
Todiramphus sanctus	Sacred Kingfisher	-	-	x			x						
Tribonyx ventralis	Black-tailed Native-hen	-	-	x			x						
Tringa glareola	Wood Sandpiper	IA	Mi			x							
Tringa nebularia	Common Greenshank	IA	Mi	x	x	x							

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Tringa stagnatilis	Marsh Sandpiper	IA	Mi			x							
Turnix castanota	Chestnut-backed Button-quail	-	-	x									
Turnix velox	Little Button-quail	-	-	x			x		x				
Vanellus tricolor	Banded Lapwing	-	-	x			x						
Mammalia													
Antechinomys laniger	Kultarr	-	-	x									
Bos taurus	*European Cattle	-	-	x				x	x	x	x	x	x
Camelus dromedarius	*Camel	-	-	x	x								
Canis lupus	*Dog	-	-	x	x				x		x	x	x
Capra hircus	*Goat	-	-	x	x						x	x	
Chalinolobus gouldii	Gould's Wattled Bat	-	-	x									
Dasykaluta rosamondae	Little Red Kaluta	-	-	x									
Felis catus	*Cat	-	-	x	x			x		x	x	x	
Notomys alexis	Spinifex Hopping Mouse	-	-	x									
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	x									
Oryctolagus cuniculus	*European Rabbit	-	-	x	x			x	x		x	x	x
Osphranter robustus	Euro	-	-	x					x	x	x	x	x
Osphranter rufus	Red Kangaroo	-	-	x				x					x
Pseudantechinus woolleyae	Woolley's Pseudantechinus	-	-	x									
Pseudomys desertor	Desert Mouse	-	-	x									
Pseudomys hermannsburgensis	Sandy Inland Mouse	-	-	x									

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	x									
Sminthopsis dolichura	Little long-tailed Dunnart	-	-	x									
Sminthopsis longicaudata	Long-tailed Dunnart	P4	-	x		x							
Sminthopsis macroura	Stripe-faced Dunnart	-	-	x									
Tachyglossus aculeatus	Short-beaked Echidna	-	-	x					x				
Taphozous hilli	Hill's Sheathtail Bat	-	-	x									
Vespadelus finlaysoni	Finlayson's Cave Bat	-	-	x									
Vulpes vulpes	*Red Fox	-	-	x	x								
Reptilia													
Antaresia perthensis	Pygmy Python	-	-	x									
Chelodina steindachneri	Steindachner's Turtle	-	-	x									
Cryptoblepharus buchananii	-	-	-	x									
Ctenophorus caudicinctus	Ring-tailed Dragon	-	-	x				x	x			x	
Ctenophorus isolepis	Military Dragon	-	-	x									
Ctenophorus nuchalis	Central Netted Dragon	-	-	x									
Ctenophorus reticulatus	Western Netted Dragon	-	-	x						x			
Ctenophorus salinarum	Salt Pan Dragon	-	-	x					x				x
Ctenophorus scutulatus	Lozenge-marked Dragon	-	-	x						x			x
Ctenotus helenae	-	-	-	x									
Ctenotus leonhardii	-	-	-	x									
Ctenotus schomburgkii	-	-	-	x									

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Ctenotus severus	-	-	-	x									
Ctenotus uber	-	-	-	x									
Diplodactylus klugei	-	-	-	x									
Diplodactylus pulcher	-	-	-	x									
Diporiphora amphiboluroides	-	-	-	x									
Egernia depressa	Southern Pygmy Spiny-tailed Skink	-	-	x					x		x		
Eremiascincus richardsonii	Broad-banded Sand Swimmer	-	-	x									
Gehyra punctata	-	-	-	x									
Gehyra variegata	Tree Dtella	-	-	x					x	x	x	x	
Heteronotia binoei	Bynoe's Gecko	-	-	x								x	
Lerista bipes	-	-	-	x									
Lerista desertorum	-	-	-	x									
Lerista eupoda	West Coast Mulga Slider	P1	-	x		x			x				
Lerista macropisthopus	-	-	-	x									
Lerista muelleri	-	-	-	x									
Lerista nichollsi	-	-	-	x									
Lerista timida	Timid Slider	-	-	x						x			
Lialis burtonis	-	-	-	x									
Lucasium squarrosum	-	-	-	x									
Menetia greyii	-	-	-	x					x				
Menetia maini	-	-	-	x									

