Unnamed creeks in the regional area are dry throughout the year except during periods of rain activity from seasonal thunderstorms and occasional cyclone remnants. Based on the high evaporation rates (>3,030 mm annual evaporation) and the porous nature of soils, surface waters drain or evaporate quickly.

In terms of surface runoff and groundwater recharge, alluvial fans flanking the Yeo Palaeovalley may be areas of enhanced groundwater recharge, where surface runoff from the fan catchment is carried upon the alluvial fan where it can infiltrate (Pennington Scott 2016). This would occur during larger rainfall events resulting in surface runoff. During exceptionally large rainfall events that result in broad-scale flooding, inundation of swales upon the floodplain and even stream flow will occur as surface runoff is directed into the valley. Infiltration of flood water into areas of permeable alluvial deposits will be rapid and result in significant groundwater recharge. This probably represents the largest recharge event which is capable of fully replenishing groundwater levels and flow (Pennington Scott 2016).

3.8 FLORA AND VEGETATION

Botanica Consulting (Botanica) was engaged by Gold Road to undertake a Level 1 desktop and field flora and vegetation survey of the Gruyere Gold Project in autumn 2014 (Botanica 2014). This survey covered an area of approximately 2,092 ha and a 21.5 km by 100 m potential road access corridor (approximately 427 ha) extending from the end of White Cliffs Road through to the Gruyere Gold Project area. Thirty-four broad vegetation communities were identified within the survey area, represented by a total of 37 families, 82 genera and 170 plant taxa (Botanica 2014).

Botanica was also engaged by Gold Road to undertake two Level 2 desktop and field flora and vegetation surveys of the Gruyere Gold Project area. Both flora surveys were planned and implemented in accordance with Guidance Statement No. 51 (EPA 2004a).

The first Level 2 survey was undertaken in spring 2014, covering MLA38/1267 and totalling 6,846 ha in size (Botanica 2015a). Thirty-seven broad vegetation communities were identified within the survey area, represented by a total 39 families, 85 genera and 199 plant taxa (Botanica 2015a).

The second Level 2 survey was undertaken in autumn 2015 covering 4,793 ha (Botanica 2015b). As a result of revised Gruyere Gold Project design, this survey focussed on the northern portion of MLA38/1267 (3,030 ha), a potential road access route to the north-east (from the Gruyere Gold Project to Point Sunday Road) and a potential infrastructure area for the airstrip and accommodation village to the south-east of the Gruyere Gold Project area. These areas were identified during the Scoping Study as being most likely to be used for the Gruyere Gold Project. The autumn 2015 report is provided in Appendix 2. In addition, the Claimant Group took part in all baseline flora surveys which provided Gold Road an insight into flora that is culturally significant to their people.

The survey areas are not located within Environmentally Sensitive Areas or Schedule 1 Areas, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Botanica 2015b). The survey areas are not located within any DPaW managed land; however the Yeo Lake Nature Reserve which is listed as a Class "A" Nature Reserve and is managed by DPaW is located approximately 13 km to the east of the Gruyere Gold Project area.

A total of 240 vascular plant taxa from 44 families and 104 genera were recorded in the autumn 2015 survey area. Botanica (2015b) mapped 32 vegetation communities in the study area, these comprise two *Acacia* shrubland communities, five *Acacia* forests and woodlands, one Mallee open woodland and sparse mallee shrubland, two *Acacia* open woodlands, two *Eucalypt* woodlands/mallee woodlands and shrublands, one *Eucalypt* woodland and one Mallee woodland and shrubland.

There was a high degree of homogeneity between the Acacia forests and woodlands/shrublands and mallee woodlands and shrublands of the breakaway, clay-loam plain, quartz/rocky plain, drainage depression and rocky hill slope groups despite obvious differences in landform structure. The sandplain communities were mainly distinguished from the breakaway, clay-loam plain, quartz/rocky plain, drainage depression and rocky hill slope. There were also differences within the sandplain communities with the acacia forest and woodland/shrubland sandplain communities mostly separated from the Eucalypt woodland/mallee woodland and shrubland sandplain communities. Species composition of the sand dune community was similar to that of the Eucalypt woodland/mallee woodland and shrubland sandplain communities (Botanica 2015b).

None of the vegetation communities were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act* (Botanica 2015b).

Based on the Keighery vegetation health rating scale (1994) all thirty-two vegetation communities were rated as 'very good' (Botanica 2015b), which is defined as *'the vegetation structure is altered by 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'*. Disturbances within the Gruyere Gold Project area were noted to be exploration activities, fire and grazing by stock and feral camels.

Botanica was engaged by Gold Road to undertake a Level 1 flora and vegetation survey of the Gruyere Borefields in spring 2015 (Botanica 2016). This report is provided in Appendix 3. The areas surveyed included the Yeo Palaeochannel, Central Palaeochannel (Anne Beadell borefield), a section of the airstrip which extends just outside of the MLA to the west (~6 ha) and sections of the Anne Beadell borefield route which extend just outside of the MLA to the east (~2km), outside of the MLA to the south (~28km) and upwards to the north-east (~14km). The survey covered an area of approximately 5,983 ha over multiple tenements *(*E38/1858, E38/2735, E38/1932, E38/2999, E38/2325, E38/3076, E38/2446, L38/0210, E38/2447, L38/0211, E38/2529 and L38/0237).

Forty-three broad vegetation communities were identified and none of the vegetation communities within the survey areas were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act* (Botanica 2016).

The borefield survey areas are not located within Environmentally Sensitive Areas or Schedule 1 Areas, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Botanica 2016). The borefield survey areas are not located within any DPaW managed land; however the Yeo Lake Nature Reserve which is listed as a Class "A" Nature Reserve and is managed by DPaW is located approximately 13 km to the east of the Gruyere Gold Project area.

Based on the Keighery vegetation health rating scale (1994) fourteen vegetation communities were rated as 'good' which is defined as *'vegetation structures that have been significantly altered by very obvious signs of multiple disturbances*'. In this instance, disturbance as a result of fire, exploration activities, grazing, vehicle access, historic clearing and introduced species; however vegetation structures retain their basic structure and have the capacity to regenerate (Botanica 2016). Twenty-nine vegetation communities were rated as 'very good', which is defined as '*vegetation that is altered due to obvious signs of disturbance'* including exploration activities, fire and camel grazing (Botanica 2016). Thirteen vegetation communities within the survey area have been affected by fire events, with three of the 13 vegetation communities only existing within the survey area in a regrowth native vegetation status (Botanica 2016).

The areas of each of the communities and the proposed percentage of impact from construction of the Gruyere Gold Project and both borefield areas according to known distributions by Botanica mapping are shown in Table 8.

Flora surveys are currently being planned for the autumn 2016 survey season for a potential new location for the camp and airstrip to the southwest of its currently shown location and for northern sections of the Yeo Palaeochannel borefield.

The conceptual site layout over all vegetation communities surveyed for the Gruyere Gold Project and both borefield areas (minus the areas to be surveyed in autumn 2016) are shown in Figure 11.

Table 8: Vegetation Communities of the Gruyere Gold Project and Borefields

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
Breakaway			
B-AS1	**Acacia Shrublands** Open scrub of *Acacia incurvaneura* over low scrub of *Acacia quadrimarginea* and low heath of *Prostanthera wilkieana* on breakaway.	143	2 ha 1%
B-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus carnei* over low scrub of *Eremophila latrobei* subsp. *latrobei* and *Senna artemisioides* subsp. *x artemisioides* and dwarf scrub of *Atriplex vesicaria/Frankenia georgei* on breakaway.	21	0 ha 0%
Closed Depression			
CD-AFW1	**Acacia Forests and Woodlands** Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa.	8	0 ha 0%
CD-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa.	39	0 ha 0%
CD-CFS/MWS1	**Casuarina Forests and Woodlands/ Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus gypsophila/* low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge.	137	4 ha 3%
CD-CSSSF1	**Chenopod Shrublands, Samphire Shrublands and Forblands** Low heath of *Tecticornia undulata/ T. halocnemoides* on playa.	77	2 ha 3%
CD-MWS1	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge.	7	0 0%
Clay-Loam Plain			
CLP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura/ Acacia caesaneura/ Acacia aptaneura* over heath of *Senna artemisioides* subsp. *x artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain.	370	26 ha 7%
CLP-AFW2	**Acacia Forests and Woodlands** Thicket of *Acacia burkittii* over heath of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain.	671	11 ha 2%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
CLP-AFW3	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura*/ *Acacia incurvaneura* over low scrub of *Eremophila forrestii* subsp. *forrestii*/ *Eremophila latrobei* subsp. *latrobei* and low grass of *Eragrostis eriopoda* on clay-loam plain.	462	0 0%
CLP-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia caesaneura*/*Acacia incurvaneura* over open low scrub of *Acacia ramulosa* var. *ramulosa*/*Maireana pyramidata* and dwarf of *Eremophila malacoides* on clay-loam plain.	181	0 0%
CLP-AS1	**Acacia Shrublands** Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus*/ low grass of *Aristida contorta* on clay-loam plain.	3,147	49 ha 2%
CLP-MOW/SMS1	**Mallee Open Woodlands and Sparse Mallee Shrublands** Very open tree mallee of *Eucalyptus lucasii*/ low woodland of *Acacia incurvaneura*/ *Acacia caesaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain.	274	1 ha 0%
Drainage Depression			
DD-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura* over dwarf scrub of *Maireana pyramidata* and low heath of *Frankenia georgei* and *Sclerolaena densiflora* in drainage depression.	162	56 ha 35%
DD-AOW2	**Acacia Open Woodlands** Open low woodland of *Acacia caesaneura* / *A. macraneura / A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa* / *Eremophila forrestii* subsp. *forrestii* / *Eremophila margarethae* / *Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression.	17	0 0%
DD-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression.	125	5 ha 4%
DD-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia aptaneura*/ *Acacia caesaneura* over open low scrub *of Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii* / *Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression.	127	0 0%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
DD-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Senna artemisioides* subsp. *x artemisioides*/ *Senna artemisioides* subsp. *helmsii* and dwarf scrub of *Eremophila malacoides* in drainage depression.	244	0 0%
DD-MOW/SMS1	**Mallee Open Woodlands and Sparse Mallee Shrublands** Very open tree mallee of *Eucalyptus lucasii*/ over low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Ptilotus obovatus* in drainage depression.	51	0 0%
Quartz/Rocky Plain			
QRP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia caesaneura*/ *Acacia aptaneura* over heath of *Senna artemisioides* subsp. *x artemisioides*/ *Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus*/ *Maireana triptera* on quartz/rocky plain.	230	54 ha 23%
QRP-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain.	187	10 ha 5%
QRP-AFW3	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over heath of mixed shrubs and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain.	225	5 ha 2%
QRP-AFW4	**Acacia Forests and Woodlands** Low woodland of *Acacia quadrimarginea*/ *Acacia caesaneura* over heath of mixed shrubs and dwarf scrub of *Ptilotus obovatus* with occasional *Triodia irritans*.	541	166 ha 31%
QRP-AFW6	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Acacia cuthbertsonii*/ heath of *Senna artemisioides* subsp. *x artemisioides* and dwarf scrub of *Ptilotus obovatus*/ low grass of *Aristida contorta* on quartz/rocky plain.	201	3 ha 1%
QRP-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *helmsii*/ *Senna artemisioides* subsp. *x artemisioides* and low heath of *Maireana glomerifolia*/ *Frankenia georgei* on quartz/rocky plain.	85	0 0%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
QRP-CFW1	**Casuarina Forests and Woodlands** Low woodland of *Casuarina pauper* over heath of *Eremophila scoparia*/ *Senna artemisioides* subsp. x *artemisioides* and low heath of *Ptilotus obovatus*/ *Maireana triptera* on quartz/rocky plain.	153	3 ha 2%
QRP-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain.	80	2 ha 3%
QRP-MWS2	**Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus lucasii* over heath of *Acacia colletioides* / *Eremophila scoparia* and open low grass of *Eragrostis pergracilis* / hummock grass of *Triodia irritans* on quartz/ rocky plain.	51	0 0%
Rocky Hillslope			
RH-AFW1	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei*/*Scaevola spinescens* and sparse hummock grass of *Triodia irritans* on rocky hillslope.	250	0 0%
RH-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Mirbelia microphylla/Thryptomene nealensis* (P3) and open low grass of *Eriachne mucronata* on rocky hillslope.	4	0 0%
Sand Dune			
SD-EW/MWS1	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune.	520	53 ha 10%
SD-MWS1	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata* / hummock grass of *Triodia basedowii* on sand dune.	33	1 ha 3%
Sand-Loam Plain			
SLP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain.	144	4 ha 3%
SLP-AFW2	**Acacia Forests and Woodlands** Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain.	30	0 ha 0%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
SLP-RMNV1	**Regrowth, Modified Native Vegetation** Regrowth open tree mallee of *Eucalyptus ?concinna* / *E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain.	82	5 ha 6%
Sandplain			
S-AFW1	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over dense hummock grass of *Triodia basedowii* in sandplain.	662	43 ha 6%
S-AFW2	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of mixed shrubs over dwarf scrub of *Eremophila gilesii* and sparse hummock grass of *Triodia irritans* in sandplain.	564	12 ha 2%
S-AFW3	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Hakea lorea* over heath of Melaleuca interioris and mid-dense hummock grass of *Triodia basedowii* in sandplain.	531	11 ha 2%
S-AFW4	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura*/ *Acacia incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain.	287	4 ha 1%
S-AFW5	**Acacia Forests and Woodlands** Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain.	14	2 ha 14%
S-AS1	**Acacia Shrublands** Open low scrub of *Acacia abrupta* over dense hummock grass of *Triodia basedowii* in sandplain.	146	3 ha 2%
S-EW1	**Eucalypt Woodlands** Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain.	791	126 ha 16%
S-EW/MWS1	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	2,457	286 ha 12%
S-EW/MWS2	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus gongylocarpa* over open mallee tree of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata*/ mid-dense hummock grass of *Triodia basedowii* in sandplain.	230	11 ha 5%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
S-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain.	1,791	55 ha 3%
S-MWS2	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	50	0 ha 0%
S-MWS3	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Acacia grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata* over mid-dense hummock grass of *Triodia irritans* in sandplain.	617	1 ha 0%
S-MWS4	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain.	842	12 ha 1%
S-MWS5	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna*/ *Eucalyptus mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain.	403	14 ha 3%
S-MWS6	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus hypolaena* over heath of *Senna artemisioides* subsp. *filifolia* and middense hummock grass of *Triodia basedowii* in sandplain.	241	7 ha 3%
S-MWS7	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain.	156	85 ha 54%
S-MWS8	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Grevillea didymobotrya* subsp. *didymobotrya*/ *Acacia desertorum* and mid-dense hummock grass of *Triodia basedowii* in Sandplain.	151	3 ha 2%
S-MWS9	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus glomerosa*/*Eucalyptus youngiana* over low scrub of *Acacia ligulata* and dense hummock grass of *Triodia irritans* in sandplain.	110	1 ha 1%
S-RMNV1	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii* / mid-dense hummock grass of *Triodia basedowii* in sandplain.	100	1 ha 1%
S-RMNV2	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana* / *Sida calyxhymenia* in sandplain.	147	0 ha 0%

