Menzies Camp and WWTP

Attachment 3B: Proposed Activities

17 July 2025

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1 INTRODUCTION

Brightstar Resources is a well-established mining company primarily engaged in the exploration and development of mineral resources within Western Australia, with a strategic focus on the Goldfields region (Figure 1). Leveraging significant experience in regional operations, Brightstar has consistently demonstrated its capability in efficiently managing mining projects, including comprehensive environmental planning, stakeholder consultation, and regulatory compliance. The company maintains a strong commitment to sustainable development practices, prioritising the careful management of environmental impacts and the proactive engagement of local communities, Traditional Custodians, and regulatory bodies.

In alignment with ongoing operational expansion, Brightstar Resources proposes the establishment of the Menzies Camp wastewater treatment plant (WWTP) and associated infrastructure. This facility is essential to support personnel accommodation and operational efficiency as mining activities continue to expand in the Menzies area. The construction and commissioning of this WWTP and irrigation sprayfield, will increase Brightstar's capacity to sustainably manage wastewater generated by the mining camp, ensuring compliance with applicable environmental standards.

Menzies is a historic town located in Western Australia's renowned Goldfields region, approximately 130 kilometres north of Kalgoorlie. Known for its rich mining heritage dating back to the gold rush era of the late 19th century, Menzies continues to be an area of significant mineral exploration and mining activity. Today, the town serves as a key strategic location for mining operations, providing essential infrastructure and logistical support to numerous projects and exploration ventures in the surrounding region.

To support the ongoing development and expansion of its operations near Menzies, Brightstar Resources is seeking approval under Category 85 of the Environmental Protection Act 1986 (EP Act) for the establishment of a new wastewater treatment plant (WWTP). The proposed facility will cater to a maximum camp population of 120 personnel, facilitating a design capacity of up to 30 cubic metres per day of treated wastewater (Figure 2). The proposed WWTP is designed to efficiently manage domestic wastewater generated by camp accommodation and amenities, including kitchens, showers, laundries, and ablution facilities.

In addition to the construction of the WWTP, Brightstar Resources proposes an integrated approach to wastewater management by incorporating a 1.75-hectare irrigation sprayfield. Treated effluent from the WWTP, will be discharged within designated irrigation area. This irrigation sprayfield will be fenced, located away from sensitive environmental receptors and watercourses, and constructed with adequate buffers to mitigate potential environmental impacts, in alignment with regulatory guidelines.

Through this application, Brightstar Resources demonstrates its ongoing commitment to environmental responsibility, seeking to establish sustainable infrastructure that meets regulatory requirements while supporting operational efficiency. The implementation of this WWTP and irrigation sprayfield will effectively manage wastewater on-site, ensuring minimal environmental impact, enhancing operational sustainability, and aligning closely with industry best practices.

1.1 PURPOSE AND SCOPE

Brightstar Resources is applying for a new works approval for the construction and operation of the Menzies Camp WWTP under Section 54 of the Environmental Protection Act 1986 (EP Act) to conduct the following activities:

- Construction and operation of the Camp WWTP with a maximum throughput capacity of up to 30 m^3 per day of effluent (Section 2).
- Construction and operation of a 1.75 hectare (ha) irrigation sprayfield, pipeline corridor and other associated infrastructure (Section 2.4).

The above works are required for the continued operation and development of Brightstar's operations in Menzies. The proposed installation of the Menzies Camp will require minimal clearing, if required, this will be undertaken in accordance with the clearing limits of Part V (NVCP) of the EP Act (CPS-10921/1; submitted to DEMIRS 20 January 2025).

The associated project works will commence immediately after the works approval has been granted.

1.2 APPROVAL BACKGROUND

This Menzies Camp WWTP is the first approval being sought under Section 54 of the EP Act. for Brightstar's Menzies operations. Additional approvals have been submitted to the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) for a Native Vegetation Clearing Permit (CPS-10921/1) and Mining Proposal and Closure Plan. At the time of submission, both applications were still under assessment.

1.3 PROPOSED PREMISES DETAILS

A description of the premises' categories relevant to this application is provided in Table 1. The proposed premises boundary (PPB) of the facility has been provided in Figure 2.

Brightstar notes that there are no additional environmental risks beyond those outlined in this document.

Table 1. Prescribed Premise Details

Prescribed Premises Category	Production or Design Capacity	Proposed Production of Design Capacity
Category 85: Sewage Facility	Greater than 20m³ and less than 100m³ per day	30m³/day
Category 52: Electric Power Generation	10MW or more in aggregate	NA – below Category 52 threshold. Notification is provided for informational purposes only.
Category 73: Bulk Fuel and Chemical Storage	1,000m³ in aggregate	NA – below Category 73 threshold Notification is provided for informational purposes only.
Category 6: Dewatering	Greater than 50,000m³/annum	To be addressed in a separate Works Approval submission and provided for informational purposes only.

1.4 APPLICANT DETAILS

The applicant and occupier of the premises for which this works approval is made are:

Brightstar Resources

[redacted]

Australian Company Number: 100 727 491

Australian Business Number: 44 100 727 491

For any specific queries, please contact the following key contact below:

Email: [redacted]

1.5 STAKEHOLDER CONSULTATION

Stakeholder consultation for Menzies Camp has formed part of a broader stakeholder engagement programme for Brightstar projects undergoing environmental approvals.

The overarching objectives of the program are:

- To inform stakeholders about the Project and its impact upon the environment and to describe the outcomes of consultation on project design; and
- To establish relationships with key stakeholders to enable ongoing dialogue throughout implementation and regulation of the Project.

Key stakeholders have been identified through Brightstar's experience in the Goldfields. Brightstar considers that no further consultation is required before approval of the works approval to construct and operate Menzies Camp WWTP and associated infrastructure.

1.5.1 Cultural Heritage and Native Title

Brightstar's approach to the management of Aboriginal Cultural Heritage is based on the 'site avoidance' principle. This means, when a site of cultural significance is identified, Brightstar will work to avoid impacting the heritage place wherever possible and will otherwise minimise and mitigate impacts. Where Brightstar cannot avoid impacts upon Aboriginal Cultural Heritage places, Brightstar will seek the required consent to impact those places and prior to doing so, will seek to discuss and agree management and impact mitigation measures with the Traditional Custodians of the area.

The proposed footprint for Menzies Camp has been both archaeologically and ethnographically surveyed. No Aboriginal Cultural Heritage (ACH) values will be impacted by the proposed project footprint.

Considering the existing and proposed levels of disturbance, no approvals are required under the *Aboriginal Heritage Act 1972 (WA)*.

2 MENZIES CAMP WWTP AND IRRIGATION SPRAY FIELD

Brightstar proposes to apply for a new Works Approval (as outlined in Table 2 below) under Section 54 of the EP Act for the construction and operation of the Menzies Camp WWTP with a throughput capacity of up to 30m^3 per day, inclusive of a 1.75ha irrigation sprayfield, pipeline corridor and other associated infrastructure.

The proposed camp will accommodate up to 120 persons and support existing and future mining projects in the Goldfields region.

The WWTP which services Menzies Camp is located approximately 50m south-west of the camp accommodation (at the closest point) and the irrigation area is approximately 1000 m north-west of the camp. The location of the camp, WWTP and irrigation area is depicted in Figure 2.

Table 2. Proposed Aspects

Aspect	Proposed
Maximum Camp Population	120
Category 85: Sewage Facilty	30m³/day
Irrigation Area	1.75ha

A summary of the proposed Menzies Camp WWTP and RO plant design parameters are provided in Table 3 below.

Table 3. Design Parameters

Aspect	Proposed
Plant type	Fixed film Bioreactor
Design capacity	Proposed capacity for this works approval application is based on a consumption estimate of 250L/person/day for a maximum population of 120 people per day.
Estimated wastewater treatment and RO plant design capacity	30m³/day Comprised of 30m³/day of treated sewage effluent
Minimum irrigation sprayfield size based on peak load	1.66ha
Proposed irrigation sprayfield size	1.75ha

2.1 KEY CHARACTERISTICS

A description of the key characteristics of the proposed Menzies Camp WWTP is outlined in Table 4.

