

Bat Call WA Pty Ltd

ABN 26 146 117 839

ACN 146 117 839

T +61 8 9402 1987

E bullen2@bigpond.com

43 Murray Drive

Hillarys W.A.

6025

AUSTRALIA

19 April 2022

Rio Tinto Cat 3 Vendor Number 11027089

Jonathon Barker

Scott Reiffer

Rio Tinto

Level 12, Central Park,
152-158 St Georges Terrace,
Perth,
Western Australia
6000

Brockman Syncline Stage 1 cave sound and vibration review, August 2021.

Following the meeting held 30th April 2021 and other follow-on discussions, I was tasked with preparing an updated assessment of the conservation values, and limits of vibration and sound that are relevant to caves at the Brockman Syncline based on their importance as diurnal bat roosts for the two conservation significant species, the Ghost bat (*Macroderma gigas*, PGb) and the Pilbara leaf-nosed bat (*Rhinioncteris aurantia*, PLNb). Following the meeting I have received a .kml file with significant cave locations and three reports (Biologic 2020, 2021; Stantec 2020) that provide information that is the basis of the current assessment. There are two boundaries under consideration here-in. The Brockman Syncline study area and the Stage 1 Development Envelope both provided as .shp files. Further I have been tasked to prepare the assessment in two parts, the majority of the Brockman Syncline Development Envelops and a subset covering the adjacent Silvergrass East area. The latter is addressed separately.

I have carried out an assessment from first principles based on my experience with bat caves and the threats appropriate to both the caves and the bat colonies roosting within from sound and in-ground vibration disturbance. The assessment is initially based on the cave's descriptions provided and then supplemented with any available survey or observational information regarding the bats using them. Each cave is assessed as a roost category (see classification system below) with all PLNb and PGb category 1 and 2 caves being "critical habitat", and groupings of PGb category 3 and 4 caves immediately surrounding higher category caves also being critical habitat as an "apartment block" grouping in the case of PGb roosts, and as nearby "satellite roosts" in the case of PLNb roosts. Isolated category 3 and virtually all category 4 caves are not considered as critical under this methodology.

There are two approaches to protecting category 2 and 3 critical habitat caves when mining operations are nearby:

1. For both species apply sound, overpressure pulse and PPV vibration limits and that don't cause the bats roosting within to abandon and don't result in physical damage that results in the cave becoming non-viable for roosting, or
2. For PGB caves based on the species known behavior of regularly moving between several roost caves, both seasonally and following better foraging opportunities, temporarily seal the caves entrance to preclude bats roosting within. The sealing must be completed prior to the breeding season of October to December to protect the reproducing females and their pups. Once sealed the acceptable Geotech PPV and overpressure levels applicable to minimising physical damage apply year-round.

Cave Classifications

Category 1 – diurnal roost caves with large and permanent occupancy

These are deep and complex caves or underground mines that have a large permanent colony of PLNb and/or PGB bats present. In all cases the roost chamber(s) lies behind a constriction that maintains a suitable microhabitat for the species. In both cases permanent colonies typically over 100 roost deep in the cave. Due to the characteristics of these caves, no detailed internal searching is possible, and assessment and/or monitoring can only be carried out from the entrances. Typically, no detailed descriptions of cavities and cave depth are available. These caves cannot be temporarily sealed.

Category 2 - diurnal roost caves with regular occupancy.

There are a number of Pilbara caves and adits where PLNb are continuously present in lower numbers, often between 5 and 100, and/or PGB have regular, but not continuous, presence over long periods including the maternity period. These caves also tend to support lower PGB numbers than Category 1 roosts. Category 2 roosts tend to be deep caves with multiple chambers and with rear chamber ceiling heights of at least 1.5 m but usually over 2 m, allowing multiple roosting opportunities out of reach of predators. Long term monitoring programs have shown these caves have PGB individuals roosting for 20 to 80% of nights for mid to long periods but then may be abandoned for periods. These caves typically have a number of other caves, shelters and overhangs within a few hundred meters. Together they make up a PGB “apartment block” grouping (TSSC 2016, Bullen 2017) that supports the ongoing presence of the bats. Category 2 roosts and any associated apartment blocks are considered as critical habitat essential for the persistence of the MNES species in the Pilbara and therefore must be maintained as viable roosts.

As EIA surveys generally only sample sites for a relatively short period of time, Category 2 roosts may or may not be used regularly or as a maternal cave during this period, as such the caves importance is inferred from cave properties and usage. In addition to presence data from acoustic monitoring, the physical characteristics of a Category 2 cave can be ascertained by:

- A high number of PLNb individuals detected departing a cave soon after dusk civil twilight and returning just before dawn civil twilight on multiple nights.
- A high number of PGB individuals (>10) witnessed roosting in a rear chamber or ceiling cavity or detected departing from a cave after sunset.
- Presence of diurnally roosting PGB on numerous occasions.

- High domed rear chamber(s) usually over 2 m high, chimney(s) or ceiling cavity(s) to allow PGB to roost away from predators.
- Domed chamber behind a constriction protected from outside light and conditions, providing a stable microclimate.
- Often a substantial PGB scat pile (> 2,000) under the domed chamber, including middens of ossified scats and food remains showing prolonged historic use although such middens are sometimes found in cat 3 caves nearby cat 2 caves.
- Multiple PGB scat piles present along the cave structure.
- Scat analysis showing usage by multiple reproducing PGB females with high levels of progesterone.
- Presence of PGB pups in a creche or the presence of mummified pups.

Category 3 - roost caves with occasional occupancy.