Vegetation Community (Code)	Vegetation Community Description	Total Mapped Areas (ha)	Proposed Clearing Area (ha) (% of Total Mapped Community)
S-RMNV3	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum* / *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	79	5 ha 6%

123.525 ° 123.600 ° 123.675 ° 123.750 ° 123.825 ° 123.900 ° 123.975 ° 124.050 ° 124.125 ° 124.200

-27.900 ° -27.975 ° -28.050 ° -28.125 ° -28.200 ° -28.275 °

N

Inset

Inset

Legend

- Mining Lease Application
- Proposed Infrastructure
- Internal Site Roads
- Borefield Pipeline
- Bores

Vegetation Communities

Breakaway
- B-AS1
- B-MWS1

Closed Depression
- CD-AFW1
- CD-AFW2
- CD-CFS/MWS1
- CD-CSSSF1
- CD-MWS1

Clay Loam Plain
- CLP-AFW1
- CLP-AFW2
- CLP-AFW3
- CLP-AOW1
- CLP-AS1
- CLP-MOW/SMS1

Drainage Depression
- DD-AFW1
- DD-AFW2
- DD-AOW1
- DD-AOW2
- DD-MOW/SMS1
- DD-MWS1

Quartz/Rocky Plain
- QRP-AFW1
- QRP-AFW2
- QRP-AFW3
- QRP-AFW4
- QRP-AFW6
- QRP-AOW1
- QRP-CFW1
- QRP-MWS1
- QRP-MWS2

Rocky Hillslope
- RH-AFW1
- RH-AOW1

Sandplain
- S-AFW1
- S-AFW2
- S-AFW3
- S-AFW4
- S-AFW5
- S-AS1
- S-EW/MWS1
- S-EW/MWS2
- S-EW1
- S-MWS1
- S-MWS2
- S-MWS3
- S-MWS4
- S-MWS5
- S-MWS6
- S-MWS7
- S-MWS8
- S-MWS9
- S-RMNV1
- S-RMNV2
- S-RMNV3

Sand Dune
- SD-EW/MWS1
- SD-MWS1

Sand-Loam Plain
- SLP-AFW1
- SLP-AFW2
- SLP-RMNV1

123.525 ° 123.600 ° 123.675 ° 123.750 ° 123.825 ° 123.900 ° 123.975 ° 124.050 ° 124.125 ° 124.200

Scale: 1:200000
Original Size: A3
Air Photo Date:2013
Grid: Mercator

0 4000 m

Gold Road Resources Limited
Gruyere Gold Project
EPA Referral

Figure 11

Vegetation Communities over Conceptual Site Layout

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3.8.1 Conservation Significant Species

No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were identified within the survey area. No Priority Flora taxa as listed by DPaW were identified within the autumn 2015 survey area (Botanica 2015b) or spring 2015 survey area (Botanica 2016).

3.8.2 Threatened and Priority Ecological Communities

No Threatened Ecological Communities pursuant to Commonwealth and State legislation or Priority Ecological Communities as listed by DPaW were recorded within the Gruyere Gold Project area (Botanica 2015b) or Gruyere Borefields areas (Botanica 2016).

3.8.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) include biological assemblages of species such as woodland and wetlands that use groundwater opportunistically or as their primary water source.

Most of the region has deeper water tables below 15 m below ground, whilst much of the Palaeodrainage system has shallower water tables between 0 and 15 m below ground, which could potentially be accessed by vegetation (Pennington Scott 2015). While the water quality has been shown to be saline from bore monitoring, shallow water, particularly associated with calcrete areas, can be fresh to brackish and within a range that may be conducive to vegetation use (Pennington Scott 2015).

Potential vegetation use of groundwater was further investigated through Normalised Vegetation Index Image (NDVI) from a Rapid Eye satellite on 18 December 2014, taken at the end of the dry season. An NDVI image is shown in Figure 12 which provides an indicator of transpiration. Areas showing a significant NDVI response during a dry period may include vegetation that is transpiring groundwater.

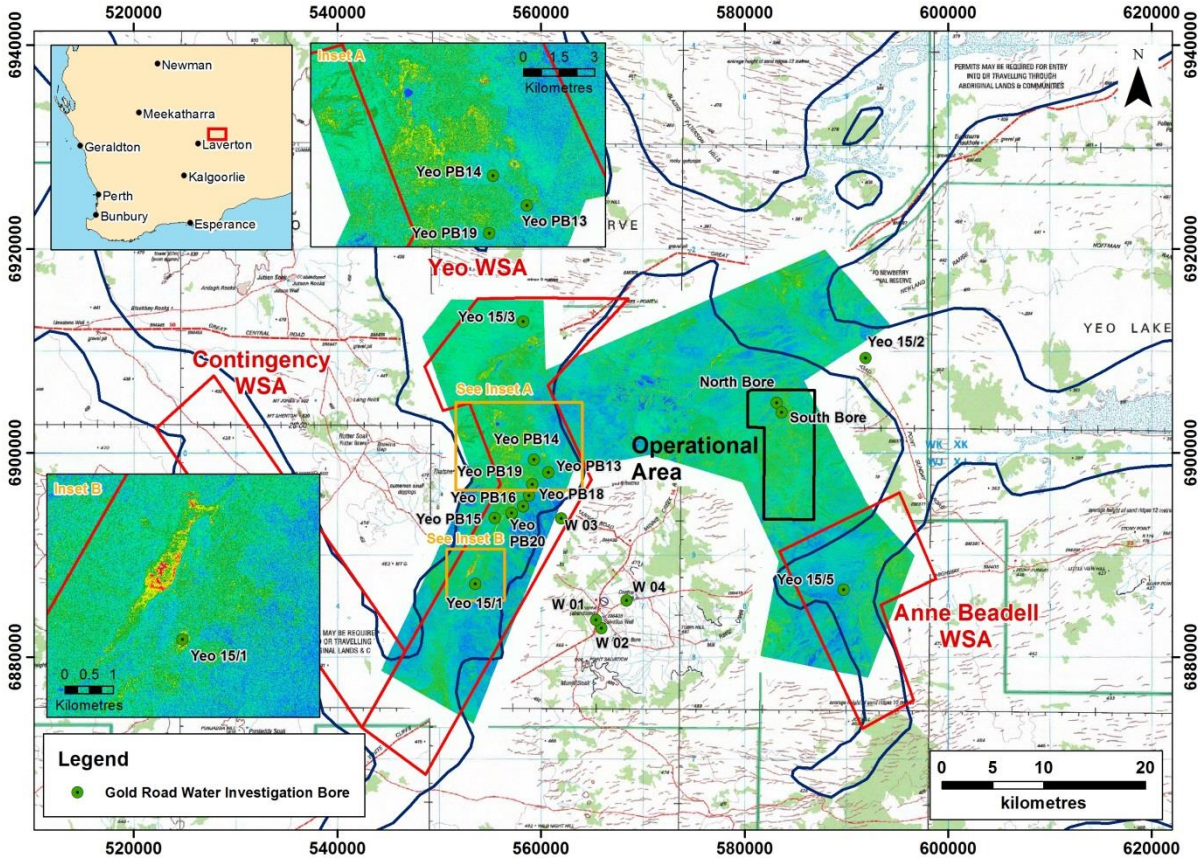
The NDVI image highlights patches of higher greenness in the Palaeochannel areas (e.g. adjacent to bore YEO_15/1 in Figure 12) which, on review of air photos, appear to correspond to stands of trees (Pennington Scott 2015). Vegetation classification shows these areas to be commonly mapped as Acacia shrubland, with areas of Eucalyptus woodland and Spinifex grassland and based on this information, in palaeochannel areas with shallow water tables, woodland vegetation may be accessing water from some combination of groundwater, stored soil moisture in the vadose zone and surface water (Pennington Scott 2015).

During the spring 2015 Gruyere borefields flora survey (Botanica 2016), Botanica were engaged to identify potential GDE areas. Botanica defined a GDE as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. Botanica identified two vegetation communities as potentially GDE which include:

- Low woodland of *Acacia aptaneura* / *A. incurvaneura* over scrub of *A. tetragonophylla* / *Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2).
- Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

As per Table 8, CD-AFW2 will not be impacted upon as no disturbance is proposed within this vegetation community. Approximately 5 ha (4%) of the DD-MWS1 vegetation community will be disturbed, however 125 ha of this community were mapped in other areas by Botanica and therefore disturbance is considered to be minimal.

Figure 12: NDVI Image for the Yeo and Central Palaeochannel Areas



3.8.4 Weeds

An environmental weed is an introduced species that establishes itself into a natural ecosystem and modifies natural processes (usually adversely) and results in the decline of the communities they invade.

Two introduced taxon were identified within the Gruyere survey area, these included *Cenchrus ciliaris* (Buffel grass) and *Cenchrus echinatus* (Burr grass). *Cenchrus ciliaris* (Buffel grass) was also identified within the Gruyere borefields survey area (Botanica 2016). Both species are naturalised pasture grasses established on the Yamarna pastoral lease. Neither taxon is listed as Declared Plants under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (Botanica 2015b).

3.9 TERRESTRIAL FAUNA AND HABITAT

A Level 1 fauna desktop and field survey of the Gruyere Gold Project area was undertaken in autumn 2014, covering an area of approximately 2,092 ha (Botanica & Harewood 2014). A potential road corridor from the end of White Cliffs Road through to the Gruyere Gold Project was also surveyed which covered an area of 427 ha. With respect to native vertebrate fauna, 28 mammals (including eight bat species), 104 bird, 102 reptile and eight frog species were noted to have previously been recorded in the general area (Botanica & Harewood 2014).

During this survey, the opportunity was taken to examine the faces of several large cuttings that had been made through red sand dunes to provide access for drill rigs for the purpose of exploration drilling. The faces of the cuttings were examined for evidence of mole holes (*i.e.* backfilled tunnels made by the DPaW Priority 4 Southern Marsupial Mole *(Notoryctes typhlops)* while tunnelling underground), in order to understand whether or not moles inhabit the area (Harewood 2015). It was concluded that marsupial moles were unlikely to be present within the area surveyed despite the existence of apparently suitable habitat.

Rapallo Environmental (Rapallo) was engaged by Gold Road to undertake a Level 2 fauna desktop and field survey in spring 2014, covering MLA38/1267 totalling 6,845 ha in size (Rapallo 2015). The report is provided in Appendix 4. A desktop search completed by Rapallo (2015) determined that there is potential for 59 reptile species, 42 bird species, 20 mammal species and nine frog species to occur in the area. A total of 116 vertebrate fauna species including 45 reptile, 54 bird and 17 mammal species (including three bats) were recorded during the Level 2 field survey. The reptile, mammal, and bird assemblages recorded from the Gruyere Gold Project area were representative of the GVD, with no unexpected species or range extensions (Rapallo 2015).