Table 4. Key Characteristics

Aspect	Key Characteristic
Location	The footprint is split between Brightstar tenements m29/153, M29/154 and M29/14
Inputs	Raw sewage Chemicals for treatment
Outputs	Inorganic waste (disposed offsite in a licenced facility) Waste sludge (disposed offsite in a licenced facility)
Irrigation sprayfield	1.75ha Fully enclosed within a fenced area Appropriate warning signage Sprayfield located outside of floodplains with the nearest water course over 700m away Sprinklers to be spaced evenly and operated to prevent pooling
Power generation and storage	3x 250 kVA generators 30m^3 self bunded fuel storage (30 000L) Or Connected to the Menzies electricity grid (Horizon application ongoing)
Discharge water quality	Wastewater will be treated to meet the low exposure risk level defined in the *Guideline for the non-potable uses of recycled water in Western Australia* (Department of Health, 2024).

Key environmental values	Dust Noise Surface water Groundwater Chemicals and hydrocarbons Waste and leachate Vegetation and flora Fauna Soil contamination Odour Public health

2.2 PROCESS DESCRIPTION

INFLUENT FLOW

Sewage from the accommodation camp is pumped to interconnected primary settling tanks. Readily settleable solids settle to the bottom of each tank as clear liquid overflow to each of the subsequent tanks. Supernatant from each of the primary settlement tanks overflows to the next tank in sequence. From the final primary settling tank, the supernatant overflows into a balance tank (50kL).

FLOW EQUALISATION

As the liquid from the primary settling tank flows into the balance tank and fills it up, the hi-level control switch activates. This activates the influent feed pump to draw liquid from the balance tank and feed it into a fixed film aerobic treatment unit. The balance tank also receives an intermittently operating stream of recycled nitrified liquor from the clarifier zone of the fixed film aerobic treatment unit via an airlift. This ensures that mal-odours are prevented from developing due to the effects of contact stabilisation. When the level in the balance tank drops to a low level, the low level control switch hangs causing the influent feed pumps to pause operation to prevent dry running. In an emergency situation or in case of a hi-hi level control switch activation due to high flow conditions, the standby influent feed pump is also activated along with the duty feed pump, this prevents tank overflow from occurring.

DESCRIPTION FOR THE TREATMENT TRAIN

Aeration/Clarifier Tank

The liquid from the balance tank enters the aerobic chamber. Here the sewage is aerated via coarse bubble diffusers in presence of fixed media. This vigorous aeration transfers oxygen to the sewage to satisfy the biochemical oxygen demand. Once BOD is satisfied, the liquid is then nitrified. The aeration is turned off periodically to allow for dissolved oxygen to be depleted and for an anoxic zone to develop. This promotes denitrification to occur.

After the denitrification phase, the aerators are restarted. The liquid then flows into the clarification section of the plant via a sludge well. A polymer is dosed into the sludge well of the clarifier to aid in agglomerating the particles to enhance settling. Heavier particles settle to the bottom of the clarifier. The clarifier operates two scum skimmers and a return sludge line for internal recycle via airlift. Any surface scum is removed and returned to the head of the reactor and the primary settlement tank via air lift. Settled sludge is also returned to upstream primary settlement tank.

Clear supernatant leaves the top of the clarifier zone via overflow weirs through the effluent launder and flows out to the Chlorine Contact Tank.

Chlorine Contact Tank & Effluent Disposal

This tank receives continuous flow from the outlet of the reactor clarifier. Chlorine tablets are used for chlorination to maintain the level of chlorine between 0.2mg/L and 2.0mg/L.

The duty/standby Effluent Pump draws chlorinated effluent from the Chlorine Contact Tank and delivers it to the sprayfield where it is distributed through impact type sprinklers. The required effluent disposal area is 1.66ha. Additional buffer has been considered and the final size of the effluent disposal area has been determined to be 1.75ha.

Proposed infrastructure associated with the wastewater treatment process is detailed in Table 5.

Table 5. Indicative Infrastructure

Tank Description	Process Description	Indicative Proposed Capacity
Primary Settling and Balance tanks	Settleable solids and associated BOD is removed in the first primary settling tank. Supernatant overflows into balance tank for flow equalization and contact stabilization.	4 x 50,000 L tanks
Aeration Treatment unit with aerobic reactor and clarifier chambers	Liquid from the balance tank is fed at a fixed rate into an aeration chamber where it is aerated in the presence of fixed media to promote growth of heterotrophs and autotrophs. The oxygen demand is satisfied and ammonia is converted to nitrate here. The liquid flows to a secondary settling chamber where settled sludge is returned upstream into the balance tanks. Clear effluent overflows into the chlorine contact tank.	2 x 21,500L Tanks (each with a 12,500L Aerobic reactor volume and a 5,900L clarifier chamber)
Emergency overflow effluent Tank	Liquid from the wastewater treatment system can overflow into this tank incase of a power outage as additional liquid containment	1 x 50,000L Tank
Chlorine Contact Tanks	Clear liquid from the secondary settling chamber is chlorinated and disinfected before they are discharged to the sprayfield.	2 x 9,000L Tank

2.3 WWTP INPUTS

Menzies Camp WWTP will primarily receive raw wastewater from camp facilities (such as toilets, showers, laundries, kitchen), and other waste generating facilities.

Chemical inputs are required for the treatment process, which include but are not limited to, sodium hypochlorite and poly aluminium chlorine based flocculant.

The preferred supplier has designed the plant to accommodate typical influent wastewater composition. The influent concentrations relative to the hydraulic load for WWTP design are inversely proportional, resulting in higher influent concentrations during low hydraulic loading periods, which are expected

during the WWTP commissioning phase. However, as demonstrated in Table 6 below, the anticipated influent characteristics at Menzies Camp requiring treatment under minimum hydraulic load conditions (approximately 12.5 m^3/day, or 50 EP) is within the typical domestic composition range.

Table 6. Untreated Wastewater Composition

Parameter	Typical Influent characteristics	Anticipated Composition
5 Day Biological Oxygen Demand (BOD5)	110 - 450 mg/l	300 mg/l
Total Suspended Solids (TSS)	100 - 400 mg/l	300 mg/l
Total Nitrogen (TN)	20-100 mg/l	60 mg/l
Total Phosphorous (TP)	5-25 mg/l	20 mg/l
pH	6.5- 8.5	6.5- 8.5

2.4 WWTP OUTPUTS

The main output produced by the Menzies Camp WWTP will be treated effluent. The treated effluent will be disposed of within a dedicated irrigation area, located approximately 1000 m (at its closest point) from the camp accommodation, and approximately 1000 m from the WWTP. Treated effluent will be discharged to the 1.75 ha irrigation area. The anticipated quality of the treated effluent water quality is shown in Table 7.

Sludge will also be produced by the WWTP and collected in dedicated sludge tanks. The sludge will be removed periodically as required by a licensed carrier and taken offsite for disposal at an appropriately licensed premises in accordance with the *Environmental Protection (Controlled Waste) Regulations 2004*.

Table 7. Expected Effluent Water Quality

Parameter	Anticipated Concentration
5 Day Biological Oxygen Demand (BODs)	< 20 mg/L
Total Suspended Solids (TSS)	< 30 mg/L
Total Nitrogen (TN)	< 60 mg/L
Total Phosphorous (TP)	< 18 mg/L
pH	6.5-8.5
Total Coliforms	< 1,000 cfu/100 ml
Free Chlorine	0.2-2 mg/L

2.5 IRRIGATION SPRAYFIELD

Treated effluent is disposed of within a designated irrigation area shown in Figure 2. The irrigation field will be fully enclosed within a fenced area. The fence perimeter will be a minimum separation distance of 5 metres (m) from the sprinkler system to allow for spray drift. Appropriate warning signage will be affixed along the fence perimeter.

The design of the irrigation sprayfield was determined using the nutrient application criteria contained in *Water Quality Protection Note 22: Irrigation with Nutrient-Rish Wastewater* (WQPN 22) (Department of Water, 2008). The phosphorous and nitrogen calculations contained in WQPN 22 were used to determine the spray irrigation field area required to prevent nutrient loading occurring as a result of the disposal of treated effluent.

The size of the irrigation area is outlined in Table 9, for total nitrogen and Table 9 for total phosphorus which demonstrate that a minimum irrigation area of 1.66 ha is required to prevent nutrient loading resulting from the disposal of effluent.