Scientific Name	Common Name	Conservation Status		Database				Literature Source					This Survey
		BC Act	EPBC Act	A	B	C	D	E	F	G	H	I	J
Nephrurus vertebralis	-	-	-	x									
Nephrurus wheeleri	Banded Knob-tailed Gecko	-	-	x									
Parasuta monachus	Inland Hooded Snake	-	-	x									
Pogona minor	Dwarf Bearded Dragon	-	-	x									
Pseudechis butleri	Spotted Mulga Snake	-	-	x									
Pseudonaja modesta	Ringed Brown Snake	-	-	x									
Pygopus nigriceps	-	-	-	x									
Rhynchoedura ornata	Western Beaked Gecko	-	-	x									
Simoselaps bertholdi	Jan's Banded Snake	-	-	x									
Strophurus	-	-	-	x									
Strophurus wellingtonae	-	-	-	x									
Suta fasciata	Rosen's Snake	-	-	x									
Tympanocryptis pseudopsephos	Goldfields Pebble-mimic Dragon	-	-	x									
Varanus caudolineatus	-	-	-	x									
Varanus gouldii	Sand Monitor	-	-	x								x	x
Varanus panoptes	Yellow-spotted Monitor	-	-	x						x	x		

*Note: * denotes introduced/non-native species.*

Appendix H Inventory of Vascular Flora Recorded

Table H-1: Inventory of vascular flora recorded.

Flora Taxa	BOO1	BOO2	BOO3	BOO4	BOO5	BOO6	BOO7	BOO8
Aizoaceae								
Gunniopsis rodwayi	✓	✓						
Amaranthaceae								
Ptilotus obovatus			✓					
Asteraceae								
Calocephalus multiflorus	✓	✓	✓					
Cratystylis subspinescens			✓	✓				
Pterocaulon sphacelatum					✓			
Chenopodiaceae								
Atriplex amnicola				✓				
Atriplex semilunaris			✓					
Atriplex ?vesicaria		✓	✓					
Dysphania simulans		✓						
Enchylaena tomentosa			✓					
Maireana amoena	✓	✓						
Maireana lobiflora		✓						
Maireana luehmannii	✓	✓						
Maireana pyramidata			✓					
Maireana triptera			✓					
Salsola australis	✓	✓						
Sclerolaena cornishiana			✓					
Sclerolaena sp.		✓						✓
Tecticornia cymbiformis	✓	✓						
Tecticornia sp. Dennys Crossing[2]	✓							
Tecticornia doliiformis				✓				
Tecticornia halocnemoides[3]	✓							
Tecticornia indica subsp. *bidens*	✓	✓						
Tecticornia peltata	✓							
Tecticornia aff. *undulata*	✓	✓						
Fabaceae								
Acacia sp. (aneura complex)						✓		
Acacia caesaneura							✓	
Acacia craspedocarpa						✓		
Acacia ?ligulata		✓	✓					
Acacia ?pteraneura						✓		

[2] *identified by K.A. Shepherd & J. English (KS 522)*
[3] *'large ovate seed aggregate'*

Flora Taxa	BOO1	BOO2	BOO3	BOO4	BOO5	BOO6	BOO7	BOO8
Acacia pruinocarpa								✓
Acacia synchronicia			✓					
Senna artemisioides subsp. *helmsii*			✓					
Senna artemisioides subsp. *sturtii*							✓	
Swainsona affinis	✓	✓						
Frankeniaceae								
Frankenia laxiflora	✓	✓	✓					
Frankenia setosa			✓					
Malvaceae								
Lawrencia helmsii	✓							
Montiaceae								
Calandrinia sp.		✓	✓					
Myrtaceae								
Melaleuca sp.	✓	✓		✓				
Poaceae								
Aristida holathera var. *holathera*		✓	✓					
Eragrostis pergracilis	✓	✓						
Paspalidium basicladum		✓						
Proteaceae								
Grevillea striata			✓					
Sapindaceae								
Dodonaea viscosa subsp. *angustissima*			✓					
Scrophulariaceae								
Eremophila compacta subsp. *fecunda*			✓					
Eremophila forrestii subsp. *forrestii*			✓					
Eremophila galeata					✓			
Solanaceae								
Nicotiana sp.		✓	✓					
Solanum lasiophyllum		✓	✓					

Note: Orange shading indicates a Priority species; green shading indicates an affinity species.

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