Greg Harewood was engaged by Gold Road to undertake a Level 1 fauna survey for the Gruyere borefields in spring 2015 (Harewood 2016). This report is provided in Appendix 5. The areas surveyed included the Yeo Palaeochannel, Central Palaeochannel (Anne Beadell borefield), a section of the airstrip which extends just outside of the MLA to the west (~6 ha) and sections of the Anne Beadell borefield route which extend just outside of the MLA to the east (~2km), outside of the MLA to the south (~28km) and upwards to the north-east (~14km). With respect to native vertebrate fauna, 28 mammals (including eight bat species), 103 bird, 105 reptile and nine frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise the survey area at times (Harewood 2016).

During this survey, the distinctive backfilled burrows of the Marsupial Mole were found in the walls of a temporary holding dam constructed on a sand dune in the extreme northern section of the proposed Yeo Palaeochannel borefield, north of the Great Central Road which confirm this species presence at this particular area (Harewood 2016). This area of dunes appears to be separate from those in other sections of Yamarna (e.g. Gruyere mine area).

All fauna surveys were completed in accordance with Position Statement No. 3 (EPA 2002), Guidance Statement No. 56 (EPA 2004b) and the Technical Guide for Terrestrial Vertebrate Fauna Surveys (EPA 2010). In addition, the Claimant Group took part in baseline fauna surveys which provided Gold Road additional anecdotal information of possible species presence as well as an insight into fauna that are culturally significant to their People.

Fauna surveys are currently being planned for the autumn 2016 survey season for a potential new location for the camp and airstrip to the southwest of its currently shown location and for northern sections of the a change in the Yeo Palaeochannel borefield.

3.9.1 Habitat

The fauna habitats and faunal assemblages present in the mining lease application area were delineated and characterised. Seven broad fauna habitats and one sub-type (transition zone / ecotone) were identified by Botanica & Harewood (2014) and Rapallo (2015).

Rapallo (2015) found the most extensive three habitats were Sand Plains (62.0%), Clay-Loam Plains (12.4%) and Quartz Rocky Plains (13.9%), which made up most of the Gruyere Gold Project area. Four habitats appear in pockets throughout the Gruyere Gold Project area; these were Sand Ridges (4.2%), Rocky Hill Slopes (4.3%), Breakaways (0.5%) and Drainage Depressions (2.7%). In addition, an ecotone (transition zone) between the Sand Plain and Clay-Loam Plain habitat was investigated, as this combination of soil and vegetation types has potential to yield specialist fauna species (Rapallo 2015).

Harewood (2016) reported several habitats within the Yeo Palaeochannel and Central Palaeochannel (Anne Beadell borefield) borefields areas which included Clay-Loam Plains (2.9%), Closed Depressions (4.4%), Drainage Depressions (2.7%), Quartz/Rocky Plains (5.6%), Sand Dunes (4.2%), Sand-Loam Plains (4.3%) and Sandplains (75.9%).

The areas of each of the habitats and the proposed percentage of impact from construction of the Gruyere Gold Project and both borefield areas according to known distributions by Rapallo and Harewood mapping are shown in Table 9. The conceptual site layout over habitat type is shown in Figure 13.

Table 9: Habitats of the Gruyere Gold Project and Borefields

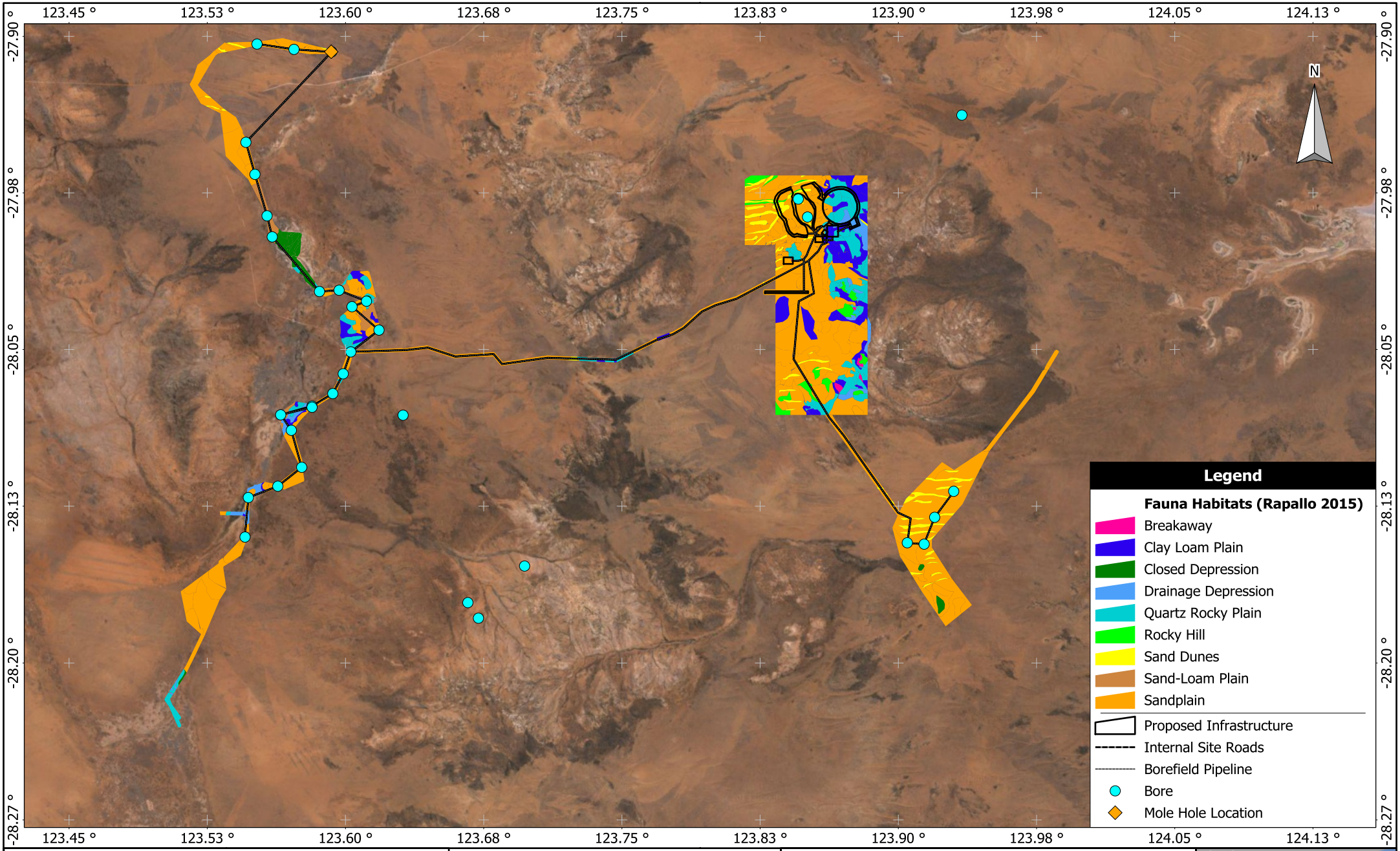
Habitat	Vegetation Description	Geology, Soil, Landform Description	Photo	Total Mapped Area (ha)	Proposed Disturbance Within Survey Area (ha, %)
Sand Ridges	Eucalypt Woodlands/ Mallee. Woodlands and Shrublands. Lower story often *Triodia* dominated.	Red sands.		553	54 ha 10%
Sand Plains*	*Acacia* Forests and Woodlands; *Acacia* Shrublands; Eucalypt Woodlands; Eucalypt Woodlands/ Mallee Woodlands and Shrublands; Mallee Woodlands and Shrublands; Regrowth (modified native vegetation). Lower story *Triodia* dominated.	Red sands.		10,413	672 ha 6%

Habitat	Vegetation Description	Geology, Soil, Landform Description	Photo	Total Mapped Area (ha)	Proposed Disturbance Within Survey Area (ha, %)
Clay Loam Plains*	*Acacia* Forests and Woodlands; *Acacia* Shrublands; Mallee Open Woodlands and Sparse Mallee Shrublands.	Clay loam red soil plains in parts bisected by minor drainage.		2,272	86 ha 4%
Quartz Rocky Plains	*Acacia* Forests and Woodlands; *Acacia* open Woodlands; *Casuarina* Forests and Woodlands.	Quartz dominated plains and rises. Skeletal red soils.		1,749	240 ha 14%
Rocky Hill Slopes	*Acacia* Forests and Woodlands.	Rocky skeletal red soils on hill slopes.		199	8 ha 4%

Habitat	Vegetation Description	Geology, Soil, Landform Description	Photo	Total Mapped Area (ha)	Proposed Disturbance Within Survey Area (ha, %)
Breakaways	*Acacia* Shrublands.	Permian breakaway with gravel soils.		164	2 ha 1%
Closed Depression	*Acacia* Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands.	Light brown clays, bare patches due to water accumulation.		265	6 ha 2%

Habitat	Vegetation Description	Geology, Soil, Landform Description	Photo	Total Mapped Area (ha)	Proposed Disturbance Within Survey Area (ha, %)
Drainage Depression	*Acacia* Open Woodlands; Mallee Open Woodlands and Sparse Mallee Shrublands. Understorey typically dominated by Chenopods.	Light brown clays, bare patches due to water accumulation.		722	61 ha 8%
Sand-Loam Plains	*Acacia* Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation.	Red sands.		255	10 ha 4%

** NB: Trap Site 3 (Ecotone) is a combination of Sand Plain and Clay Loam Plain habitat. It exists in the overlap zone where these two habitats meet, and therefore cannot be mapped or its extent measured.*



Scale: 1:300000
Original Size: A4
Air Photo Date: 2013
Grid: Latitude / Longitude

0 5 km

Gold Road Resources Limited
Gruyere Gold Project
EPA Referral

Figure 13

Fauna Habitats over Conceptual Site Layout

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W:\Gold Road Resources\Gruyere\Approvals\EPA Referral\Drawings\EPA Referral March 2016.map 31/03/2016 F13 Fauna Habitats Layout

3.9.2 Species of Conservation Significance

Database searches by Rapallo (2015) and Harewood (2016) identified 12 species of conservation significance that have the potential to occur within the Gruyere Gold Project and borefield areas. Rapallo (2015) reported the Australian Bustard (*Ardeotis australis*) as conservation significant however this species Priority 4 status was removed from the DPaW Threatened and Priority Fauna Rankings list as of 20 November 2015. Rapallo (2015) and Harewood (2016) reported that no evidence of the Australian Bustard was found during the spring 2014 Level 2 field survey and Level 1 fauna survey of the Gruyere borefields areas.

These 12 species of conservation significance are detailed in Table 9, in addition to their conservation status and an assessment of their likelihood to occur within the Gruyere Gold Project and borefield areas.

Table 9: Conservation Significant Species at Gruyere Gold Project and Borefields

Species	Common Name	Conservation Status*	Likelihood to Occur in Gruyere Gold Project Area	Comments (Rapallo 2015)	Likelihood to Occur in Gruyere Borefields Areas	Comments (Harewood 2016)
Merops ornatus	Rainbow Bee-eater	S5 Mg	High (likely)	Species recorded in Gruyere Gold Project area and nearby.	High (likely)	Species observed/heard during survey of borefields area.
Dasycercus blythi	Brush-tailed Mulgara	P4	Medium (possible)	Gruyere Gold Project area within species' range and suitable habitat present.	Medium (possible)	Species not observed during survey of borefields area; however habitat in some sections of the survey area appears suitable.
Falco peregrinus	Peregrine Falcon	S7	Medium (possible)	Gruyere Gold Project area within species' range and some suitable habitat present.	Medium (possible)	Species not observed during survey of borefields area however habitat in some sections of the survey area appears suitable for foraging purposes only.
Amytornis striatus striatus	Striated Grasswren (Sandhill race)	P4	Medium (possible)	Gruyere Gold Project area within species' range and suitable habitat present. Species cryptic and difficult to detect when present in low numbers.	Medium (possible)	Species not observed during survey of borefields area however suitable habitat may occur east of the Anne Beadell borefield area.
Polytelis alexandrae	Princess Parrot	P4 VU	Medium (possible)	Gruyere Gold Project area within species' range and suitable habitat present. Species would be sporadic visitor.	Medium (possible)	Species not observed during survey of borefields area. Species may frequent the area at times; however frequency of occurrence would be low and temporary.
Notoryctes typhlops	Southern Marsupial Mole	P4	Low (unlikely)	Signs of the species not detected via targeted surveying and lack of continuality of habitat that the species requires.	High (likely)	Mole holes found in extreme northern section of proposed Yeo Palaeochannel borefield.