Brightstar requests for the construction and operation of a 1.75 ha irrigation sprayfield to provide for a buffer of approximately 5% (0.083 ha) additional area to account for redundancy, provide for operational flexibility and compliance with the Department of Health minimum wetted area requirements requiring a non-overlapping sprinkler design.

Ongoing flexibility of blending and disposal within the irrigation field may be required in the event of

large rainfall events or due to operational requirements.

Table 8. Irrigation Area Required for TN

Design Paramter	Value
Maximum Camp Population	120
Water Consumption Rate	250L/pp/day
Daily Effluent Discharge	30,000L
Anticipated TN Load	60mg/L (0.000006kg/L)
Daily TN Load	1.8kg/day
Annual TN Load	657kg/year
TN Disposal Rate	480kg/ha/year (Department of Health, 2024)
Area Required	1.37ha

Table 9. Irrigation Area Required for TP

Design Paramter	Value
Maximum Camp Population	120
Water Consumption Rate	250L/pp/day
Daily Effluent Discharge	30,000L
Anticipated TP Load	20mg/L
Daily TP Load	0.54kg/day
Annual TP Load	197.1kg/year
TP Disposal Rate	120kg/ha/year (Department of Health, 2024)
Area Required	1.66ha

2.6 ADDITIONAL INFRASTRUCTURE CONTROLS

The following additional controls provided in Table 11 will be implemented for the respective irrigation sprayfield, WWTP, associated pipeline, and RO brine pipeline to ensure that the proposed infrastructure associated with this works approval application operates optimally.

Table 10. WWTP Controls

Infrastructure	Controls
WWTP and Pipeline	Volumetric flowmeters are maintained on the WWTP outlet to the irrigation sprayfield. Appropriate earthen bunding (or similar) is maintained around the WWTP perimeter. Sludge is removed by a licensed waster carrier for disposal to a licensed disposal facility. Chemicals are stored in accordance with Australian Standard AS 3780:2008 Storage and Handling of Corrosive Substances. Spills are cleaned up as soon as practicable.
Irrigation Sprayfield	Maintained and free of leaks and defects. Buffer distance of 5 m between sprinklers and perimeter fence. Fences with appropriate safety signage installed.

2.7 ENVIRONMENTAL COMMISSIONING PLAN

Post compliance checks, commissioning will commence to enable time limited operations and submission of the Environmental Commissioning Report, and granting of a Licence in accordance with Division 3, Part V of the Environmental Protection Act 1986.

Brightstar Resources will undertake the commissioning of the facility to ensure it has been constructed according to the manufacturer's specifications, ensure the facility's integrity, and perform the appropriate

verification and validation monitoring under the Department of Health Guidelines and associated ANZECC guidelines.

2.7.1 Verification and Validation Monitoring

During the WWTP Environmental Commissioning phase, validation monitoring will be conducted on the treated wastewater to ensure the required standard and confirm that the WWTP is operating correctly. Validation monitoring will be undertaken by obtaining an effluent sample over the facility's monitoring period (1 x sample). Table 11 outlines the monitoring frequency and compliance values required to validate and verify the WWTP.

Environmental Commissioning is expected to occur over a period not exceeding 60 calendar days in aggregate. Within 30 calendar days of the completion of Environmental Commissioning, an Environmental Commissioning Report will be submitted to the CEO. Time limited operations not exceeding 180 calendar days or until such time as a Licence is issued, will commence from the completion of Environmental Commissioning.

Table 11. Emissions and Discharge Monitoring

Monitoring Location	Parameter	Compliance Value	Sample Frequecy
WWTP Outlet	5 Day Biological Oxygen Demand (BODs)	< 20 mg/L	Once during Environmental Commissioning then monthly during Time Limited Operations.
	Total Suspended Solids (TSS)	< 30 mg/L	
	Total Nitrogen (TN)	< 60 mg/L	
	Total Phosphorous (TP)	< 18 mg/L	
	pH	6.5-8.5	
	E.Coli (Total Coliforms)	< 1,000 cfu/100 ml	
	Free Chlorine	0.2-2 mg/L	
	Volume discharged to the sprayfield	< 30m³/day average	Weekly

2.8 SUPPORTING INFRASTRUCTURE

Key characteristics of the supporting infrastructure associated with system controls, power supply and fuel requirements are outlined in Table 12.

Table 12. Supporting Infrastructure

Supporting Infrastructure	Indicative Requirements
Power Supply	3x 250 kVA, equivalent to 0.75 MW in aggregate {below 10 MW threshold for Category 52) or connected to town supply
Fuel Storage	1x 30m^3 diesel storage tank/s {below 1,000 m^3 threshold for Category 73)
Water Supply	Proposed to be connected to town supply

2.8.1 Power Supply

Power supply for the camp accommodation and WWTP will either be connected to the Menzies electrical grid or be comprised of diesel generators with an indicative apparent power of 750 kVA (3 x 0.25 MW diesel generator sets), approximately equivalent to 0.75 MW of real power.

Whilst the specific model and type of the generators is still being considered, Brightstar has determined that approximately 0.75 MW of power generation capacity is required to support Menzies Camp. Therefore, Brightstar requests operational flexibility in providing this information to the Department, if required, at the Environmental Construction Report stage.

If power is produced by generators produced at the facility to support operations, then power generation will be below the Category 52 threshold of 10 MW. Due to the minor power generation capacity of 0.75 MW, there are unlikely to be additional fugitive cumulative impacts associated with the construction and operation of the gensets.

2.8.2 Fuel Supply

Fuel storage for power generation and other activities to support the Menzies Camp project will be located within the proposed premises boundary. The total indicative combined fuel storage capacity is approximately 30m^3, which is below the 1,000 m^3 aggregate production capacity threshold of Category 73 and remains

below the EP Regulation thresholds.

All chemicals and hydrocarbons will be stored in accordance with Brightstar's *Chemical and Hydrocarbon Management Plan*. Refer to Section 5.3 for further details.

3 SITE ENVIRONMENTAL CHARACTERISTICS

A detailed assessment of the existing environment relating to the proposed Menzies Camp and WWTP sprayfield was undertaken. The following sections highlight the key environmental characteristics of the location.

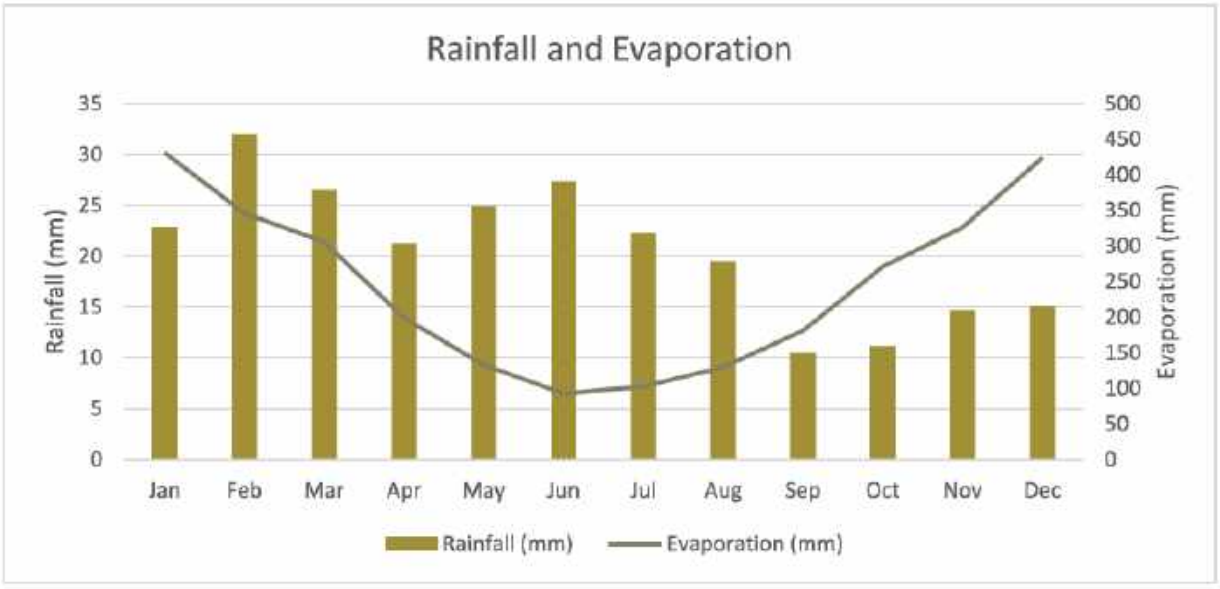
Menzies Camp does not impact on any of the following areas:

- National Parks.
- Any reserves.
- Wetlands.
- Environmental Protection Policy areas.
- Water resource area, water reserve, declared or proposed catchment, significant lake or wetland.
- Surface and groundwater protected areas.