There are a small number of caves where PLNb roost regularly or occasionally in small numbers and large number of caves and adits where PGB roost occasionally or rarely in small numbers of one to a few. Many are located nearby higher category roosts as PLNb “satellites” or PGB apartment blocks, but many PGB caves are also in isolated locations. Surveys in recent years have identified numerous caves that have PGB scats or small food middens present but either no evidence of roosting bats or with rarely repeated presence observations. Individually, for PLNb these are considered as critical habitat however for PGB they are not considered as critical habitat unless they are located nearby one or more category 1 or 2 caves and are part of an apartment block. For both species, they are important for the persistence in the local area and the PGB cave grouping becomes critical. Due to the number of caves across the Hamersley Ranges and the Eastern Pilbara, isolated category 3 caves may also be considered important for the long-range dispersal of the species.

Category 3 roosts differ from Category 2 caves by:

- Providing less suitable or unstable microclimate.
- A less complex and more open cave structure usually without a rear chamber behind a constriction.
- Will have at least one domed chamber with a ceiling height over 1.5 m.
- Not used continuously throughout the maternity period by either species or has inconsistent progesterone levels from PGB scat analysis.
- Having smaller PGB scat piles present (generally 50- 2,000).

Category 4 - roost caves

Numerous observations suggest that the majority of shallow caves, shelters and deep overhangs in the Pilbara are used in at least an opportunistic manner by itinerant PLNb and PGB. This may be anything from a single foraging visit to a longer visit, with a resting period or possibly a feeding session. Evidence of such visits is the widespread presence of small numbers of scats and/or food scraps found, or occasional echolocation calls recorded during surveys. These visits may or may not be repeated, depending whether the bat is passing through a district or is a more permanent resident nearby. These are not considered critical habitat unless they are included in a PGB apartment block.

Results

PLNb

There are two category 2 PLNb roosts within or immediately adjacent to the study area. These are the known Upper Beasley River Roost (50K 534110 7503415) and the yet to be identified Lower Caves Creek Roost (believed to be within 1.5 km of a point at 50K 521400 7538315). Both are considered critical habitat, and neither is known at this time to have a satellite cat 3 PLNb roost nearby.

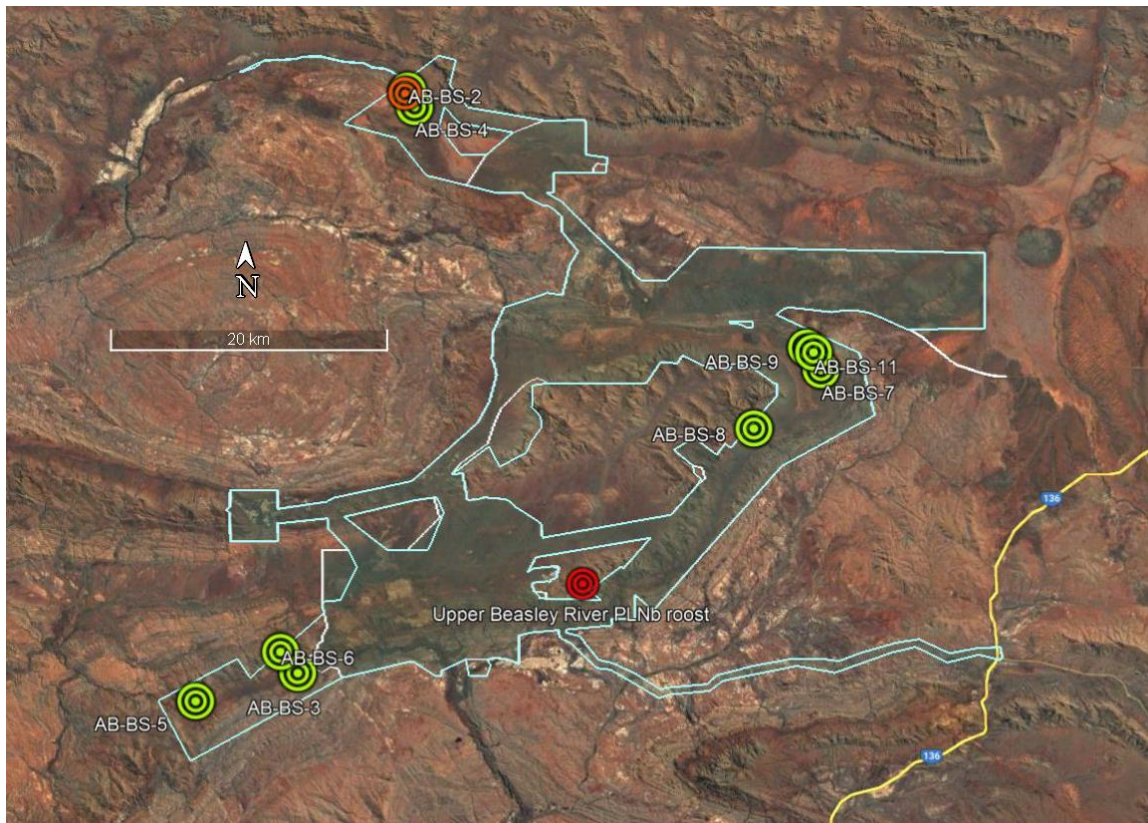
PGB

Currently I have assessed sixteen PGB roosts within or immediately adjacent to the study area as critical habitat. Eleven are apartment block cave groupings and five are isolated caves without a nearby cave complex, Table 1, Figure 1.

Table 1. Ghost bat critical habitat caves and groupings at Brockman Syncline.