Species	Common Name	Conservation Status*	Likelihood to Occur in Gruyere Gold Project Area	Comments (Rapallo 2015)	Likelihood to Occur in Gruyere Borefields Areas	Comments (Harewood 2016)
Liopholis kintorei	Great Desert Skink	S1 VU	Low (unlikely)	Species likely to be locally extinct.	N/A	N/A
Ramphotyphlops margaretae	Buff-snouted Blind Snake	P2	Low (unlikely)	Gruyere Gold Project area outside of species (highly restricted) range.	Medium (possible)	Species not observed during survey of borefields area; however suitable habitat occurs.
Sminthopsis psammophila	Sandhill Dunnart	S1 EN	Low (unlikely)	Gruyere Gold Project area outside of species' range and no yellow sand.	N/A	N/A
Leipoa ocellata	Malleefowl	S3 VU Mg	Low (unlikely)	Gruyere Gold Project area outside of species' range and habitat only marginally suitable.	Medium (possible)	Species not observed during survey of borefields area and habitat present is considered unsuitable for breeding. Possibility for transient individuals may occur.
Ardea modesta	Eastern Great Egret	S3 Mg Ma	Low (unlikely)	No suitable habitat.	N/A	N/A
Charadrius veredus	Oriental Plover	S3 Mg Ma	Low (unlikely)	No suitable habitat and Gruyere Gold Project area well outside species' normal range in Australia.	N/A	N/A

**Explanation of conservation status (Harewood 2016):*

S1 = Wildlife Conservation Act 1950, Schedule 1: Critically endangered species.

S2 = Wildlife Conservation Act 1950, Schedule 2: Endangered species.

S3 = Wildlife Conservation Act 1950, Schedule 3: Vulnerable species.

S4 = Wildlife Conservation Act 1950, Schedule 4: Presumed extinct species.

S5 = Wildlife Conservation Act 1950, Schedule 5: Migratory birds protected under an international agreement.

S6 = Wildlife Conservation Act 1950, Schedule 6: Fauna that is of special conservation need as conservation dependent fauna.

S7 = Wildlife Conservation Act 1950, Schedule 7: Other specially protected fauna.

P2 = DPaW Priority 2: Taxa in urgent need of study, known from 5 or less locations some of which under threat.

P4 = DPaW Priority 4: Taxa in need of regular monitoring.

EN, VU = EPBC Act 1999 Endangered and Vulnerable

Ma, Mg = EPBC Act 1999 Marine and Migratory species.

Species that have been classed as having a high and medium likelihood of occurring in the Gruyere Gold Project and borefields areas are detailed below.

3.9.2.1 Rainbow Bee-eater (Merops ornatus)

The Rainbow Bee-eater is listed under the *WC Act* as Schedule 3 – Migratory birds protected under an international agreement. It is protected under Japan-Australia Migratory Bird Agreement (JAMBA). Under the *EPBC Act* the species is listed as Migratory. The Rainbow Bee-eater prefers open or lightly timbered areas, often near water. This species has been recorded in dry open sclerophyll forest, open woodlands and shrublands, including mallee, spinifex tussock grassland with scattered trees, chenopod shrubland with scattered trees and riparian or littoral assemblages. It is often seen around disturbed areas such as quarries, road cuttings and mines where exposed bare soil provides suitable breeding sites (Marchant and Higgins 1993). The Rainbow Bee-eater is a migratory bird and will move north from the southern areas of Australia during winter (Johnstone & Storr 1998).

Botanica & Harewood (2014) reported there is potential for the species to breed in some sections of the Gruyere Gold Project where ground conditions are suitable however the Rainbow Bee-eater would not be specifically attracted to the site. Rapallo (2015) recorded a small flock of Rainbow Bee-eaters foraging in the vicinity of Yamarna Camp, 20 km south-west of the Gruyere Gold Project area. This species was also recorded at Tropicana by Ecologia (2009), 200 km to the south-east of the Gruyere Gold Project area (Rapallo 2015) and it was reported in the DPaW Threatened and Priority fauna database search and the *EPBC Act* 'Protected Matters' search. The Rainbow Bee-eater is therefore likely to occur in the Gruyere Gold Project area as a visitor using the area for hunting however it is a wide spread migratory species and is unlikely to breed in the Project area (Rapallo 2015). Therefore Gruyere Gold Project development is unlikely to impact upon the Rainbow bee-eater.

Harewood (2016) observed and heard the Rainbow Bee-eater during the Gruyere borefields Level 1 fauna survey. It was reported that the Rainbow Bee-eater is a very common and widespread seasonal visitor to the southern half of Western Australia and would not be specifically attracted to the Gruyere borefields areas and that there is potential for the species to breed in some sections of the survey area where ground conditions are suitable (Harewood 2016).

3.9.2.2 Brush-tailed Mulgara (Dasycercus blythi)

The Brush-tailed Mulgara (*Dasycercus blythi*) is listed by DPaW as Priority 4. The Brush-tailed Mulgara has a widespread but patchy occurrence in sandy regions of arid central Australia (Menkhorst & Knight 2011). It occurs in a range of vegetation types including spinifex grassland on plains, sand ridges and mulga shrubland on loamy sand. The principal habitat is mature hummock grasslands of spinifex, especially *Triodia basedowii* and *T. pungens* where it lives in burrows that it digs on the flats between low sand dunes (Van Dyck & Strahan 2008).

Rapallo (2015) and Botanica & Harewood (2014) found no evidence of the presence of the Brush-tailed Mulgara in the Gruyere Gold Project area. The desktop search yielded very few records and Botanica & Harewood (2014) states that the most recent nearby records are just south-west of Yamarna, dating back to 1990. The Gruyere Gold Project area falls within the known range of the species and contains suitable habitat on the spinifex-covered sand plains and sand ridges. This indicates it is possible that the species occurs in the Gruyere Gold Project area, although in low numbers.

Harewood (2016) found no evidence of the Brush-tailed Mulgara in the Gruyere borefields areas and stated there is a paucity of records of this species within the area. Harewood (2016) reports that this species may be present in some areas of the Gruyere borefields considering suitable habitat occurs (e.g. sand plains, sand ridges, *Acacia* shrubland on loamy sand).

3.9.2.3 Peregrine Falcon (Falco peregrinus)

The Peregrine Falcon (*Falco peregrinus*) is listed under the WC Act as Schedule 4 - Other Specially Protected Fauna. The species experienced a large population decline as a result of herbicide and pesticide use in the 1950's to the 1970's, which caused major reductions in breeding success. However, since the banning of such chemicals the species population has stabilised and expanded. In Western Australia, populations are stable in areas with granite outcrops and cliffs (Johnstone & Storr 1998). This species is uncommon throughout its range, preferring areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land. In the absence of such habitats, the species is known to nest in trees using the nests of species from the family *Corvidae* and occasionally hollows for nesting (Marchant & Higgins 1993).

The Peregrine Falcon was not recorded during the Rapallo (2015) or Botanica & Harewood (2014) surveys of the Gruyere Gold Project area, however database searches indicate that it may occur in the area. The DPaW fauna database search covered a 150 km buffer area and the exact locality is not specified. Birdlife Australia's Birdata database shows repeated records of the species from a locality 50 km south of the Gruyere Gold Project area. The Gruyere Gold Project area provides suitable hunting habitat for the species, as well as potential breeding habitat in large hollow trees and abandoned large nests. Therefore the species could possibly occur in the Gruyere Gold Project area.

Harewood (2016) reported that the Peregrine Falcon potentially utilises some sections of the Gruyere borefields areas as part of a much larger home range for foraging purposes only and would only be represented by a small number of individuals for limited periods.

3.9.2.4 Striated Grasswren-Sandhill Race (Amytornis striatus striatus)

The Striated Grasswren (*Amytornis striatus*) is listed by DPaW as Priority 4. The reason for listing is that the race has suffered loss and fragmentation of habitat as a result of clearing during the last century. This has resulted in reduced population size and the population being scattered in isolated remnants, making them more vulnerable to extinction. The Straited Grasswren is a small bird that spends most of its time on the ground hunting insects. It lives in small family groups in areas of mallee over spinifex (*Triodia* sp.) and it is exceptionally well camouflaged with its presence often detected only on calls. Striated Grasswrens have been shown to recolonise burnt areas after six or seven years and the habitat remains suitable up to around 40 years after fire (Rapallo 2015).

The Gruyere Gold Project area falls within the distribution of the Sandhill Grasswren however it was not recorded during the Rapallo (2015) or Botanica & Harewood (2014) surveys. The DPaW Threatened and Priority fauna database search shows that recent records exist from the vicinity of the Gruyere Gold Project area. Similarly, Birdata records show repeat observations of the species both north, south, east and west of the Gruyere Gold Project area within 100 to 200 km. The Gruyere Gold Project area contains suitable habitat in the form of mallee over spinifex on sand plains and sand ridges. Combined with the cryptic habits of the species, this suggests that it is possible that the Sandhill Grasswren occurs in the Gruyere Gold Project area, however it would only occur in low numbers and there is ample suitable habitat present in surrounding areas.

The Striated Grasswren (sandplain) was not observed during the Level 1 Gruyere borefields fauna survey; however it was reported that suitable habitat occurs (Harewood, 2016).

3.9.2.5 Princess Parrot (Polytelis alexandrae)

The Princess Parrot (*Polytelis alexandrae*) is listed by DPaW as Priority 4 and as Vulnerable under the *EPBC Act*. It is a slim, medium-sized parrot that grows to 40 to 45 cm in length (Higgins 1999). It is a colourful bird with a distinctive flight profile and flight movements and a harsh far-ranging call (Johnstone & Storr 1994). The Princess Parrot occurs in lightly wooded country of open mallee over spinifex or open marble gum *(Eucalyptus gongylocarpa*) woodland (Johnstone & Storr 1998). It is confined to arid regions of Western Australia, the Northern Territory and South Australia (Barrett et al. 2003, Johnstone & Storr 1998). In Western Australia it occurs in a broad band from the Great Sandy Desert in the north, across the Gibson and Tanami Desert to the Great Victoria Desert in the south (Johnstone & Storr 1998, Higgins 1999). The species is rare and highly nomadic, occurs over a very large area in remote or rarely visited regions and its movements are largely unknown (Higgins 1999). These habits make it difficult to determine its exact range or decide whether there has been a change in its population size and/or range. Historical records paint a picture of large range fluctuations over the decades but they do show a decline in the frequency of records from the periphery of its distribution since 1950 which might indicate a decline in range (Garnett & Crowley 2000).

The Princess Parrot was not recorded during the Rapallo (2015) or Botanica & Harewood (2014) surveys. The Gruyere Gold Project area falls within the species' known range and contains suitable habitat in the form of mallee over spinifex and marble gum woodland. It is therefore possible that the Princess Parrot visits the Gruyere Gold Project area occasionally, but due to its nomadic habits its presence would only be temporary. The most significant habitats in the Gruyere Gold Project area would be areas with large mature marble gums which could offer hollows for breeding (Botanica & Harewood 2014).

The Princess Parrot may frequent the Gruyere borefields areas at time; however the frequency of occurrence would be very low given that it is highly nomadic (Harewood 2016). Habitat containing *Eucalyptus gongylocarpa* woodland are of most significance as they have the potential to contain larger trees with hollows that may represent potential breeding habitat (Harewood 2016).

3.9.2.6 Southern Marsupial Mole (Notoryctes typhlops)

As of 3 December 2015, the Northern Marsupial Mole (*Notoryctes caurinus,* also known as *Kakarratul)* and Southern Marsupial Mole (*Notoryctes typhlops*, also known as *Itjaritjari)* were removed from the Threatened Species List under the *EPBC Act* as they no longer meet any of the criterion that would make them eligible for listing (DoE 2016). The Southern Marsupial Mole is listed as S1 under the *Wildlife Conservation Act 1950 (WC Act)* and is a DPaW Priority 4 species.

The Marsupial Mole is sparsely distributed across much of arid Australia (Menkhorst & Knight 2011). There is morphological and genetic information to support the delineation of Marsupial Moles into two species, however, there does appear to be a degree of range overlap between the two (DoE 2015). On the surface, Marsupial Moles are difficult to detect, being an extremely elusive species that rarely ventures to the surface and whose burrows collapse behind it as it "swims" through the sand (Van Dyck and Strahan 2008). Marsupial Moles are adapted to living underground, they lack external ears and their body is covered with long, silky, golden-brown fur (DoE 2015).

At the Gruyere Gold Project area, Harewood (2015) found that no structures consistent with holes created by burrowing Marsupial moles were observed in any of the large cuttings and no other evidence of the species being present was found *e.g.* surface tracks. Harewood (2015) concluded it was unlikely that Marsupial Moles were present within the area surveyed despite the existence of apparently suitable habitat. This conclusion was supported by the fact that the dune field in the Gruyere Gold Project area appears to represent part of an isolated pod separate from other red dune systems in surrounding areas and that the Gruyere Gold Project area appears to be outside the western/north-western limit of the Southern Marsupial Moles range (Harewood, 2015). Rapallo (2015) concurred with Harewood (2015) that based on the lack of signs and lack of habitat continuity, the Marsupial Mole is unlikely to be present within the Gruyere Gold Project.

At the Yeo Palaeochannel and Anne Beadell borefield areas, Harewood (2015a; 2016) reported that distinctive backfilled burrows were found in the walls of a temporary holding dam. The dam had been constructed on a sand dune in the extreme northern section of the proposed Yeo Palaeochannel borefield, north of the Great Central Road. This finding confirms the presence of the Southern Marsupial Mole in this particular area. Harewood (2016) found that this area of dunes appeared to be separate from those in other areas e.g. Gruyere Gold Project area where no evidence of the species had been found despite targeted searches (i.e. trenches and examination of large cutting in dunes).