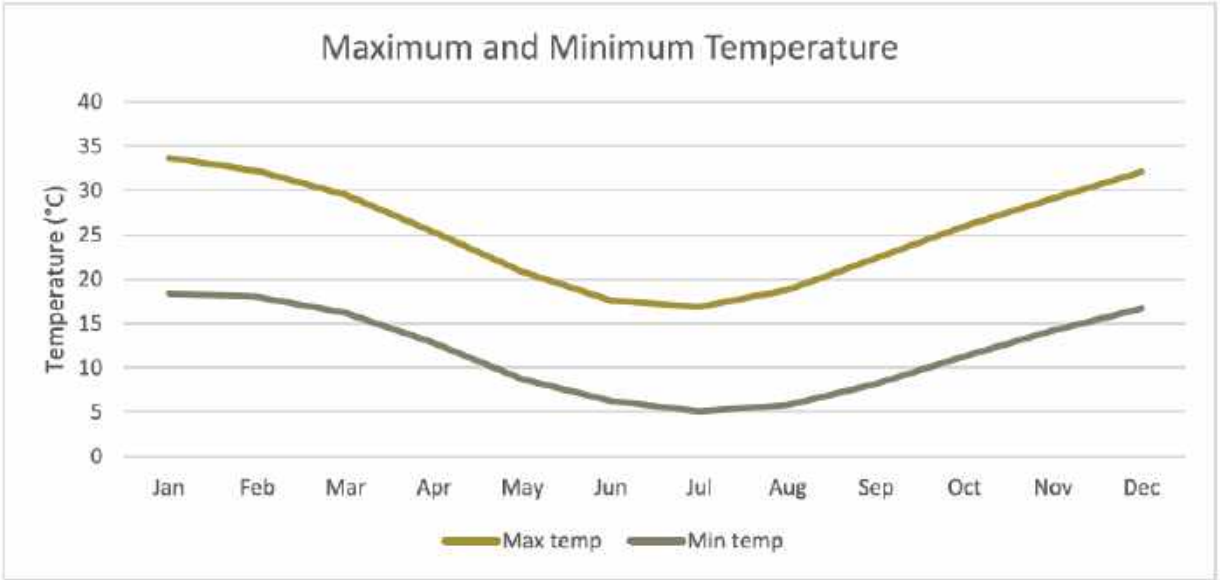
3.1 CLIMATE

Menzies, situated in Western Australia's northern Goldfields region, experiences a semi-arid climate characterized by hot summers and cool winters. According to the Bureau of Meteorology, the area receives an average annual rainfall of approximately 236.3 mm, with the majority falling during the summer months (Graph 1). Average maximum temperatures range from 36.5°C in January to 17.3°C in July, while minimum temperatures vary from 22.0°C in January to 5.2°C in July (Graph 2). These climatic conditions are crucial considerations for the design and operation of wastewater treatment and irrigation systems, particularly concerning evaporation rates and seasonal rainfall patterns.

Graph 1. Menzies mean rainfall and evaporation



Graph 2. Menzies maximum and minimum temperatures



3.2 LANDFORMS, GEOLOGY AND SOILS

The Menzies region, located within the Eastern Goldfields of Western Australia, predominantly features

gently undulating plains interspersed with low rises and scattered rocky outcrops. Landforms typically consist of weathered bedrock, lateritic duricrusts, and superficial sandy soils. The geological profile is characterized by Archean-aged granitic and greenstone rock units, associated with significant mineralisation—particularly gold—typical of the broader Goldfields geological province. The land system encompassing the entire proposed development, exists entirely within the Moriary Land System, consisting of stony planes and low rises based on granite (Figure 4).

Soils in the Menzies area are predominantly shallow, skeletal, and sandy to loamy-textured, reflecting the underlying geology. These soils are often characterised by a low nutrient profile, variable permeability, and susceptibility to erosion if disturbed, particularly by wind and water during heavy rainfall events. This context consideration of soil stabilisation and erosion control measures during construction and ongoing operation of infrastructure, including the wastewater treatment and irrigation facilities proposed by Brightstar Resources.

3.3 LOCAL HYDROGEOLOGY

The hydrogeology in the Menzies region is dominated by fractured-rock aquifers typically associated with Archean-aged bedrock, primarily composed of granite and greenstone lithologies. Groundwater resources in these fractured-rock aquifers are generally limited, occurring mostly in discrete fractures and fault zones, with highly variable permeability and yields. The groundwater table in this region is commonly encountered at considerable depths, typically greater than 30 to 50 meters below ground level, reflecting the area's semi-arid climate and limited annual recharge.

Groundwater quality within the Menzies region often exhibits elevated salinity levels, ranging from brackish to saline, with total dissolved solids (TDS) commonly exceeding 2,000 mg/L, closer to 30,000 mg/L or seawater levels. Due to these hydrogeological characteristics, groundwater resources around Menzies are usually suitable only for non-potable purposes, such as mining operations and industrial applications. Management practices for wastewater treatment and irrigation facilities, as proposed by Brightstar Resources, will ensure minimal impact on groundwater quality, incorporating suitable buffer distances, nutrient loading assessments, and ongoing applicable environmental monitoring protocols.

The nearest drainage feature to the proposal is an unnamed ephemeral creek 200m to the south of the camp, and approximately 900m south of the WWTP sprayfield (Figure 5).

3.4 FLORA AND VEGETATION

A flora and vegetation survey was undertaken for the area by Western Botanical (2021) and updated in

2025. The vegetation of the camp location has been described as consisting of the following vegetation units provided in Table 13 and depicted in Figure 6.

Table 13. Vegetation Units

Vegetation Code	Description
EsSafS	Alluvial plains with sparse overstories and dominant Eremophila scoparia and Senna artemisioides mid-storeys
HPMS	Level to very gentle inclined plains subject to sheet flow, often with mantles of fine ironstone gravel, supporting scattered to moderately close Acacia aneura tall shrublands
GHAS-As	Hills and low rises of red earths on greenstone or basalt indurated by iron, supporting Acacia sibirica
DRMS	Narrow unincised linear drainage zones receiving concentrated run-on, supporting A. aneura tall shrublands
PSAS	Alluvial plains with red earths or duplex soils on hardpan dominated by Maireana pyramidata
CpAsS	Stoney rises and plains with moderate to abundant mixed mantles of greenstone, quartz and ironstone pebbles and cobbles, supporting prominent Casuarina pauper overstoreys with Acacia sibirica.
Disturbed	Disturbed

None of the vegetation communities of the camp area were considered Threatened Ecological Communities or Priority Ecological Communities. No Priority 1 or Declared Rare flora species have been previously identified within the camp area or in vicinity of the sprayfield and pipeline infrastructure.

3.5 FAUNA

Terrestrial Ecosystems undertook vertebrate and invertebrate fauna surveys in 2021 (updated in 2025) and determined that the broad fauna habitat type of the Menzies Camp is disturbed, or bushy shrubland habitat (Figure 7). Due to the existing levels of disturbance within the camp vicinity, and minimal clearing associated with the Project, it is unlikely that any potential habitat loss will impact the species.

4 SITING AND LOCATION

Nearby environmentally sensitive receptors and aspects were assessed in accordance with the Guidance Statement: Environmental Siting.

Brightstar does not anticipate that the proposed activities requested in this application for a works approval to impact upon any nearby sensitive receptors.

4.1 SENSITIVE LAND USES

There are no known sensitive land uses within the immediate area of the proposed premises boundary. The nearest sensitive receptors are two heritage sites, approximately 600m west of the Menzies Camp and adjacent to the pipeline route.