Roost designation	Primary Cat 2 cave	Caves in Apt. Blk grouping	Within Stg 1 Dev Env
AB-BS-2	CBRK-005 or 7	CBRK-005, -007 & -011	No
AB-BS-3	CBRK-08 (currently cat 3)	CBRK-10	No
AB-BS-4	CBRK-21	CBRK-09, -23, -25, -33, -35, -37 & -39	No
AB-BS-5	CBRK-14	CBRK-16 & -42	No
AB-BS-6	CBRK-60	CBRK-58	No
AB-BS-7	CBRK-67	CBRK-61, -63 & -65	Yes
AB-BS-8	CBRK-69	CBRK-71	Yes
AB-BS-9	CBRK-76	CBRK-79, -81, -83, -85 & -87	Yes
AB-BS-11	GBS-CA-14 (currently cat 3)	GBS-CA-08, -09, -10, -11 & -12	Yes
Isolated Cat 2	CBRK-15	Deep multi chamber cave. No other caves nearby	No
Isolated Cat 2	CBRK-38	Deep multi chamber cave. No other caves nearby	No
Isolated Cat 2	CBRK-46	Deep multi chamber cave. CBRK-44 is 130 m distant	No
Isolated Cat 2	CBRK-93	Deep multi chamber cave. Caves CBRK - 095, -097 and -099 are over 230 m distant.	Yes
AB-SGE-1	Sg1	Caves Sg1, C3, C4, C5, C6 and C7	See separate assessment
AB-SGE-2	CBRK-78	CBRK-78 & -80	See separate assessment
Isolated Cat 2	CBRK-82	Deep multi chamber cave. AB-SGE-1 is 700 m distant	See separate assessment

Figure 1 Locations of confirmed and proposed critical bat habitat. Blue outline indicates the extended study area. Smaller white outline with yellow highlight indicates project stage 1 development envelope.



Apartment Block 2 (AB-BS-2) is centered on adjacent category 2 caves CBRK-005 and '-007 at Silvergrass West. Both are multi chamber caves over 20 m deep with ceiling heights over 2 m (Biologic 2020). PGB have been recorded roosting diurnally in '-007 and both have extensive scat middens. Category 4 cave CBRK-011 nearby in the gully provides a feeding and/or refuge site and also contains scats (Biologic 2020).

Apartment Block 3 (AB-BS-3) is centered on adjacent category 3 caves CBRK-008 and '-010 at BS4MM. Both are deep single chamber caves over 20 m deep with '-008 having a high ceiling of 7m (Biologic 2020). Both have extensive scat middens. PGB calls consistent with roosting have been recorded at '-008 in September 2019.

Apartment Block 4 (AB-BS-4) is centered on category 2 cave CBRK-021 at Silvergrass West. It is a multi-chamber cave approximately 35 m deep with ceiling heights over 4 m (Biologic 2020). It has PGB scats present. It lies in a gully surrounded by a number of less complex caves and overhangs. Caves '-033 and '-035 are shallow multi-chamber category 3 caves capable of supporting reproducing females. Nearby overhangs '-009, '-023, '-025, '-037 and '-039 provide feeding and/or refuge sites within the gully and some have scats present (Biologic 2020).

Apartment Block 5 (AB-BS-5) is centered on category 2 cave CBRK-014 at Vivash. It is a multi-chamber cave approximately 30 m deep with ceiling heights over 5 m (Biologic 2020). It has PGB

scats present. It lies in a gully surrounded by a number of less complex caves and overhangs. Caves '-016 and '-042 are deep single-chamber category 3 caves capable of supporting reproducing females. Nearby overhangs provide feeding and/or refuge sites within the gully and some have scats present (Biologic 2020).

Apartment Block 6 (AB-BS-6) is centered on category 2 cave CBRK-060 at Atlantis. It is a multi-chamber cave approximately 35 m deep with ceiling heights of 4.5 m (Biologic 2020). PGB have been recorded roosting diurnally and an extensive scat midden is presents. Cave '-058 nearby is a deep single-chamber category 3 cave with a high ceiling capable of supporting reproducing females. PGB calls consistent with roosting have been recorded at '-058 in September 2019. Nearby overhangs provide feeding and/or refuge sites within the gully.

Apartment Block 7 (AB-BS-7) is centered on category 2 cave CBRK-067 at Nammuldi. It is a multi-chamber cave approximately 35 m deep with ceiling heights of 5 m (Biologic 2020). It has PGB scats present. It lies on a cliff surrounded by a number of less complex caves and overhangs. Caves '-063 and '-065 are shallow single and multi-chamber category 3 caves with 2 m ceiling heights capable of supporting reproducing females. PGB have been reported roosting in '-065. Nearby category 4 caves '-061 and '-101 provide feeding and/or refuge sites and '-101 has scats present (Biologic 2020).

Apartment Block 8 (AB-BS-8) is centered on category 2 cave CBRK-069 at BS3Ext. It is a single-chamber cave approximately 25 m deep with ceiling heights up to 15 m (Biologic 2020). PGB have been reported roosting in 2019 (Biologic 2020) and in February 2020 (author's obs). It has PGB scats present. Cave '-071 is a nearby shallow single-chamber category 3 cave with 2 m ceiling heights capable of supporting reproducing females and has scats present (Biologic 2020).