The Yeo Palaeochannel borefield design has considered potential disturbance of this P4 species. The disturbance area is expected to be minimal considering infrastructure will consist of a pipeline and track. Habitat will be avoided through pipeline alignment and placement of the pipeline on the surface of dunes (with shallow covering) as opposed to a directional cut through the dune.

3.9.2.7 Buff-snouted Blind Snake (Ramphotyphlops margaretae)

The Buff-snouted blind snake (*Ramphotyphlops margaretae*) is listed by DPaW as a Priority 2. It is about 30 cm in length, non-venomous, burrowing worm-like snake that feeds mostly on the larvae and pupae of ants and termites (Harewood 2016).

This species was not found within the Gruyere Gold Project survey area and Rapallo (2015) reported this species as known only from Lake Throssell and the restricted range of the species indicates that it is unlikely to occur in the Gruyere Gold Project area. This species was also not recorded during previous flora surveys in the region by Botanica & Harewood (2011; 2014) and KLA (2012).

Harewood (2016) did not record this species within the Gruyere borefields areas and reported this species as having a wide distribution across the GVD and the lack of records could be attributed to the area's remoteness and the secret habits of blind snakes. Given suitable habitat occurs (sand dunes and sand plains); the presence of the Buff-snouted blind snake is possible within the Gruyere borefields areas (Harewood 2016).

3.9.2.8 Malleefowl (Leipoa ocellata)

In Western Australia, the Malleefowl (*Leipoa ocellata*) is listed under the WC Act as Schedule 1: Fauna that is rare or likely to be extinct (Government of Western Australia 2013). Nationally, the species is listed under the *EPBC Act* as Vulnerable as well as Migratory (Department of the Environment 2013). The Malleefowl belongs to an ancient family called *Megapodiidae* whose members build mounds for nesting (Marchant & Higgins 1993). The Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or Acacia species. A sandy substrate and abundance of leaf litter are required for mound construction and heat regulation (Johnstone & Storr 1998). Clearance for agriculture has eliminated and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations.

A Level 1 fauna survey undertaken by Botanica & Harewood (2011) within the Central Bore prospect area reported that a single old abandoned nest mound had previously been observed within the Attila-Alaric prospect corridor several years ago (pers. comm. Jim Williams), although its age and exact location are unclear. No Malleefowl were found during this survey and it was reported that there are no other recent documented records of the Malleefowl occurring in the immediate area and based on the lack of records, the Malleefowl appears to be locally extinct (Botanica & Harewood 2011). A Level 2 fauna survey undertaken by KLA (2012) within the Central Bore prospect area later confirmed that no Malleefowl, mounds or tracks were identified during their two seasonal surveys.

The Level 1 fauna survey undertaken by Botanica & Harewood (2014) within the Gruyere area found no suitable habitat for the Malleefowl and no recent documented records of this species occurring in the immediate area, concluding that the Malleefowl appears to be locally extinct. Botanica & Harewood (2014) found a structure that appeared to be a very old 'mega-mound' within the area and it was reported that mounds of this size have been attributed to an extinct relative of the Malleefowl and therefore it cannot be associated with any more recent Malleefowl activity in the area. The Level 2 fauna survey undertaken by Rapallo (2015) within the Gruyere Gold Project area reported the Malleefowl as being recorded within the *EPBC Act* 'Protected Matters Search', however it was not recorded in any of the other databases and previous surveys that were reviewed. The Birdlife Australia Atlas database (Birdata 2013) indicates that the survey area falls outside the species' main range, with only one unrepeated sighting more than 300 km to the east of the Gruyere Gold Project area. The species is therefore considered unlikely to occur in the Gruyere Gold Project area.

Harewood (2016) found no evidence of the Malleefowl during the Level 1 fauna survey of the Gruyere borefields areas and reported that habitat appears unsuitable within much of the survey area primarily due to the sparse nature of the vegetation, recent fires and/or lack of leaf litter.

3.9.3 Introduced Species

Six species of introduced mammal were recorded within the Gruyere Gold Project area. These species included the House mouse (*Mus musculus*), Dromedary Camel (*Camelus dromedaries*), Cattle (*Bos taurus*), Feral cat (*Felis catus*), Wild dog (*Canis* sp.) and the European Rabbit (*Oryctolagus cuniculus*).

Four species of introduced mammal were recorded within the Gruyere borefields areas. These species included the Dromedary Camel (*Camelus dromedaries*), Cattle (*Bos taurus*), Feral cats (*Felis catus*) and the European Rabbit (*Oryctolagus cuniculus*).

3.9.4 Short Range Endemics

Previous collections of potential Short Range Endemic (SRE) species have been made by Botanica & Harewood (2014) and KLA (2012). Botanica & Harewood (2014) reported that there was no significant areas of relictual habitats, geographic boundaries or landform changes which would create habitat isolates most often associated with the presence of terrestrial invertebrates with restricted distributions (*i.e.* SREs) present within the Gruyere Gold Project area based on the results of the habitat assessment. Botanica, Harewood (2014) suggests there is a low probability of SREs within the Gruyere Gold Project area and that breakaways and drainage depressions which represent potential terrestrial SRE habitat only make up 0.3% (approximately 7 ha) of the Gruyere Gold Project area.

The Rapallo autumn 2014 fauna survey (Rapallo 2015) included consideration of invertebrates and met the requirements of a Level 1 SRE survey. The survey included consideration of invertebrates recorded in pitfall traps and from leaf litter samples collected within the Gruyere Gold Project area. A total of 37 potential SRE specimens were collected during the Rapallo (2015) survey. These comprised eight spiders, 25 scorpions and two pseudoscorpions. No snails were found during the survey.

Table 10 details the potential six SRE species (comprising three species of Mygalomorph spider and three species of scorpion) and the habitat within which they were recorded during the Rapallo (2015) survey. The pseudoscorpions were identified as not likely to be SRE.

Table 10: Potential SRE Species of the Gruyere Gold Project

Species	Common Name	Site	Habitat
Synothele sp. *indet*	Mygalomorph Spider	Pitfall Trap 3	Clay Loam Plain/Sand Plain Ecotone
Aname 'yamarna'	Mygalomorph Spider	Pitfall Trap 3	Clay Loam Plain/Sand Plain Ecotone
Kwonkan 'yamarna'	Mygalomorph Spider	Pitfall Trap 4	Clay Loam Plain
Lychas 'GVD'	Scorpian	Pitfall Traps 2 and 4	Sand Plain Clay Loam Plain
Lychas 'multipunctatus complex'	Scorpian	Pitfall Traps 1 and 2	Sand Ridge Sand Plain
Urodacus 'yaschenkoi complex'	Scorpian	Pitfall Trap 3	Clay Loam Plain/Sand Plain Ecotone

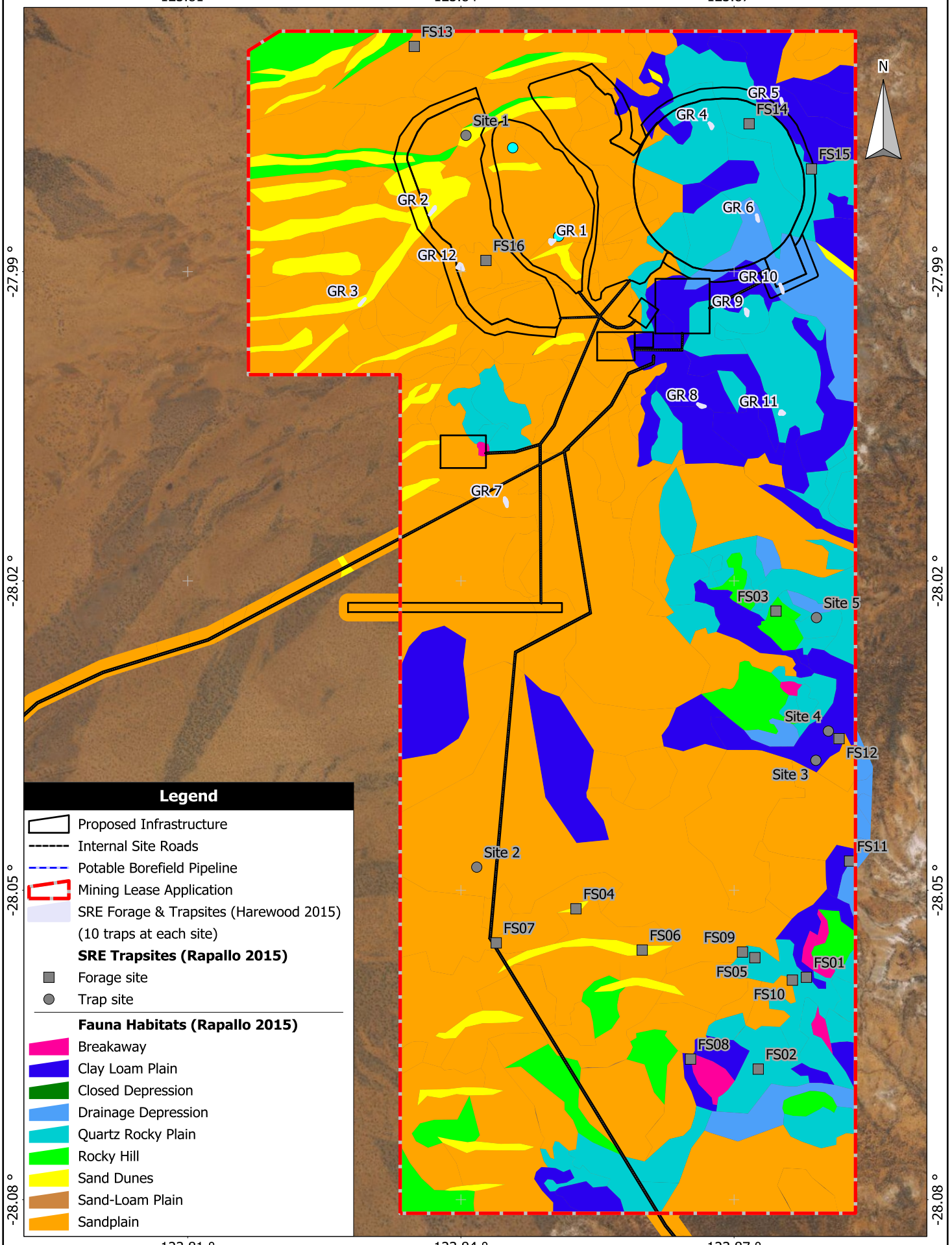
A Level 2 SRE survey was commissioned by Gold Road from August 2015 to October 2015 (Harewood 2016a) considering that all of the potential SRE specimens found were only known from the Gruyere Gold Project area and on a regional scale, as with many regions of Western Australia, SRE invertebrate survey data from the Shield and Central subregions of the GVD is deficient. This report is provided in Appendix 6. The survey was designed in accordance with EPA Guidance Statement No. 20 *'Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia'* (EPA, 2009).

Wet pit traps were left in the field for two months within the Gruyere Gold Project area. These Level 2 trapping sites in addition to Rapallo's (2015) trapping sites with fauna habitat over the site layout are shown in Figure 14. The Level 2 field survey resulted in the collection of 249 specimens representing 20 species from the targeted SRE groups including scorpions, spiders, pseudoscorpions, isopods and centipedes (Harewood 2016a). The SRE status of each species is as follows (Harewood 2016a):

- None of the species collected were identified by taxonomic experts as being confirmed SREs.
- Eight of the 20 species were identified as representing potential SREs. These are comprised of two species of scorpion, four species of spider, one species of isopod and one species of centipede. The remaining 12 species are considered to be widespread and therefore not SREs.
- All eight species of the potential SREs were collected from outside of the currently proposed disturbance footprint, with only two species (one species of isopod and one species of centipede) also being recorded at one or more sites inside the disturbance footprint.
- Six species of invertebrates collected by Rapallo (2015) within the Gruyere Gold Project area were also identified as representing potential SREs (some of which may be conspecific with specimens collected during the 2015 survey). None of these specimens were collected within the currently defined disturbance footprint.
- Habitats within which the potential SREs were recorded inside the disturbance footprint are widespread outside of this area.

The results of this survey suggests that the conservation status of SRE taxa will not be adversely changed as a result of the Gruyere Gold Project and surveys carried out to date, have not identified any confirmed SRE species as being present within the proposed disturbance area. The two species of potential SREs which have been identified as occurring within areas likely to be impacted have also been recorded outside of the proposed disturbance area and their respective habitats are also widespread in the area.

Harewood 2016a concluded that there is a very low likelihood of any significant impact/change occurring to local invertebrate communities or to the conservation status of individual species occurring as a result of the Gruyere Gold Project or from narrow linear infrastructure (e.g. borefield pipelines) given that populations can be expected to persist in adjoining unaffected locations.