4.2 SENSITIVE RECEPTORS AND ASPECTS

There are no environmentally sensitive receptors or localities within the boundary of the proposed premises or within the vicinity of the Project. The siting and location assessment of the premises boundary and the proposed activities are considered controlled and low risk due to the highly developed and disturbed regional context. A summary of environmentally sensitive receptors and aspects is provided in Table 14.

Table 14. Sensitive Receptors

Type	Description	Premise Boundary	Controls
Environmentally Sensitive Areas	Nil within vicinity	Nil within vicinity	NA
Threatened Ecological Communities	Nil within vicinity	Nil within vicinity	NA
Threatened and/or	Nil within vicinity	Nil within vicinity	NA

Priority Fauna			
Declared Rare Flora	Nil within vicinity	Nil within vicinity	NA
Aboriginal and other Heritage Areas	2 x scar trees	1. 600m west of the camp. 2. Adjacent to pipeline route	Refer to Section 5.10
Rivers, Lakes, Oceans, and other bodies of surface water, etc.	Unnamed ephemeral creek	200m south of proposed camp and 900m south of the spraryfield	Refer to Section 5.1 and 5.2
	Lake Ballard	12km north of the sprayfield	NA
Acid Sulfate Soils	Nil within vicinity	Nil within vicinity	NA
Other	Nearest human receptor	1. 120m north of the camp 2. 1500m east of the sprayfield	Refer to Section 5.8 and 5.9
	Menzies PDWSA	2.7km south-east of the sprayfield	NA

5 RISK ASSESSMENT

An assessment and review of the potential sources, pathways and receptors and their adverse environmental impacts as a result of the proposed works approval activities is provided in this section. The corresponding management measures to minimise environmental impacts are also detailed.

The potential environmental impacts that may occur as a result of the proposed activities during operation are summarised in Table 15 below.

Table 15. Risk Assessment/Proposed Controls

Risk Source	Potential Pathway	Receptor	Potential Impact	Risk Level	Mitigation/Management Measures
Treated effluent discharge	Surface runoff / overland flow	Local soils, surface water (ephemeral creek)	Nutrient loading, eutrophication, pooling	Low	Sprayfield min distance from surface water, bunding, 5m buffer to fence, non-overlapping sprinkler layout, monitoring

Irrigation over-application	Infiltration through soil	Groundwater (>50m depth)	Nitrate or phosphate contamination	Low	<3mm/day loading, evapotranspiration >3200mm/year, soil retention, 2m vertical buffer to wet-season water table
Sludge production	Leachate or mismanagement during handling	Soil, groundwater	Contamination due to poor sludge disposal	Low	Sludge tank storage, periodic removal by licensed carrier, compliance with Controlled Waste Regulations 2004
Chemical storage and handling	Spills or leaks	Soil, groundwater, surface water	Soil contamination, fire hazard, ecosystem damage	Medium	AS 3780 compliant storage, bunded areas, spill response plan, Chemical & Hydrocarbon Management Plan
Power generation (diesel gensets)[1]	Emissions (noise, particulates), fuel spills	Local air quality, nearby workers	Air pollution, odour, potential fuel spills	Low	Fuel <1,000m^3, <10MW gen-sets, self-bunded tanks, located >100m from receptors, maintenance plans
Raw sewage leaks (during commissioning)	Pipe leak or tank overflow	Soil, groundwater	Pathogen exposure, odour, contamination	Medium	Emergency tank (50kL), high-level alarms, dual pumps, bunds around WWTP, routine inspections
Odour generation	Air emissions during biological treatment	Camp residents, nearest receptor 120m away	Public nuisance, complaint risk	Low	Bunded enclosure, odour monitoring, separation from camp, periodic aeration control
Weed propagation	Nutrient-rich irrigation promoting weed growth	Surrounding native vegetation	Displacement of native species	Low	Weed management plan, regular inspections, controlled nutrient dosing
Dust during construction	Wind erosion	Air, flora, fauna	Respiratory issues, visual nuisance, habitat smothering	Low	Dust suppression (water carts), minimal clearing, staged works, temporary fencing
Construction noise	Direct emission from machinery	Nearby fauna	Temporary displacement, stress	Low	Construction during daylight hours, limited vegetation clearing, no blasting
Aboriginal heritage disturbance	Ground disturbance near scar trees	Registered Aboriginal Heritage Sites	Cultural harm, legal compliance risk	Low	Sites flagged, Ground Disturbance Permit Procedure followed, no direct impact planned
Public health risk	Treated effluent exposure, odours	Site personnel, nearest camp 120m away	Illness from pathogens, community concern	Low	DoH application for on-site system, chlorination to 0.2–2mg/L, fencing, signage

[1] Not applicable if connected to the Menzies electrical grid

5.1 SURFACE WATER MANAGEMENT

The WWTP has been located to minimise risks associated with surface water tables, waterlogging and flooding (Department of Water, 2009). The irrigation field will be managed to ensure that treated effluent will not pool on the surface where it can flow into the surrounding environment. The irrigation field will not intercept any surface water features, and separation buffers of 100 m will be utilised where sensitive environmental areas are identified, e.g. water pools (Department of Water, 2009).

5.2 GROUNDWATER MANAGEMENT

Groundwater levels in the area are greater than 50 metres below ground level. A minimum two- metre vertical separation will be maintained between the irrigated surface and the end of the wet-season water table to maintain aerobic soils. This will limit water-logging and foster contaminant control via soil filtration and microbial action (Department of Water, 2009). The treated wastewater will be applied to support vegetation growth needs and couple the infiltration and nutrient retention capacity of the soil.

It is unlikely that groundwater will receive any loading from the WWTP and irrigation field, or cause local groundwater nutrient concentrations to increase.

Therefore, as additional controls, the sprayfield will be operated so that most of the water evaporates and there is no water pooling on the surface so that seepage to groundwater does not occur. Furthermore, it is anticipated that nutrients in treated wastewater will be taken up by vegetation growth or retained in the soil, and it is unlikely that groundwater will receive any loading from the irrigation of treated wastewater.

5.3 CHEMICAL AND HYDROCARBON MANAGEMENT

Chemicals and Hydrocarbons utilised will be managed under the Chemical and Hydrocarbon Management Plan to ensure that the storage, handling, transportation, and disposal of chemicals are managed to minimise environmental impact. Bunding will be installed around the WWTP units and chemical storage locations as a further mitigation measure.

Any chemical or hydrocarbon spills arising from the WWTP facilities will be managed in accordance with the Chemical and Hydrocarbon Storage Procedure.

5.4 WASTE AND LEACHATE MANAGEMENT

The solid waste generated from the installation of the WWTP will be appropriately contained, stored, and disposed of by a licensed waste management contractor. Sludge produced by the WWTP will be collected

in a sludge tank. The sludge will be removed periodically from the tank by a licensed carrier and taken offsite for disposal at an appropriately licensed facility in accordance with the Environmental Protection (Controlled Waste) Regulations 2004 (Government of Western Australia, 2004).

5.5 VEGETATION AND FLORA MANAGEMENT

Weeds are expected to be present within the irrigation area due to the nature of the activity and emission. Brightstar will manage weeds within the irrigation area in accordance with the elements of the Brightstar Weed Management Plan, where relevant and practicable. The irrigation area will be monitored to minimise the potential risks of weeds spreading outside the containment, thus minimising any potential impacts to conservation values.

5.6 FAUNA MANAGEMENT

Minimal impacts to fauna are expected to result from the proposed Menzies Camp. Due to minimal clearing required for the construction and installation of the WWTP, sprayfield and associated infrastructure loss of fauna habitat will be limited. Disturbances to fauna within the area as a result of construction noise and dust are expected to minor and temporary. Additionally, individuals are unlikely to be in proximity of the premises due to existing levels of disturbance within the vicinity and adjacent operating railway.

5.7 SOIL CONTAMINATION

The nutrient retention capacity of the soil within the field application area is expected to be suitable, as the total amount of nutrients will likely match vegetation growth needs with allowance for excess nutrient retention in the topsoil (Department of Water, 2008).