Apartment Block 9 (AB-BS-9) has two category 2 caves CBRK-076 and '-085 at Nammuldi. Both are deep multi-chamber caves over 30 m deep with ceiling heights of 3 m (Biologic 2020). Both have PGB scats present. They lie along a cliff surrounded by a number of less complex caves and overhangs. PGB were detected in August 2019 and diurnally roosting in November 2019 (author's data). They were also observed roosting in February and August 2020 (author's obs). Caves '-079 and '-083 are deep category 3 caves with low ceilings approximately 1.5 m high capable of supporting reproducing females. Both have scats present. Nearby category 4 caves '-081 and '-087 are both shallow caves with low ceilings and with scats present that provide feeding and/or refuge sites (Biologic 2020).

Apartment Block 10 (AB-BS-10). This designation is not used.

Apartment Block 11 (AB-BS-11) is centered on category 3 cave GBS-CA-14 at Nammuldi. It is a relatively shallow cave with scats present (Stantec 2020). It lies in a gully surrounded by a number of less complex caves and overhangs, GBS-CA-08, '-09, '-10, '-11, '-12 and CBRK-077. All provide feeding and/or refuge sites and have scats present (Stantec2020; Biologic 2020). The internal characteristics of these caves were assessed by Stantec to a different standard to the majority of the caves and the descriptions potentially differ. Therefore, they require re-confirmation of category and should be resurveyed.

Isolated category 2 cave CBRK-015 at Silvergrass West. It is a multi-chamber cave approximately 40 m deep with ceiling heights up to 10 m (Biologic 2020). PGB were diurnally roosting and it has an extensive scat midden present (Biologic 2020).

Isolated category 2 cave CBRK-038 at Vivash. It is a multi-chamber cave approximately 35 m deep with ceiling heights up to 5 m (Biologic 2020). It has an extensive scat midden present (Biologic 2020). No other caves are present within 250 m.

Isolated category 2 cave CBRK-046 at Vivash. It is a multi-chamber cave approximately 50 m deep with ceiling heights up to 6 m (Biologic 2020). It has an extensive scat midden present (Biologic 2020). Cave CBRK-044 is 130 m distant. AB-5 is 300 m distant.

Isolated category 2 cave CBRK-093 at Nammuldi. It is a multi-chamber cave approximately 40 m deep with ceiling heights of 3 m (Biologic 2020). It has an extensive scat midden present. PGB were detected foraging nearby in Nov 2019 and scats are present in nearby Caves '-095, '-97 and '-099. All are over 200 m distant.

Limiting vibration levels.

Regarding the vibration limitations for the critical habitat PGB caves, I believe that the current analysis contained in Wood (2021) based on a limit of 10 mms^{-1} is appropriate to PLNb Cat 2 caves but is overly restrictive for the majority of PGB caves. I am proposing that the 10 mms^{-1} PPV only be applied to the confirmed, and not temporarily sealed, PGB apartment block cave groups containing a category 2 cave and the isolated cat. 2 cave(s) during the months of 1 October to 31 December, the time that the females are heavily pregnant and or nursing pups. Higher vibration limits of 25, 50 75 or even 100 mms^{-1} can be applied to the caves outside this period of time based on a Geotech assessment of their stability and ability to remain viable as roost caves (i.e. not sustain major internal damage from the vibration that would make them unsuitable for PGB roosting). The intention is to fully protect the breeding females and their pups should they be present in the cat 2 caves. Further it has been shown that PGB will recolonise a suitable cave once mining operations have passed on as long as the cave retains a viable internal complex of chambers. Given that the majority of these sites are in either Brockman or Marra Mamba BIF that is often less stable than other strata, in the absence of a formal Geotech assessment, default vibration levels can be linked to caves with environmental significance as follows:

- All PLNb caves Cat 1 and 2 caves; UBRR and LCCR are of High environmental significance and 10 mms^{-1} PPV is applicable all year.
- All PLNb Satellite Cat 3 caves; High environmental significance and 10 mms^{-1} PPV is applicable to high Geotech sensitivity caves all year. There are none currently known at Brockman Syncline.
- All PGB Cat 1 caves; High environmental significance and 10 mms^{-1} PPV applicable to high Geotech sensitivity caves all year. There are none currently known at Brockman Syncline.
- PGB Cat 2 caves and Apartment Block Cat 3 caves; High environmental significance and 10 mms^{-1} PPV applicable to high Geotech sensitivity for maternity period of 1 October to 31 December, then 25 mm^{-1} PPV applicable to medium Geotech sensitivity outside of maternity period. For temporarily sealed caves the Geotech sensitivity analysis applies year-round. This applies to all apartment blocks and isolated significant caves (Table 1) with the exception of CBRK-082, see above.
- Isolated PGB Cat 3 caves; Medium environmental significance and 50 mm^{-1} PPV applicable to medium Geotech sensitivity applies all year.
- All Cat 4 caves; Low environmental significance and 75 mm^{-1} PPV applicable to low Geotech sensitivity applies all year.

Limiting sound levels.

Regarding the sound limitations for the critical habitat PGB and PLNb caves, I am proposing that the 60 dB(A) limit currently being applied (Wood 2021) to the caves is overly restrictive. The threshold value of 60 dB(A) correctly comes from Bullen and Creese (2014). Currently, my thinking is that for bats we should be using Z weighted, or linear, sound measurements as we don't fully understand their hearing capability and they probably don't reduce their sensitivity like humans do at higher frequencies and therefore don't follow A weighting for sound disturbance. Z weighting results in higher assessed sound levels as frequency increases above something like 8 kHz and so 60 dB(A) often corresponds to mid-60 dB(Z) depending upon the frequency range present. I therefore would prefer to see sound analysis applying to bat caves quoting dB(Z) values. Further on this value, Bullen and Creese (2014) also found that 70 dB(A) at the entrance did not

cause resident PGB to abandon the cave and can therefore be assumed to be a safe level. Further, similar to vibration levels causing disturbance, this sound level should only be applied to critical category 2 habitat caves in the same months as listed above, i.e. October to January for the PGB and all year for the PLNb.