Scale: 1:60000
Original Size: A4
Air Photo Date: 2013
Grid: Latitude / Longitude
0 1000 m

Gold Road Resources Limited
Gruyere Gold Project
EPA Referral

Figure 14

SRE Habitats and Trapping Sites

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3.10 SUBTERRANEAN FAUNA

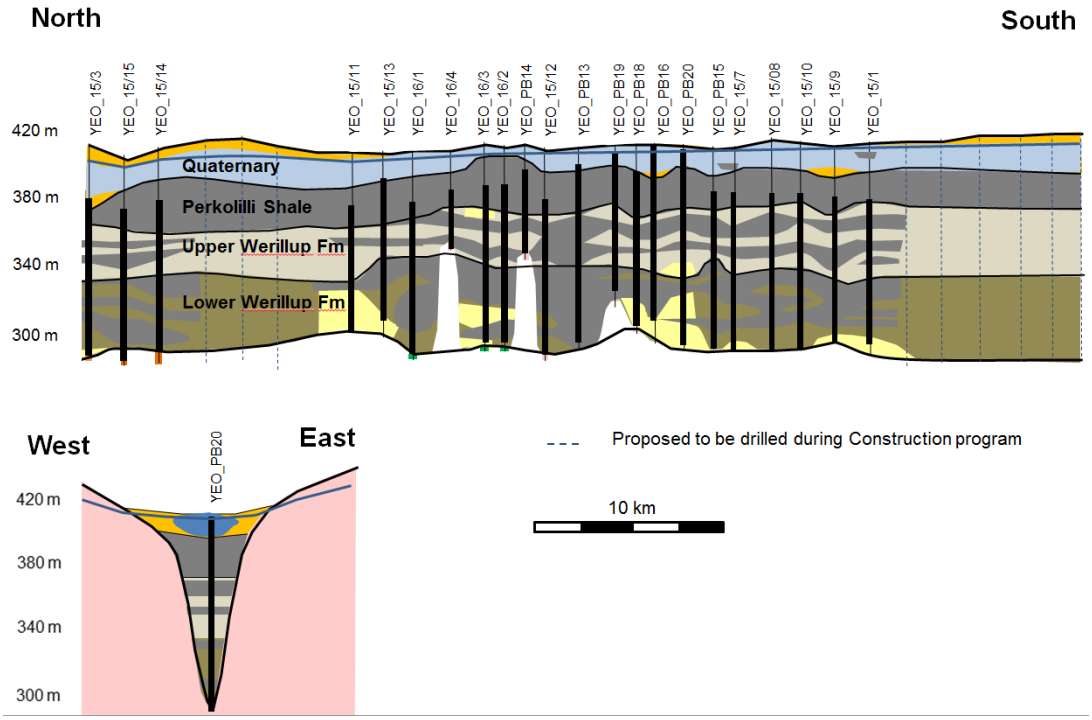
MBS Environmental was engaged by Gold Road in 2015 to undertake a Level 1 Subterranean Fauna desktop and field survey within the Gruyere Gold Project area (MBS 2015d). The report is provided in Appendix 7. The survey included sampling for stygofauna and troglofauna within the anticipated zone of impact of mine dewatering and outside of the potential zone of impact to provide a regional context. The sampling sites focussed on exploration holes and water bores within the proposed pit area which intersects the aquifers associated with the Gruyere "Orebody Aquifer".

Previous to this survey, Bennelongia was engaged by Gold Road in 2013 to undertake a desktop review and pilot-scale survey and subterranean fauna assessment for the Central Bore prospect, which is located 25 km south-west of the Gruyere Gold Project and for a possible borefield within the calcretes associated with the Yeo Palaeochannel (Bennelongia 2013a, b). The nearby Atilla and Alaric prospects were also surveyed, providing regional context for an area where little previous sampling has occurred. Bennelongia was engaged by Gold Road to undertake baseline stygofauna surveys of the Gruyere borefields, including the Yeo Palaeochannel and Central Palaeochannel (Anne Beadell Borefield). The report documenting the findings of the surveys is provided in Appendix 8. These surveys were carried out from October 2015 through to February 2016. Additional stygofauna surveys are currently being conducted across the Yeo Palaeochannel as additional groundwater investigation bores are completed as part of project Feasibility Studies.

3.10.1 Stygofauna

3.10.1.1 Stygofauna Habitat

The Quaternary Detritals aquifer in the Yeo Palaeochannel, which lies within colluvium, alluvium and saturated calcrete, is considered the main habitat for stygofauna. This habitat is typically only a few metres thick. The calcrete unit is not continuous along the length of the palaeovalley and also varies in width across the valley with significant variability in thickness of the Quaternary Detritals as shown in Figure 15. The extent of the alluvial valley and near surface calcrete is shown in Figure 16.



(Source: Pennington Scott 2016)

Figure 15: Geological Long and Cross Section through the Yeo Borefield

0 20,000

metres

520,000 mE | 530,000 mE | 540,000 mE | 550,000 mE | 560,000 mE | 570,000 mE | 580,000 mE | 590,000 mE

6,920,000 mN | 6,910,000 mN | 6,900,000 mN | 6,890,000 mN | 6,880,000 mN

LIMESTONE MRD BORE

Field_Bore_Code	Lowest_ID
LIMESTONE MRD BORE	Nematoda sp.
LIMESTONE MRD BORE	Schizopera sp. B09
LIMESTONE MRD BORE	Nitocrellopsis sp. B06
LIMESTONE MRD BORE	Parastenocaris sp. B24
LIMESTONE MRD BORE	Kinnecaris sp.
LIMESTONE MRD BORE	Yilgarniella sp. B02
LIMESTONE MRD BORE	Stygochiltonia sp. B02
LIMESTONE MRD BORE	Limbodessus sp. B05

PS10

Field_Bore_Code	Lowest_ID
PS10	Dussartcyclops uniarticulatus

PB15

Field_Bore_Code	Lowest_ID
PB15	Aeolosomatidae sp.
PB15	Aeolosomatidae sp.
PB15	Tubificidae sp. B01
PB15	Fierscyclops (Fierscyclops) fiersi
PB15	Schizopera sp. B09
PB15	Schizopera sp. B14
PB15	Nitocrella sp. B06
PB15	Nitocrellopsis sp. B04
PB15	Nitocrellopsis sp. B06
PB15	Nitocrellopsis sp. B07
PB15	Nitocrellopsis sp. B08
PB15	Hexabathynella sp. B07
PB15	Stygochiltonia sp. B02
PB15	Amphipoda sp.

YUNK03

Field_Bore_Code	Lowest_ID
YUNK03	Nematoda sp.
YUNK03	Tubificidae sp. B01
YUNK03	Enchytraeus sp.
YUNK03	Halicyclops kieferi
YUNK03	Halicyclops eberhardi
YUNK03	Fierscyclops (Fierscyclops) fiersi
YUNK03	Nitocrella sp. B06
YUNK03	Nitocrellopsis sp. B04
YUNK03	Nitocrellopsis sp. B06
YUNK03	Nitocrellopsis sp. B07
YUNK03	Hexabathynella sp. B07
YUNK03	Stygochiltonia sp. B02

YE0008A

Field_Bore_Code	Lowest_ID
YE0008A	Aeolosomatidae sp.
YE0008A	Phreodrilidae with similar ventral chaetae
YE0008A	Enchytraeus sp. 2 (PSS) Pilbara
YE0008A	Halicyclops eberhardi
YE0008A	Schizopera sp. B09
YE0008A	Schizopera sp. B11
YE0008A	Schizopera sp. B14
YE0008A	?Parapseudoleptomesochra sp. B03
YE0008A	Nitokra lacustris sp. B02
YE0008A	Nitocrella sp. B07
YE0008A	Ameiridae sp.
YE0008A	Nitocrellopsis sp. B04
YE0008A	Nitocrellopsis sp. B07
YE0008A	Stygochiltonia sp. B02

Soma Bore

Field_Bore_Code	Lowest_ID
Soma Bore	Nematoda sp.
Soma Bore	Bdelloidea sp. 2-2

Near Cole Bore

Field_Bore_Code	Lowest_ID
Near Cole Bore	Enchytraeidae sp.
Near Cole Bore	Parastenocaris sp. B33

PS01

Field_Bore_Code	Lowest_ID
PS01	Cyclopoida sp.

PS02

Field_Bore_Code	Lowest_ID
PS02	Yilgarniella sp. B02

FYRC051

Field_Bore_Code	Lowest_ID
FYRC051	Halicyclops eberhardi
FYRC051	Nitocrellopsis sp. B08

YUNK02

Field_Bore_Code	Lowest_ID
YUNK02	Nematoda sp.

AC268

Field_Bore_Code	Lowest_ID
AC268	Halicyclops eberhardi
AC268	Schizopera sp. B14
AC268	Nitocrella sp. B06
AC268	Yilgarniella sp. B02
AC268	Stygochiltonia sp. B02

AC267

Field_Bore_Code	Lowest_ID
AC267	Nematoda sp.
AC267	Insulodrilus sp.
AC267	Halicyclops eberhardi
AC267	Fierscyclops (Fierscyclops) fiersi
AC267	Nitocrella sp. B06

AC280

Field_Bore_Code	Lowest_ID
AC280	Halicyclops eberhardi
AC280	Fierscyclops (Fierscyclops) fiersi

AC269

Field_Bore_Code	Lowest_ID
AC269	Nematoda sp.
AC269	Nitocrellopsis sp. B08

AC272

Field_Bore_Code	Lowest_ID
AC272	Halicyclops eberhardi

AC273

Field_Bore_Code	Lowest_ID
AC273	Nematoda sp.
AC273	Tubificidae sp. B02
AC273	Halicyclops eberhardi
AC273	?Parapseudoleptomesochra sp. B03

AC283

Field_Bore_Code	Lowest_ID
AC283	Tubificidae sp. B02

PB13

Field_Bore_Code	Lowest_ID
PB13	Turbellaria sp.
PB13	Nematoda sp.
PB13	Tubificidae sp. B01
PB13	Tubificidae sp. B02
PB13	Halicyclops eberhardi
PB13	Dussartcyclops uniarticulatus
PB13	Cyclopoida sp.
PB13	Schizopera sp. B08
PB13	?Parapseudoleptomesochra sp. B03
PB13	Nitocrella sp. B06
PB13	Atopobathynella sp. B13

Bluey

Field_Bore_Code	Lowest_ID
Bluey	Enchytraeus sp. 1 (PSS) Pilbara
Bluey	Nitocrella sp. B06

12ALRC0117

Field_Bore_Code	Lowest_ID
12ALRC0117	Atopobathynella sp. B21

RC0151

Field_Bore_Code	Lowest_ID
RC0151	Nematoda sp.
RC0151	Parastenocaris sp. B24

W03

Field_Bore_Code	Lowest_ID
W03	Parastenocarididae sp.
W03	nr Atopobathynella sp. B19
W03	Atopobathynella sp. B21
W03	Kimberleybathynella sp. B06
W03	Parabathynellidae sp.

YUNK04

Field_Bore_Code	Lowest_ID
YUNK04	Dussartcyclops uniarticulatus
YUNK04	Parastenocaris sp. B24
YUNK04	Stygochiltonia sp. B02

PB19

Field_Bore_Code	Lowest_ID
PB19	Tubificidae sp. B01
PB19	Tubificidae sp. B02
PB19	Halicyclops eberhardi
PB19	Fierscyclops (Fierscyclops) fiersi
PB19	Dussartcyclops uniarticulatus
PB19	Cyclopoida sp.
PB19	Schizopera sp. B08
PB19	Schizopera sp. B14
PB19	Nitokra lacustris sp. B02
PB19	Nitocrella sp. B06
PB19	Nitocrellopsis sp. B04
PB19	Nitocrellopsis sp. B05
PB19	Nitocrellopsis sp. B08
PB19	Yilgarniella sp. B02
PB19	Stygochiltonia sp. B02
PB19	Amphipoda sp.
PB19	Limbodessus sp.
PB19	Limbodessus sp. B06

PB16

Field_Bore_Code	Lowest_ID
PB16	Tubificidae sp. B02
PB16	Halicyclops eberhardi
PB16	Fierscyclops (Fierscyclops) fiersi
PB16	Dussartcyclops uniarticulatus
PB16	?Parapseudoleptomesochra sp. B03
PB16	Nitocrella sp. B06
PB16	Nitocrellopsis sp. B04
PB16	Nitocrellopsis sp. B06
PB16	Parastenocaris sp. B24
PB16	Stygochiltonia sp. B02

YEO 15/1

Field_Bore_Code	Lowest_ID
YEO 15/1	Phreodrilidae with similar ventral chaetae
YEO 15/1	Fierscyclops (Fierscyclops) fiersi
YEO 15/1	Nitokra sp. B04
YEO 15/1	Nitocrella sp. B06

PB17

Field_Bore_Code	Lowest_ID
PB17	Tubificidae sp.
PB17	Tubificidae sp. B01
PB17	Tubificidae sp. B02
PB17	Halicyclops eberhardi
PB17	Fierscyclops (Fierscyclops) fiersi
PB17	Dussartcyclops uniarticulatus
PB17	Schizopera sp. B09
PB17	Schizopera sp. B14
PB17	?Parapseudoleptomesochra sp. B03
PB17	Nitocrella sp. B06
PB17	Nitocrellopsis sp. B04
PB17	Nitocrellopsis sp. B05
PB17	Nitocrellopsis sp. B07
PB17	Yilgarniella sp. B02
PB17	Limbodessus sp.