The anticipated maximum actual hydraulic loading rate per m^2 per day is <3 mm. The point potential for evapotranspiration at the proposed site is approximately 3,200 mm per annum. Based on the maximum irrigation rate of roughly 2.5mm per day, it is evident that the actual migration of effluent water into the sub-soil structure will be minimal and provide limited benefit to the vegetation growing in the nominated effluent disposal application area of 1.75 ha.

Therefore, Brightstar does not anticipate that the operation of the WWTP will adversely impact soil quality. The proposed irrigation area is of a sufficient size to ensure that the nutrient loading from the treated effluent disposed of will comply with the nutrient loading criteria contained within WQPN 22 (Department of Water, 2008) (refer Section 2.4).

5.8 ODOUR MANAGEMENT

The WWTP contained within self-bunded units, which will control odour emissions from the infrastructure. The daily maintenance schedule for the WWTP will include a check for any odours outside the facility. Should the facility be found to be producing odours, the source of these odours will be identified, and any necessary repairs to the facility will be performed.

The WWTP is separated from the camp and is a significant distance from any sensitive community receptors.

5.9 PUBLIC HEALTH

An application will be put forward to the Department of Health (DoH) for a commercial on-site wastewater system in accordance with the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*.

5.10 ABORIGINAL HERITAGE

All nearby aboriginal heritage sites have been flagged on the ground. All disturbance activities will be managed as per the Ground Disturbance Permit Procedure.