Note that the 70 dB(Z) limit for sound is based on bats abandoning or failing to reproduce due to mid and long-term annoyance and stress level assessments i.e. from personnel visits, drilling, HV movements, plant operation etc. Blast over pressure is a separate short-term phenomenon that applies at the cave mouth for damage minimisation but doesn't necessarily permeate the caves inner reaches where the bats are roosting. Acceptable over pressure spikes therefore could be at much higher levels than the 70 dB depending on the cave's inner characteristics and ability of internal constrictions to mitigate the spike. Currently there is no data available to propose an overpressure spike limit based on bat disturbance.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'R Bullen', is centered on the page.

Robert Bullen
Managing Director and Principal Ecologist

References:

- Biologic (2020). Brockman Syncline targeted vertebrate fauna survey, Rev. 5. Unpublished report RTIO-HSE-0343367 for Rio Tinto by Biologic Environmental Survey, dated 17 July 2020
- .
- Biologic (2021). Targeted conservation significant fauna surveys for Greater Brockman Syncline. Letter report for Rio Tinto dated 24 February 2021.
- Bullen, R. D., & Creese, S. (2014). A note on the impact on Pilbara leaf-nosed and ghost bat activity from cave sound and vibration levels during drilling operations. *Western Australian Naturalist* (Perth), 29, 145-154.
- Bullen, R. D. (2017). Robe Valley Mesa A to Mesa 2405A, impact of mining on Ghost bat presence and activity, April 2017, including assessment of caves on Mesas F and G. Unpublished report by Bat Call WA Pty Ltd for Rio Tinto dated July 2017.
- Bullen, R. D. (2020). Silvergrass East Ghost bat cave review; 2019-2020. Bat Call WA Memo for Rio Tinto dated 15 May 2020.
- Stantec (2020). Brockman Syncline proposal detailed fauna survey, Vsn. 3. Unpublished report RTIO-HSE-0341104 for Rio Tinto by Biologic Environmental Survey, dated 21 January 2020.
- Threatened Species Scientific Committee, TSSC. (2016). Conservation Advice: *Macroderma gigas*, Ghost Bat., Canberra, Australian Capital Territory.
- Wood (2021). Greater Brockman proposal noise and vibration impact assessment. Unpublished report for Rio Tinto dated April 2021.

Attachment 1 Review of MNES caves at Brockman Syncline

Notes:

1. Cave categories are based on physical descriptions and PGB/scat presence from Biologic July 2020 report plus all other available data. UBRR is a known PLNb cat 2 roost cave. There is a second PLN roost as yet not located in the vicinity of Silvergrass West. All Cat 2 caves and lower PGB category caves in apartment blocks (AB-X) are “critical habitat”. All recommended PPV limits are the maximum allowable based on protecting the cave structural integrity and/or the presence of heavily pregnant females and their pups during the breeding season. Lower limits may be applied. All are applied assuming that the cave is not sealed. If sealed, the higher PPV limit designed to minimise physical damage to the cave and retain it as a viable roost applies year-round.
2. Data from Biologic report dated July 2020 plus addendum memo dated Feb 2021. Other records are noted
3. Echolocation call data from Bat Call data base. R = roosting PGB indicated, F = foraging PGB indicated, BC = Bat Call, B = Biologic survey, S = Stantec survey
4. BC review = Bat Call memo dated 15 May 2020 by author.
5. Bat Call current assessment based on all available data and reports.
6. Field work in 2016 and 2017 by RTIO and Bat Call recorded few deep and complex caves in the Brockman Syncline MM and MN area south of the main ridge line. This cave is therefore likely to be a cat 3 or 4. Recommended conservative PPV of 50 mms⁻¹ applies subject to a future review. There are 12 caves effected. B4jun16-36, BS4MM-Aug16-04, '-13, '-15, BS4MMJul16-11, -13, -14, -15, -17, -30, CBRK-173, and GBS_CA_07/13.
7. Cat 4 caves in apartment blocks are not used for diurnal roosting during the reproduction season but are refuge and/or feeding sites, therefore, tighter wet season restrictions are not appropriate. For protection against damage, a PPV of 50 mms⁻¹ applies year-round to these caves. There are 13 caves effected. CBRK-0009, -011, -023, -025, -037, -039, -071, -081, -175 and GBS-CA-16.
8. There is insufficient detail available for this cave. It may be classified as a Cat 2 or 3. Further survey work is required to confirm. Preliminary conservative recommended PPV is therefore equivalent to Cat 2 if closer than 350 m to the proposed mining operational area. There is 1 cave effected. CBRK-164.
9. This cave requires more survey work to confirm its category and characteristics if it is within 350 m of mining operations. There are 10 caves potentially affected. CBRK-029, -041, -044, GBS-CA_08, 09, 10, 11, 12, 15 and MAMBAT93-01.
10. Caves GBS-06, 20, 21 and 22 have been assessed as PLNb cat 4 and PGB cat 3 or 4 therefore no further work to confirm characteristics is required.