PB20

Field_Bore_Code	Lowest_ID
PB20	Tubificidae sp. B02
PB20	Halicyclops eberhardi
PB20	Fierscyclops (Fierscyclops) fiersi
PB20	Dussartcyclops uniarticulatus
PB20	Schizopera sp. B09
PB20	Schizopera sp. B14
PB20	?Parapseudoleptomesochra sp. B03
PB20	Nitocrella sp. B06
PB20	Nitocrellopsis sp. B06
PB20	Harpacticoida sp.
PB20	Yilgarniella sp. B02
PB20	Stygochiltonia sp. B02
PB20	Amphipoda sp.
PB20	Limbodessus sp. B05

PB18

Field_Bore_Code	Lowest_ID
PB18	Nematoda sp.
PB18	Tubificidae sp. B01
PB18	Tubificidae sp. B02
PB18	Halicyclops kieferi
PB18	Halicyclops eberhardi
PB18	Fierscyclops (Fierscyclops) fiersi
PB18	Schizopera sp. B08
PB18	Schizopera sp. B11
PB18	Schizopera sp. B14
PB18	?Parapseudoleptomesochra sp. B03
PB18	Nitokra lacustris sp. B02
PB18	Nitocrella sp. B06
PB18	Nitocrellopsis sp. B04
PB18	Nitocrellopsis sp. B05
PB18	Nitocrellopsis sp. B06
PB18	Nitocrellopsis sp. B07
PB18	Nitocrellopsis sp. B08
PB18	Hexabathynella sp. B07
PB18	Yilgarniella sp. B02
PB18	Stygochiltonia sp. B02
PB18	Limbodessus sp.
PB18	Limbodessus sp. B05
PB18	Limbodessus sp. B06
PB18	Limbodessus sp. B07

11THACUNK01

Field_Bore_Code	Lowest_ID
11THACUNK01	Nematoda sp.
11THACUNK01	Fierscyclops (Fierscyclops) fiersi
11THACUNK01	Amphipoda sp.

11THAC043

Field_Bore_Code	Lowest_ID
11THAC043	Nematoda sp.
11THAC043	Tubificidae sp. B01
11THAC043	Enchytraeus sp. 2 (PSS) Pilbara
11THAC043	Nitokra lacustris sp. B02
11THAC043	Copepoda sp.

YEO 15/2

Field_Bore_Code	Lowest_ID
14GYWB0003	Enchytraeidae sp.

14GYWB0003

11THAC135

Field_Bore_Code	Lowest_ID
11THAC135	Nematoda sp.
11THAC135	Fierscyclops (Fierscyclops) fiersi
11THAC135	Nitocrellopsis sp. B06
11THAC135	Stygochiltonia sp. B02

14GYRC0213

Field_Bore_Code	Lowest_ID
14GYRC0213	Atopobathynella sp. B19

GRUYERE PIT

14GYWB0002

Field_Bore_Code	Lowest_ID
14GYWB0002	Enchytraeidae sp.

14GYRC0130

Field_Bore_Code	Lowest_ID
14GYRC0130	Parastenocaris sp. B30

14GYRC0026

Field_Bore_Code	Lowest_ID
14GYRC0026	nr Atopobathynella sp. B19

15MNAC0169

Field_Bore_Code	Lowest_ID
15MNAC0169	Nematoda sp.
15MNAC0169	Enchytraeus sp. 1 (PSS) Pilbara

15MNAC0187

Field_Bore_Code	Lowest_ID
15MNAC0187	Nematoda sp.
15MNAC0187	Tubificidae sp. B01

YEO 15/5

Field_Bore_Code	Lowest_ID
YEO 15/5	Enchytraeus sp. 1 (PSS) Pilbara

LEGEND

Species Count

- 15 to 24 (5)
- 10 to 15 (4)
- 5 to 10 (6)
- 1 to 5 (26)
- Sampled- stygofauna absent (34)
- Centre of Palaeochannel (60-80m depth)

Drawdown contours (metre)

- 1
- 2
- 5
- 10
- 15
- 20
- Near Surface Calcrete
- Alluvial valley
- Yamarna Pastoral Lease

GOLD ROAD RESOURCES

StygoFauna Sampling
Results
Drawdown Contours
Calcrete- Valley environment
Palaeochannel

Project: GRUYERE PROJECT

0 2 4 8
kilometres

Originator: Drawn:	Projection: MGA Zone 51 (GDA 94)	Technical Report No. -
Date: 30/03/2016 Scale: 1:75000	Workspace:	Figure No.:

The Perkolilli Shale Aquitard that lies between the Quaternary Detritals and the Werrilup Formation reduces opportunities for colonisation by stygofauna and also reduces inflow of nutrients and carbon. Thus, while stygofauna species may be present below the aquitard, they would be expected to be present in low numbers and to be relatively insensitive to changes in the upper aquifer (Bennelongia 2016a).

The optimal salinity for stygofauna varies according to the particular species that occur at a site. While saline groundwater would be expected to have fewer species than fresh groundwater, the species occupying brackish and saline groundwater mostly have relatively narrow salt tolerances that will occupy only part of palaeochannel that exhibits a large salinity gradient, as is the case with the Yeo Palaeochannel. Given that groundwater salinity is variable over time, it is possible species will occur in a series of disjunct areas along the palaeochannel where salinity is favourable. However, relatively few stygofauna species are likely to occur at groundwater salinities greater than 35,000 mg/L and probably no species occur at salinities >50,000 mg/L (Bennelongia, 2016). As can be seen in Figure 17 taken from the Pennington Scott Hydrogeological Report (Appendix 1), salinity generally increases as you travel south to north along the Yeo Paleochannel.

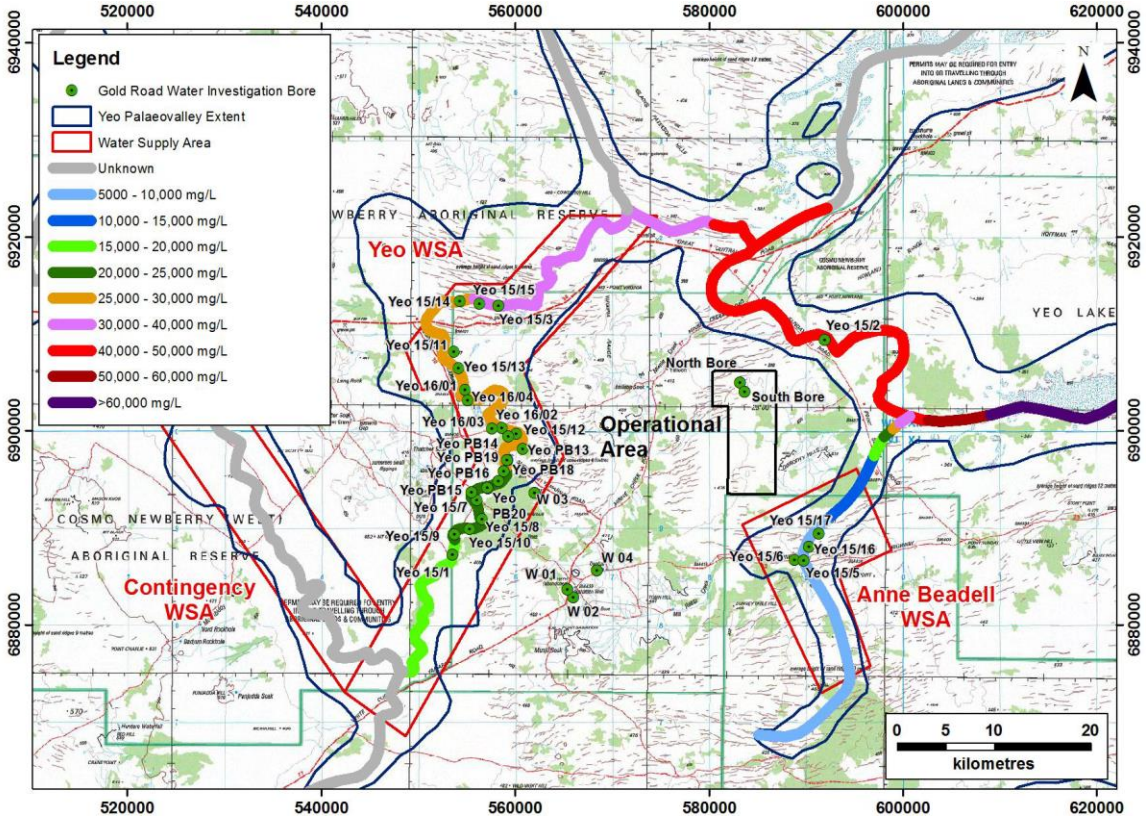


Figure 17: Groundwater Salinity (mg/L TDS) in the Gruyere Region

(Source: Pennington Scott 2016)

3.10.1.2 Stygofauna Survey Results

Mine Site Envelope

During the Level 1 Gruyere Gold Project survey of the "Orebody" Aquifer (MBS 2015d); three stygofauna species were recorded from five of ten sampling sites which included:

- One species of Tubificida (Class *Oligochaete*).
- One species of Syncarida *(nr Atrpobathynella* sp. B19).
- One species of Copepoda (*Parastenocaris* sp. B30).

The Tubificida worm (*Enchytraeidae* sp.) was collected from two locations (14GYWB002 and 14GYWB003) within the Gruyere Gold Project pit footprint. These specimens were immature and were only identified to the family level. *Enchytraeidae* sp. are regarded as being widespread having been recorded in the Pilbara and South Coast bioregions (Subterranean Ecology Pty Ltd 2010; Rockwater Pty Ltd 2006) as well as 20 km north-west of Laverton at the Windarra Nickel Project (MBS Environmental 2011) and within the Northern Goldfields at Gidgee (MBS Environmental 2013).

The Syncarida and Copepoda are new undescribed crustacean species based on morphological differences. The new species of Syncarida (nr *Atopobathynella* sp. B19) was collected in two locations (14GYRC0026 and 14GYRC0213). The two sampling holes are located up to 2.5 km apart and hole ID 14GYRC0026 is approximately 800 m south and outside of the proposed pit footprint. The recording of this species at these locations indicates their wider distribution, through hydraulic connection within the "Orebody Aquifer" system (MBS 2015d).

The new Copepoda species (*Parastenocaris* sp. B30) was collected from 14GYRC0130. The *Parastenocaris* sp. is a widespread species known from a number of locations across Western Australia including West Kimberley, East Kimberley, Pilbara and Murchison and north-eastern Goldfields as well as 20 km north-west of Laverton at the Windarra Nickel Project (MBS 2011). The recording of this species at the southern extremity of the pit footprint between the two recorded locations of the Syncarida species would indicate that the Copepoda species is likely to be more widely distributed through hydraulic connection within the aquifer system.

Based on the use of habitat surrogates as per Section 4.3 of EAG 12, it has been determined that the hydraulic connections within the "Orebody Aquifer" (see Section 3.6.4) provides a habitat that is continuous between data (sampling) points which is believed to be suitable for both the Syncarida and Copepoda species identified during the survey. It can thus be inferred that both these species have a high likelihood of occurring outside of the development footprint.

Yeo Borefield Development Envelope

The baseline stygofauna report of the Gruyere borefields by Bennelongia included results from the 2012 Central Bore prospect survey in order to gain an understanding of the distribution of stygofauna species across the Gruyere Gold Project. A total of 118 stygofauna samples were collected during six rounds of sampling between July 2012 and January 2016. Figure 18 shows sampling locations and which of these recorded the presence or absence of stygofauna.

Sampling collected 42 species of stygofauna representing 12 higher taxonomic groups. Four of the 42 species collected appear to be relatively widespread across the Murchison, although the copepod *Halicyclops eberhardi* is a species complex and the ranges of the component species are not well documented (Bennelongia 2016). A further five species were higher level identifications for which ranges cannot be determined and three species belonged to groups for which ranges are not usually assessed in impact assessment studies because their taxonomic frameworks are too poor (Bennelongia 2016).

Thirty six species were collected in the Yeo Palaeochannel, while six species were recorded only from upland areas. Thirty of the species collected are likely to be restricted to the vicinity of the Yeo Palaeochannel and adjacent uplands in the vicinity of the Gruyere Gold Project (Bennelongia 2016). One of these species, the syncarid nr *Atopobathynella* sp. B19, is known from upland areas only. The copepod *Parastenocaris* sp. B24 occurs in upland areas as well as in the Palaeochannel. Eight of these 30 species are known only from a single bore, three are known from two bores (but sometimes many samples) and 19 species are known from three or more bores (Bennelongia 2016).