6 REFERENCES

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***FIGURE 1** LOCATION MAP*

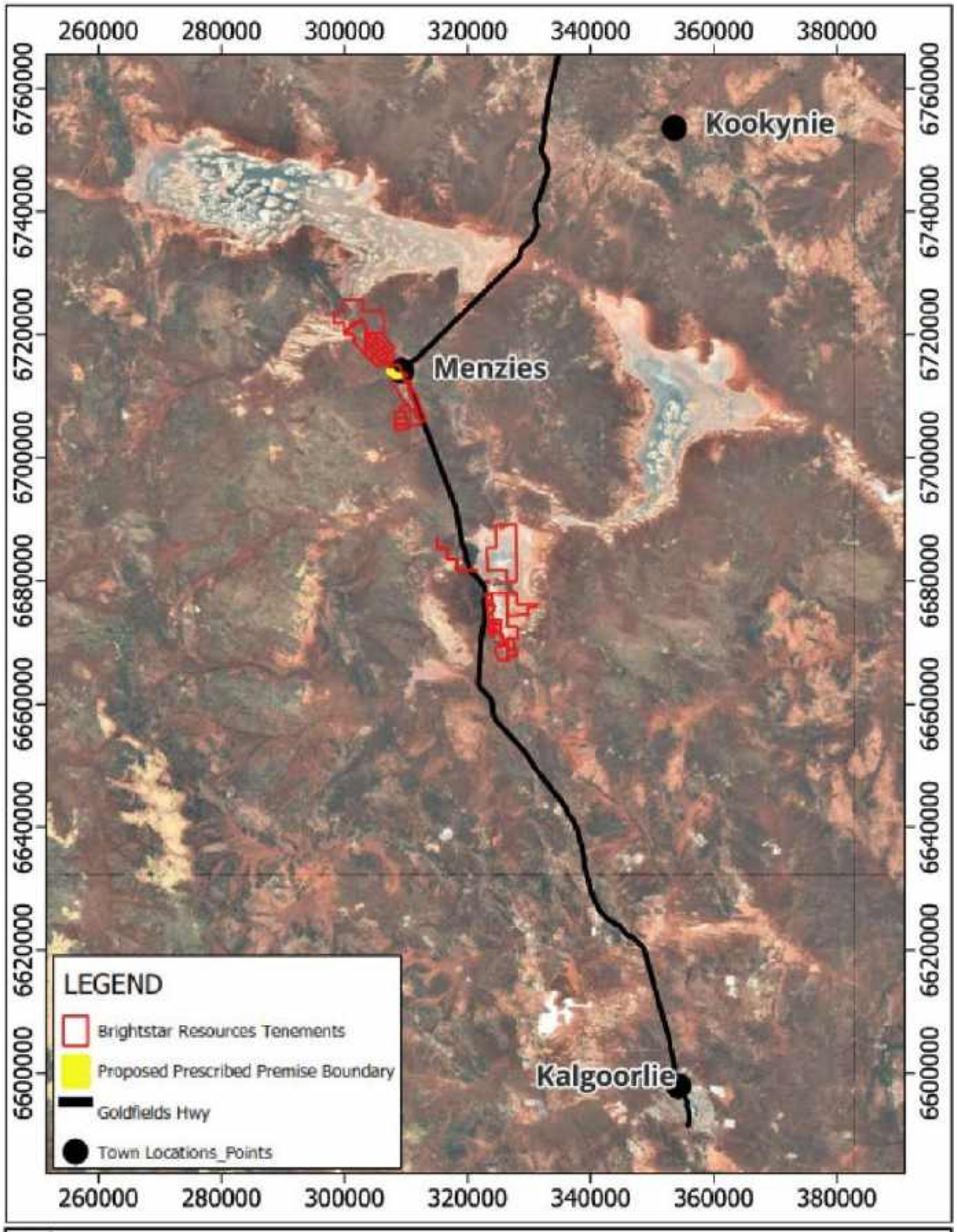

Figure 1. Project Location

***FIGURE 2** PROPOSED PREMISES BOUNDARY*

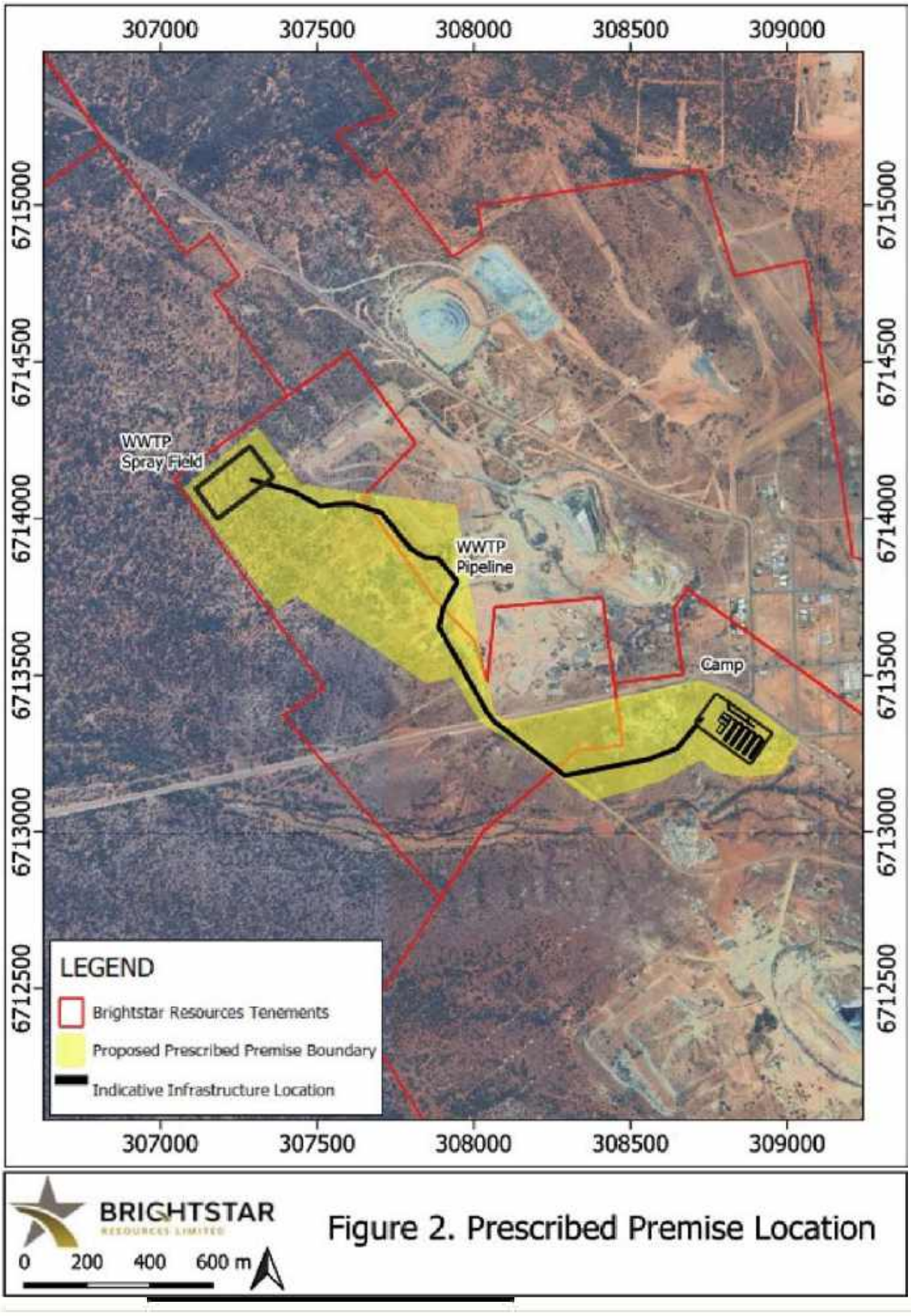

FIGURE 3 *INDICATIVE WWTP GENERAL ARRANGEMENT*