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
B4jun16-36	Yes	Note 6	3		No PGB data recorded	50*
BS4MM-Aug16-03	Yes		4		“Shelter” @ 220 m from CBRK-111. No PGB data recorded	75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
BS4MM-Aug16-04	Yes	Note 6	3		“Cave >10 m deep” @ 230 m from CBRK-111. No PGB data recorded	50*
BS4MM-Aug16-13	Yes	Note 6	3		“Cave goes back” @ 260 m from CBRK-111. No PGB data recorded	50*
BS4MM-Aug16-15	Yes	Note 6	3 or 4		“Cave” @ 1.2 km from CBRK-111. No PGB data recorded	50*
BS4MM-Aug16-19	Yes		3		“Cave >10 m deep” @ 75 m from CBRK-174. No PGB data recorded	50
BS4MMJul16-11	Yes	Note 6	3 or 4		“Cave” @ 310 m from CBRK-111. No calls recorded (BC-BS4MM Jul16)	50*
BS4MMJul16-13	Yes	Note 6	3 or 4		“Cave” @ 320 m from CBRK-111. No calls recorded (BC-BS4MM Jul16)	50*
BS4MMJul16-14	Yes	Note 6	3 or 4		“Cave” @ 320 m from CBRK-111. No calls recorded (BC-BS4MM Jul16)	50*
BS4MMJul16-15	Yes	Note 6	3 or 4		“Cave” @ 320 m from CBRK-111. No calls recorded (BC-BS4MM Jul16)	50*
BS4MMJul16-17	Yes	Note 6	3 or 4		“Cave” @ 370 m from CBRK-111. No calls recorded (BC-BS4MM Jul16)	50*
BS4MMJul16-30	Yes	Note 6	3 or 4		“Cave” @ 50 m from CBRK-109. F (BC-B4SMM-Jul 16)	50*
CBRK-000	Yes		3	12 m deep single chamber with 4 m high ceiling	PGB present F@VBRK-115 nearby (B-Nov 19) No other cave listed within 100 m.	50
CBRK-001			4	17, 1, 1	1 scat present	75
CBRK-002			4	8, 1, 3	F@Bat10 nearby (S-Sept 19)	75
CBRK-003			4	9, 1, 1.2		75
CBRK-004			4	8, 1, 8		75
CBRK-005		AB-BS-2	2	23, 2, 4	In Apt Blk gully CBRK-05, -07 & -11. 3500 scats present Cat 2 PLNb roost Nearby.	10, Oct to Dec 25, Jan to Sept
CBRK-006	Yes		4	2.5, 1, 1.5	12 scats present	75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-007		AB-BS-2	2	30, 2, 2	In Apt Blk gully CBRK-05, -07 & -11. PGb and 400 scats present R (B-Sept 19) Cat 2 PLNb roost Nearby	10, Oct to Dec 25, Jan to Sept
CBRK-008		AB-BS-3	3	30, 1, 7	In Apt Blk gully CBRK-08, & '-10. 2000 scats present R (B-Sept 19 listed as VBRK-08)	10, Oct to Dec 25, Jan to Sept
CBRK-009		AB-BS-4	4	9, 1, 4	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39	50 Note 7
CBRK-010		AB-BS-3	3	30 m Deep single chamber with 1 m ceilings	In Apt Blk gully CBRK-08, & '-10. 450 scats present R (B-Sept 19 listed as VBRK-08)	10, Oct to Dec 25, Jan to Sept
CBRK-011		AB-BS-2	4	Description TBA	In Apt Blk gully CBRK-05, -07 & -11. F (B-Sept 19) Cat 2 PLNb roost Nearby	50 Note 7
CBRK-012			3	20, 2, 3		50
CBRK-013			4	6, 1, 1	30 scats present	75
CBRK-014		AB-BS-5	2	30, 3, 5	In Apt Blk gully CBRK-14, -16 & -42. 40 scats present	10, Oct to Dec 25, Jan to Sept
CBRK-015		Isolated Cat 2	2	40, 4, 10	Isolated Cat 2 cave. PGb, desiccated pup and 20,000 scats present. R (B-Sept 19)	10, Oct to Dec 25, Jan to Sept
CBRK-016		AB-BS-5	3	30, 1, 4	In Apt Blk gully CBRK-14, -16 & -42.	10, Oct to Dec 25, Jan to Sept
CBRK-017			3	18, 1, 3	30 scats present	50
CBRK-018			3	20, 1, 2.5	2 scats present	50
CBRK-019			3	6, 1, 2	100 scats present	50
CBRK-020			4	14, 1, 5		75
CBRK-021		AB-BS-4	2	35, 2, 4	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39 3 scats present	10, Oct to Dec 25, Jan to Sept
CBRK-022			3	35, 1, 10	100 scats present	50
CBRK-023		AB-BS-4	4	7, 1, 2	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39 6 scats present	50 Note 7
CBRK-024			4	25, 1, 2.5		75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-025		AB-BS-4	4	2, 1, 0.5	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39 1 scat present	50 Note 7
CBRK-026			3	18, 1, 5		50
CBRK-027			4	8, 1, 1.5	150 scats present	75
CBRK-028			3	4, 2, 2.5	15 scats present	50
CBRK-029		Note 9	Description TBA		Isolated cave 2.8 km from AB-BS-4	N/A
CBRK-030			4	12, 1, 2.5		75
CBRK-031	Yes		3	8, 2, 5	15 scats present	50
CBRK-032			4	15, 1, 2		75
CBRK-033		AB-BS-4	3	10, 2, 2	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39	10, Oct to Dec 25, Jan to Sept
CBRK-034			3	30, 1, 4.5		50
CBRK-035		AB-BS-4	3	10, 2, 3	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39	10, Oct to Dec 25, Jan to Sept
CBRK-036			3	35, 2, 5		50
CBRK-037		AB-BS-4	4	12, 1, 2.5	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39	50 Note 7
CBRK-038		Isolated Cat 2	2	35, 2, 5	Isolated cat 2 cave. No other cave listed within 250 m. 800 scats present No PGB observed (B-Sep 19)	10, Oct to Dec 25, Jan to Sept
CBRK-039		AB-BS-4	4	11, 1, 1	In Apt Blk gully CBRK-9, -21, -23, -25, -33, -35, -37 & -39	50 Note 7
CBRK-040			4	3, 1, 7		75
CBRK-041		Note 9	Description TBA		Cave is outside the development envelope for stage 1.	N/A
CBRK-042		AB-BS-5	3	30, 1, 5	In Apt Blk gully CBRK-14, -16 & -42.	10, Oct to Dec 25, Jan to Sept
CBRK-043			3	35, 1, 2	25 scats present	50
CBRK-044		Note 9	Description TBA		Cave is outside the development envelope for stage 1.	N/A
CBRK-045	Yes		3	8, 2, 3		50
CBRK-046		Isolated Cat 2	2	50, 2, 6	80 scats present CBRK-44 undescribed is 130 m away	10, Oct to Dec 25, Jan to Sept