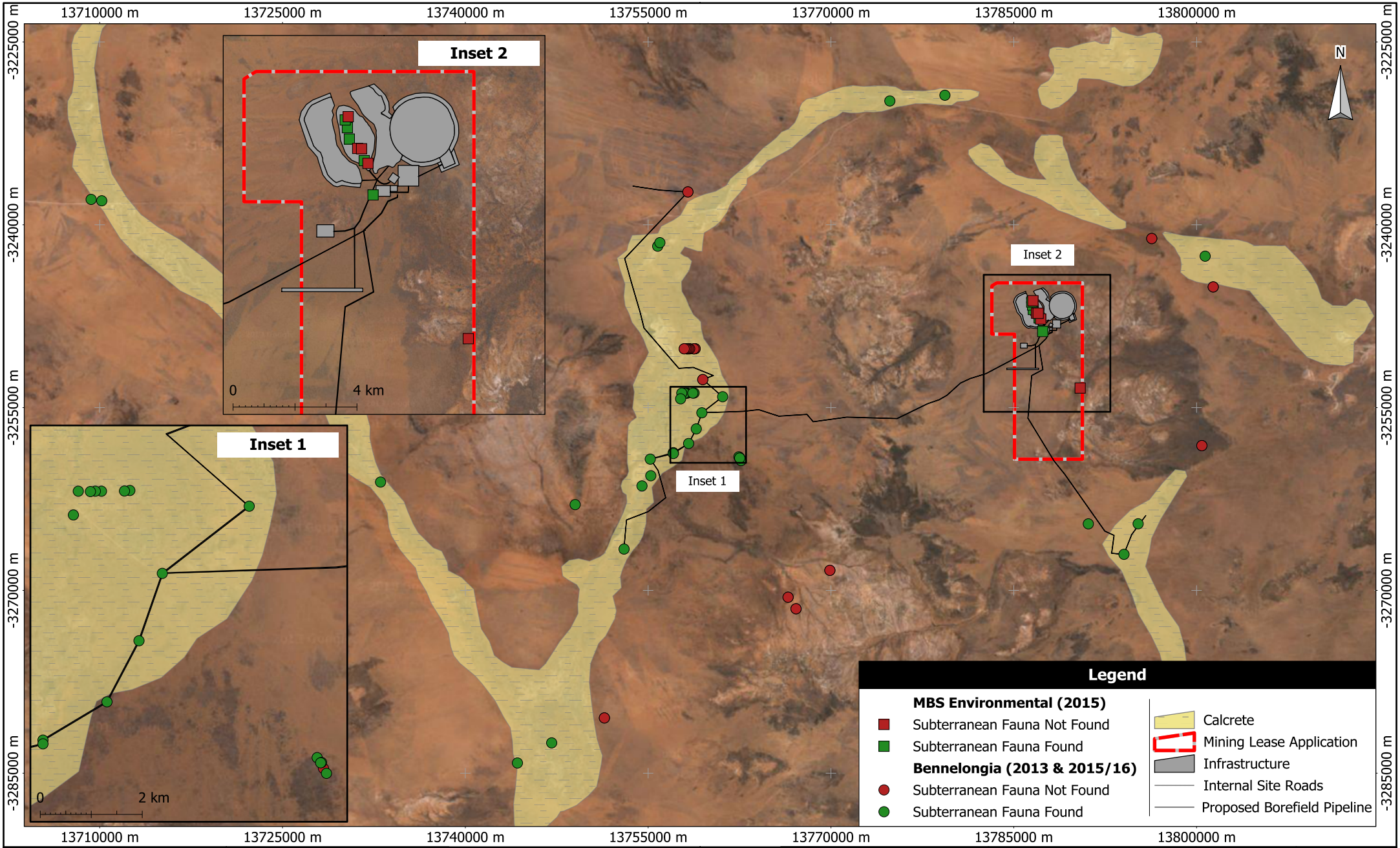
Twenty-eight species are known only from the Yeo Palaeochannel (Bennelongia 2016). Surveys elsewhere in the Yilgarn suggest it is likely that most of the 28 species known only from the Yeo Palaeochannel are restricted to the Yeo Palaeochannel in the vicinity of the Gruyere Gold Project, although species' ranges may extend beyond the area sampled in the surveys. Few species were collected from the Anne Beadell borefield area (Bennelongia 2016). Results of all stygofauna sampling in relation to regional stygofauna habitat and predicted groundwater drawdown contours for the non process and process water borefields are shown in Figure 16.

3.10.2 Troglofauna

During the Level 1 survey (MBS 2015d) of the mine deposit area; no troglofauna were recorded from six sampling sites, comprising a total of six scrape and seven trap samples. The geology of the Gruyere Gold Project area and immediate surrounds above the water table, comprise of lithologies that do not typically provide subterranean habitat suited to troglofauna which is substantiated by the nil recordings.

It can be inferred that few troglofauna are present within the Central Bore deposit area. From the surveys undertaken by Bennelongia in 2012, only two species of troglofauna were collected from the Atilla Deposit (a thysanuran and an isopod) and three species of troglofauna were collected from the original borefield during stygofauna sampling (a palpigrad and two species of symphylans). It can be inferred there are few troglofauna in these deposits and at Gruyere.

Troglofauna were not sampled during the 2015 borefields survey undertaken by Bennelongia (2016). Any risk to troglofauna is considered to be low to negligible given that no excavation of habitat is occurring in the two borefields associated with the Gruyere Gold Project and therefore it is considered unlikely that the Project will reduce the amount of habitat suitable for troglofauna. Drawdown of the water table is unlikely to lead to significant reduction in above water table humidity and in fact, drawdown may increase the amount of troglofauna habitat available (Bennelongia 2016).



Scale: 1:400000
Original Size: A4
Google Earth Image
Grid: Latitude / Longitude

0 10 km

Gold Road Resources Limited
Gruyere Gold Project
EPA Referral

Figure 18

Subterranean Fauna Sampling Locations

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W:\Gold Road Resources\Gruyere\Approvals\EPA Referral\Drawings\EPA Referral March 2016.map 31/03/2016 F18 Subterranean Fauna Layout

3.11 WASTE MATERIAL CHARACTERISTICS

3.11.1 Mine Wastes

MBS Environmental was engaged by Gold Road in 2015 (MBS 2015b) to undertake an assessment of the potential generation of acid and metalliferous drainage (AMD) from mine waste (waste rock) expected from mining of the Gruyere deposit.

The oxide zone extends to a depth of between approximately 20 and 40 m and the transition zone extends below this to a depth of approximately 90 to 100 m. All waste rock below the transition zone is classified as fresh (MBS 2015b).

The estimated mine waste volume from the presently optimised pit total is around 250 Mt (Gold Road 2015b). The expected composition of mine waste material is summarised in Table 11.

Table 11: Likely Composition of Mine Waste Material

Waste Type	10 Year Life of Mine		15 Year Life of Mine	
	Estimated Volume (Mt)	Estimated % of Mine Waste	Estimated Volume (Mt)	Estimated % of Mine Waste
Cover	16	11	20	7
Saprolite	21	15	31	10
Saprock	25	17	32	11
Transitional	13	9	21	7
Fresh	68	48	191	65
Total	**142**	**100**	**295**	**100**

Geochemical assessment of 41 waste rock samples, representing four weathering zones across all lithological units of potential waste rock from the proposed Gruyere pit area indicated that (MBS 2015b):

- All samples of waste rock contained low total sulfur concentrations (all less than 0.3%) and low to moderate Acid Neutralising Capacity (ANC) which increased with depth.
- All samples were classified as Non-Acid Forming (NAF).
- Levels of potentially reactive non-sulfate sulfur were higher in samples taken from fresh and transitional waste rock samples than weathered saprolite and saprock, but far below levels normally considered to be required for acid formation in arid areas.
- ANC in fresh rock and transition samples was indicated to primarily be in the form of calcite and/or dolomite. Samples in the saprolite and saprock zone with generally lower ANC values were consistent with the presence of more siderite ($FeCO_3$), but still mixed with the effective calcite and/or dolomite as a source of alkalinity and soluble alkalinity for acid neutralisation.
- Analysis of samples for total metals identified very low concentrations of environmentally significant metals and metalloids and only concentrations of selenium, tellurium and tungsten in some samples were enriched relative to average earth crustal or soil concentrations after calculation of the Global Abundance Index. The minor enrichments in selenium, tungsten and tellurium were still at low overall concentrations and none of these species are considered to be of environmental concern. Selenium concentrations and enrichment are considered typical of the Yilgarn Craton. Tellurium has a very low average crustal abundance of 0.001 mg/kg and no applicable guideline values. Tungsten elevation (two samples only), may be an artefact of sample grinding and tungsten species have a low environmental solubility under normal conditions.

- Analysis of samples for fresh water leachable metals identified no concentrations of metals or metalloids in the water leachate of environmental significance for the local environment. Seepage from all waste rock is predicted to be below health based Human and *ANZECC 2000 Livestock Drinking Water Guidelines* for soluble metals and metalloids (with the possible exception of selenium).
- All Gruyere competent waste rock is considered benign and suitable for use as construction material for embankments, waste rock landforms and TSF closure cover materials, with very low risk of seepage adversely affecting existing groundwater quality.
- Some of the highly weathered saprolite and possibly saprock material may be less suitable for construction and landforms as clay-sized material present is potentially dispersive.

3.11.2 Tailings

MBS Environmental was engaged by Gold Road in 2015 (MBS 2015c) to undertake a tailings geochemical characterisation to determine the potential for AMD, neutral or saline drainage to occur from tailings material generated from Gruyere ore and if this is likely to pose a significant risk to the surrounding environment. A geochemical assessment of four composite tailings samples, representing four ore areas across the Gruyere deposit indicates that:

- Tailings samples had generally low levels of total sulfur (0.32 to 0.53%), with moderate amounts of sulfate-sulfur and estimated sulfide sulfur (non sulfate-sulfur) concentrations ranging from 0.02 to 0.40%.
- Levels of ANC were moderate and sufficient to readily compensate for the marginal presence of reactive sulfides. ANC was identified to be predominantly present as readily reactive calcite (calcium carbonate).
- All tailings samples were classified as NAF with an alkaline reaction under simulated oxidation conditions (NAG pH of 9.4 to 10.8).
- Analysis of samples for total metals identified very low concentrations of environmentally significant metals and metalloids. While there was marginal enrichment in arsenic and selenium in some samples, concentrations are lower than most other gold deposits of the Yilgarn Craton and are not considered to be of concern.
- Fresh water leachates for all tailings samples were alkaline (pH 9.27 to 9.41), with moderate levels of soluble alkalinity (38 to 42 mg/L as $CaCO_3$). Based on the raw water proposed to be used for site processing (21,000 mg/L TDS), tailings are also predicted to be saline to hypersaline, saturated with respect to gypsum and calcite and have a tendency to form a gypsum crust at or just below the tailings surface.
- Tailings are not expected to be spontaneously dispersive.
- Concentrations of soluble metals, metalloids and cyanide species were very low and at a 1:5 extraction ratio, well below ANZECC 2000 livestock health based drinking water guidelines.
- Based on results of dilute acid leach testing, primary metals that may be released from partial or complete oxidation of the low levels of available sulfidic materials in tailings, would be calcium (from subsequent acid neutralisation), iron and manganese – all of which are low toxicity metals with solubility dependent on final pH.
- A sample of supernatant from a 50% solids tailings slurry was examined to indicate the nature of tailings porewater during the operational phase of the TSF. Consistent with low levels of enrichment in the ore and tails, the supernatant was very low in most metals and metalloids. Selenium (0.07 mg/L) and mercury (0.01 mg/L) were selectively extracted under the high salinity, high cyanide conditions of trial processing, but for pore waters, these concentrations are still considered low in relation ANZECC 2000 livestock drinking water guidelines.

3.12 SOCIAL ENVIRONMENT

3.12.1 Social Setting

The Gruyere Gold Project and borefield areas are within the north-eastern Goldfields region of Western Australia. This area contains Unallocated Crown Land, reserves, pastoral and exploration leases and is used for grazing, tourism, exploration and mining.

The Gruyere Gold Project and borefields areas are located within the Shire of Laverton and the nearest permanent town is Laverton which is approximately 160 km to the south-west of the Gruyere Gold Project. There are small retail shops in Laverton to support the local population in addition to tourists passing through the town. The closest community is Cosmo Newberry which is located approximately 80 km north-west of Gruyere.

There are no existing facilities at the Gruyere Gold Project or borefield areas. Gold Road has an exploration camp located approximately 25 km from Gruyere Gold Project at the old Yamarna homestead near its Central Bore Project area which includes accommodation and a messing arrangement that can cater for up to 30 exploration personnel, an office, a core yard, a storage/laydown area and a number of portable equipment items.

3.12.2 Mining History

Excluding the disturbance caused from exploration activities, there are no current mining-related disturbances or historic disturbances in the Gruyere Gold Project or Gruyere borefields areas.

3.12.3 Pastoral

The Gruyere Gold Project is located within the Yamarna Pastoral Lease, which is wholly owned and managed by Gold Road. The Yamarna Station is in the process of being destocked and will be being rested to improve the grazing rangeland capability.

3.12.4 Native Title

A Native Title Mining Agreement is currently being negotiated with a Claimant Group (Native Title Claim WC2008/005 registered on 6 August 2009). Gold Road is negotiating a Native Title Mining Agreement that provides for input into environmental management and monitoring, employment and contracting opportunities and cultural awareness programmes as well as payments based on production. Central Desert Native Title Services (CDNTS) are the legal representatives for the Claimant Group.