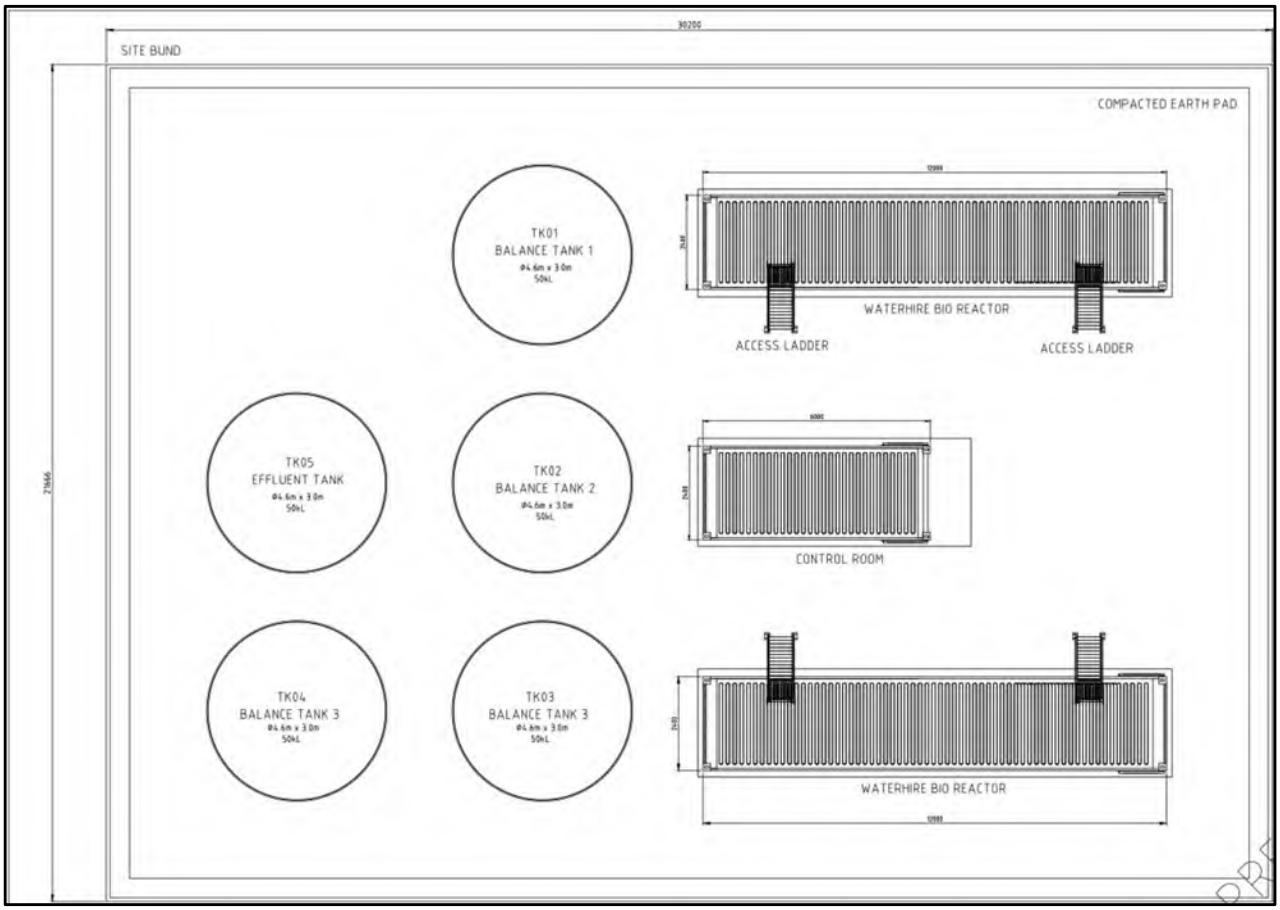

***FIGURE 4** LAND SYSTEMS*

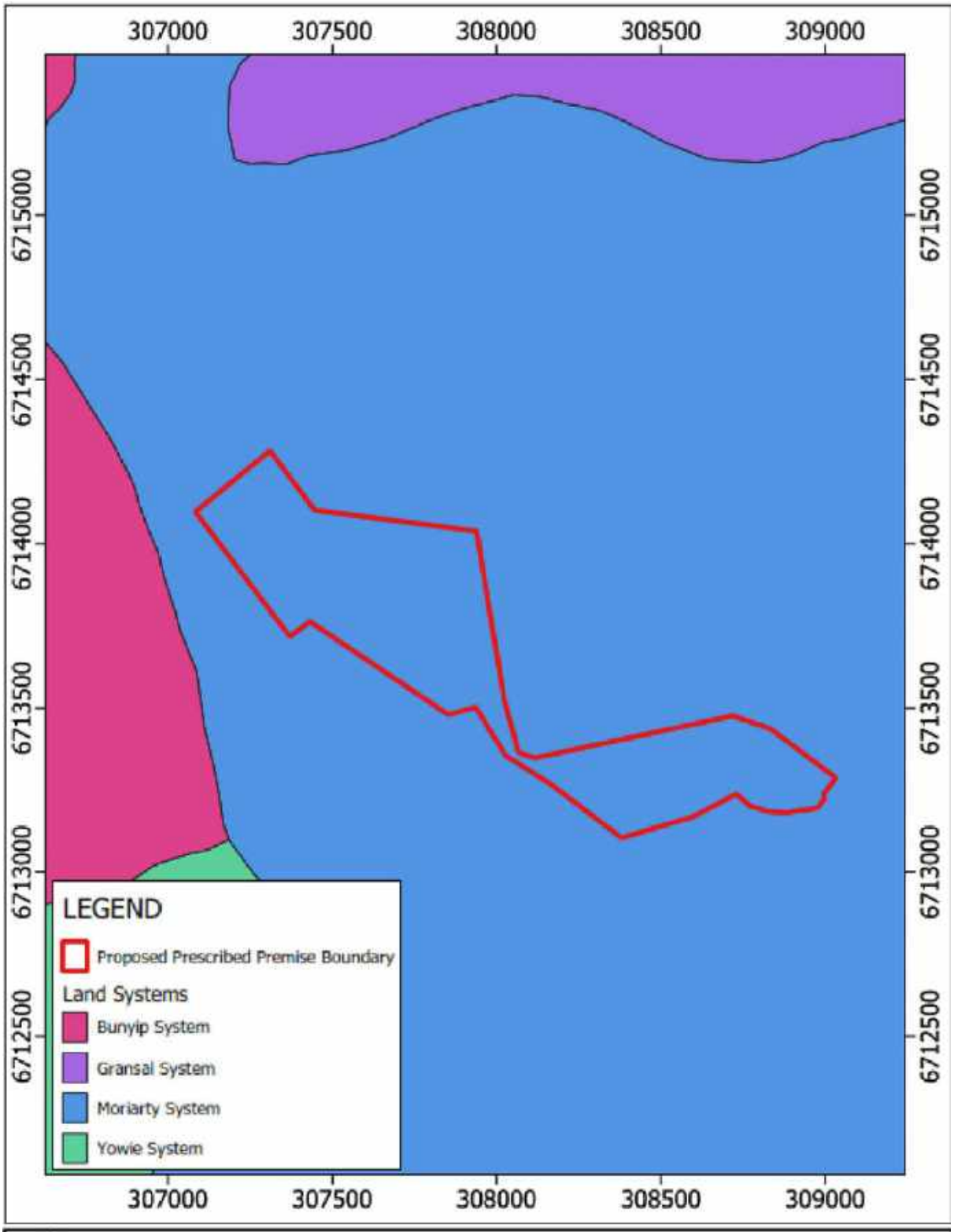

***FIGURE 5** SURFACE WATER*

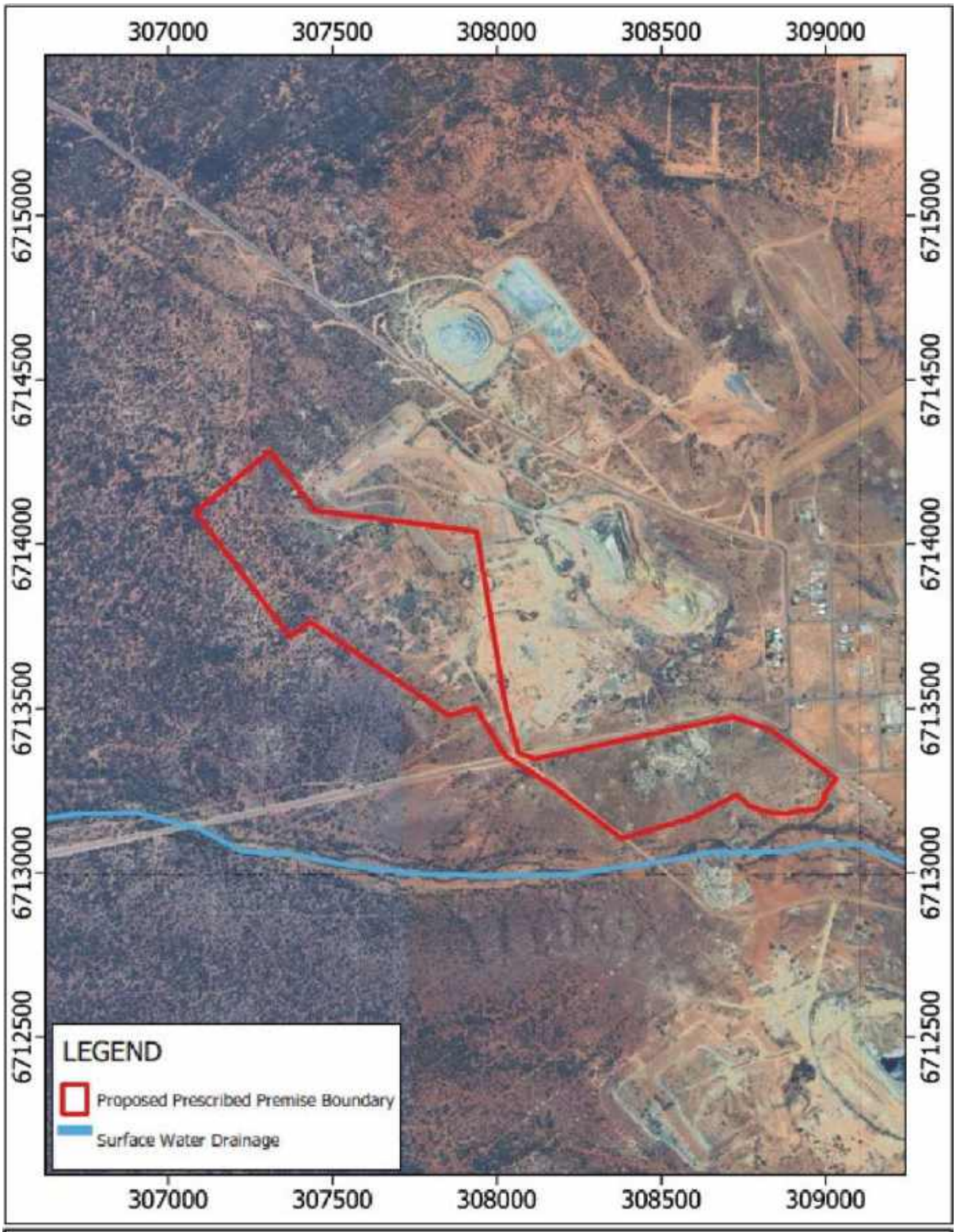

***FIGURE 6** FLORA AND VEGETATION*

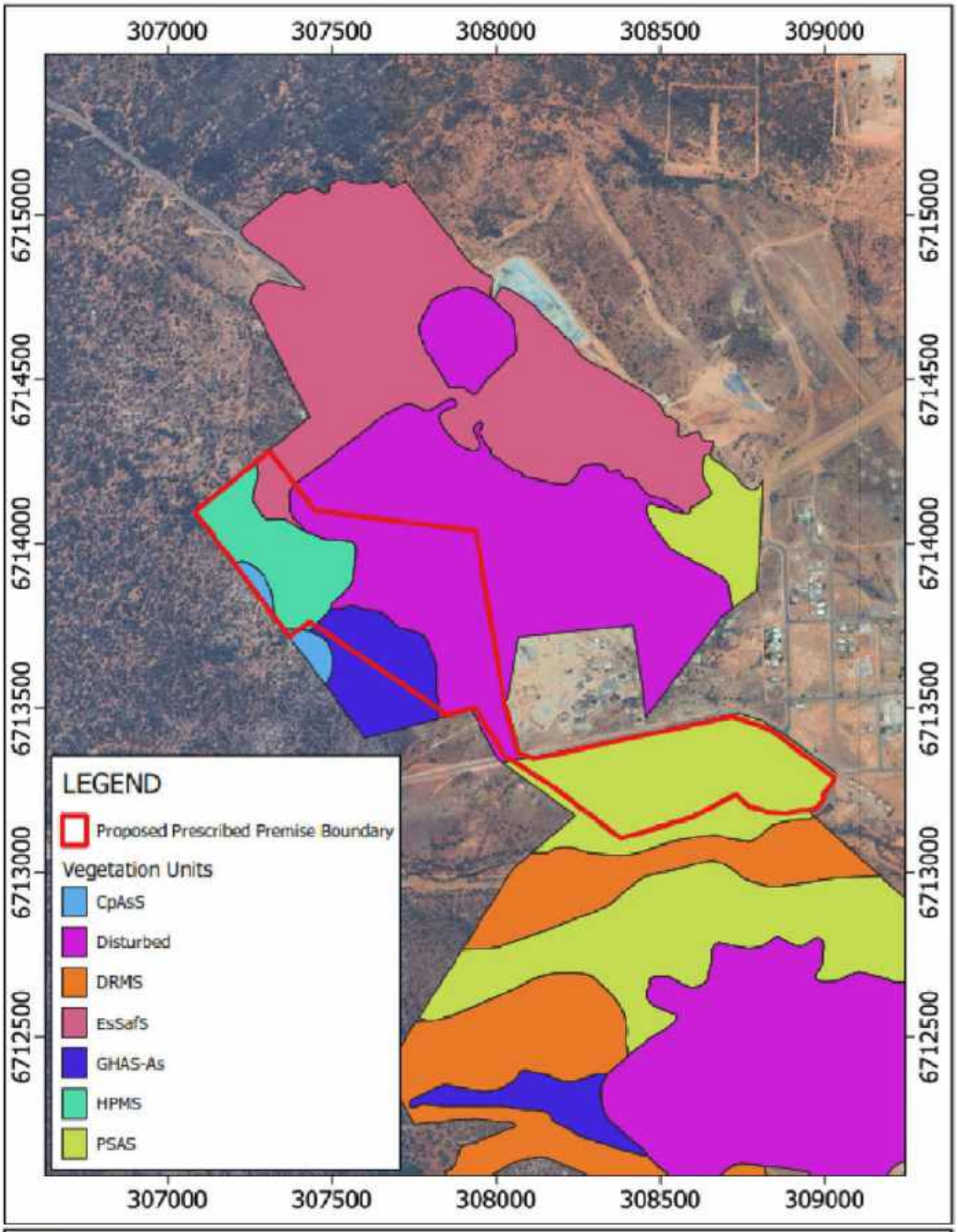

Figure 6. Vegetation Units

FIGURE 7 *FAUNA HABITAT*