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-047			3	16, 2, 3	500 scats present Isolated. No other cave listed within 750 m. No PGb observed (VBRK-79 - B-Sep 19)	50
CBRK-048			4	12, 1, 5		75
CBRK-049			4	5, 1, 3	3 scats present	75
CBRK-050			4	25, 1, 10		75
CBRK-051			3	35, 2, 15	Biota B2bat05 Oct19. No PGb calls detected	50
CBRK-052	Yes		3	15, 2, 3	F (S-May 19) F@Bat10 nearby (S-Sept 19)	50
CBRK-053	Yes		3	15, 3, 5	1 scat present	50
CBRK-054			4	15, 1, 4		75
CBRK-055	Yes		4	15, 1, 1.5	20 scats present	75
CBRK-056			3	12, 2, 3		50
CBRK-057	Yes		4	16, 1, 1.2	20 scats present	75
CBRK-058		AB-BS-6	3	35, 1, 7	In Apt Blk gully CBRK-58, & -60. F (B-Sept 19)	10, Oct to Dec 25, Jan to Sept
CBRK-059	Yes		3	20, 1, 3.5	50 scats present	50
CBRK-060		AB-BS-6	2	35, 2, 4.5	PGb and 14,500 Scats present In Apt Blk gully CBRK-58, & -60	10, Oct to Dec 25, Jan to Sept
CBRK-061	Yes	AB-BS-7	Descrip tion TBA		Group CBRK-61, -63, -65 & -67	10, Oct to Dec 25, Jan to Sept
CBRK-062			4	3, 1, 2	2 scats present	75
CBRK-063	Yes	AB-BS-7	3	25, 3, 2	Group CBRK-61, -63, -65 & -67 15 scats present	10, Oct to Dec 25, Jan to Sept
CBRK-064			4	18, 1, 5		75
CBRK-065	Yes	AB-BS-7	3	15, 1, 2.2	PGb present. Group CBRK-61, -63, -65 & -67	10, Oct to Dec 25, Jan to Sept
CBRK-066			3	18, 1, 5	80 scats present	50
CBRK-067	Yes	AB-BS-7	2	35, 2, 5	Group CBRK-61, -63, -65, -67 & -101 are 200 m away. 4,000 scats present R (B-Nov 19)	10, Oct to Dec 25, Jan to Sept
CBRK-068			4	15, 1, 6	2 scats present	75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-069	Yes	AB-BS-8	2	25, 1, 15	PGb and 2000 Scats present “Roost” in Biota Oct19 PGb netted Feb 20. In gully with CBRK-71.	10, Oct to Dec 25, Jan to Sept
CBRK-070			4	15, 1, 3.5		75
CBRK-071	Yes	AB-BS-8	4	7, 1, 2	2 scats present In gully with CBRK-69	50 Note 7
CBRK-072			4	25, 1, 1.5		75
CBRK-073	Yes		3	20, 2, 4	2 scats present	50
CBRK-074	Yes		3	5, 1, 3	400 scats present F (B-Sept 19)	50
CBRK-075	Yes		4	Description “Overhang”		75
CBRK-076	Yes	AB-BS-9	2	45, 3, 3	5000 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87 PGb netted Feb and Aug 20. R (B-Nov 19) F (S-Aug 19)	10, Oct to Dec 25, Jan to Sept
CBRK-077	Yes		4	12, 1, 1.6	33 scats present R@BAT 2A nearby (S-Aug 19)	75
CBRK-079	Yes	AB-BS-9	3	25, 2, 1.5	500 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87	10, Oct to Dec 25, Jan to Sept
CBRK-081	Yes	AB-BS-9	4	8, 1, 1.5	6 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87	50 Note 7
CBRK-083	Yes	AB-BS-9	3	30, 1, 1.5	300 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87	10, Oct to Dec 25, Jan to Sept
CBRK-084	Yes		3	22, 1, 1.5	1000 scats present No PGb calls detected Biota B2bat06 Oct19.	50
CBRK-085	Yes	AB-BS-9	2	30, 3, 3	300 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87	10, Oct to Dec 25, Jan to Sept
CBRK-086	Yes		3	12, 1, 1.5	40 scats present	50
CBRK-087	Yes	AB-BS-9	4	13, 1, 2.5	90 scats present In Apt Blk complex CBRK-76, & - 79, -81, -83, -85 & -87	10, Oct to Dec 25, Jan to Sept

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-088			3	15, 3, 4	50 scats present Description "Overhang" in Biologic 2020	50
CBRK-089	Yes		3	15, 3, 2	400 scats present	50
CBRK-090	Yes		4	4, 1, 9	10 scats present	75
CBRK-091	Yes		4	8, 2, 1.5	4 scats present	75
CBRK-092	Yes		4	4, 1, 6	20 scats present	75
CBRK-093	Yes		Iso'd Cat 2	40, 3, 3	20 scats present	10, Oct to Dec 25, Jan to Sept
CBRK-094	Yes		4	20, 1, 5	2 scats present	75
CBRK-095	Yes		4	15, 1, 3	Desiccated pup and 2 scats present	75
CBRK-096	Yes		4	15, 1, 5		75
CBRK-097	Yes		4	5, 1, 2	15 scats present	75
CBRK-098	Yes		4	6, 1, 3		75
CBRK-099	Yes		3	10, 1, 3	22 scats present	50
CBRK-100	Yes		3	10, 1, 3	50 scats present	50
CBRK-101	Yes		4	8, 1, 2	2 scats present	75
CBRK-102	Yes		4	12, 1, 2.2		75
CBRK-103	Yes		3	15, 2, 3		50
CBRK-104	Yes		3	20, 1, 2.5	20 scats present	50
CBRK-105	Yes		4	10, 1, 2	60 scats present	75
CBRK-106	Yes		3	15, 1, 2	R? (BC-B4SMM-June 16) 3 Scats present (Note 3)	50
CBRK-107	Yes		4	10, 1, 3		75
CBRK-108	Yes		3	20, 2, 13		50
CBRK-109	Yes		3	30, 1, 2	2,000 scats present	50
CBRK-110	Yes		3	16, 2, 2.2	R? (BC-B4SMM-June 16) 1 Scat present (Note 3)	50
CBRK-111	Yes		3	15, 1, 2.5	F (BC-B4SMM-Jul 16-26/27) 1 Scat present	50
CBRK-113	Yes		4	10, 1, 4.5	10 scats present	75
CBRK-114			3	15, 2, 5		50
CBRK-115			4	15, 1, 3.5	2 scats present	75
CBRK-116	Yes		3	8, multi, 3.5	500 scats present	50
CBRK-119	Yes		3 or 4	15, 1, 1.5	4,000 scats present	50
CBRK-120	Yes		4	15, 1, 3	10 scats present	75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-121	Yes		3	20, 3, 5	1 scats present	50
CBRK-122	Yes		4	10, 1, 4		75
CBRK-123	Yes		4	10, 1, 2.5		75
CBRK-124	Yes		4	18, 1, 2.5		75
CBRK-125	Yes		3	15, 5, 8	500 scats present Isolated Cat 3 with CBRK-126.	50
CBRK-126	Yes		4	16, 1, 6.5		75
CBRK-136	Yes		4	4, 1, 2	3 scats present	75
CBRK-137	Yes		3	20, 1, 5	4,000 scats present In a group with CBRK-116 & -136. No PGB observed (VBRK-127 & VBRK-228 Nov19 & Stan T5 May 19)	50
CBRK-138	Yes		4	7, 2, 2		75
CBRK-139	Yes		3	15, 1, 2.8		50
CBRK-140	Yes		3	7, 1, 3	100 scats present	50
CBRK-141	Yes		3	10, 3, 1.8	20 scats present	50
CBRK-142	Yes		4	8, 1, 1.7	70 scats present	75
CBRK-143	Yes		4	8, 1, 2	10 scats present	75
CBRK-144	Yes		3	25, 1, 3.5	50 scats present	50
CBRK-145	Yes		4	12, 1, 5	5 scats present	75
CBRK-146 (not in Wood report)			3	45, 1, 4	1 scats present	50
CBRK-147	Yes		4	10, 1, 5	10 scats present	75
CBRK-148	Yes		4	8, 1, 4	50 scats present	75
CBRK-149	Yes		4	5, 1, 3	70 scats present	75
CBRK-150	Yes		3	20, 1, 4	5 scats present	50
CBRK-151	Yes		3	25, 1, 4	15 scats present	50
CBRK-152	Yes		4	12, 1, 3.5		75
CBRK-153	Yes		3	30, 1, 4		50
CBRK-154	Yes		3	30, 2, 2		50
CBRK-160			4	Description "Cave"		75
CBRK-161			4	Description "Cave"	Outside Brockman Syncline study area. "No usage" – Sept 20	75

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-162			3	Description "Cave"	20 scats present "Night roost" – Sept 20 Outside Brockman Syncline study area	50
CBRK-163			4	Description "Cave"	Outside Brockman Syncline study area. "Potential night roost" – Sept 20	75
CBRK-164		Note 8	2 or 3	30, 3, 2	Outside Brockman Syncline study area. "No usage" – Sept 20	25*
CBRK-165			3	Description "Cave"	Outside Brockman Syncline study area. "No usage" – Sept 20	50
CBRK-166			3	Description "Cave"	100 scats present. "Potential day roost" – Sept 20 Outside Brockman Syncline study area	50
CBRK-167			3	Description "Cave"	20 scats present. "Potential day roost" – Sept 20 Outside Brockman Syncline study area	50
CBRK-168			4	Description "Cave"	Outside Brockman Syncline study area. "Potential night roost" – Sept 20	75
CBRK-169	Yes		4	Description "Cave"	Outside Brockman Syncline study area. "No usage" – Sept 20	75
CBRK-170			3	Description "Cave"	150 scats present. "Night roost" – Sept 20 Outside Brockman Syncline study area	50
CBRK-171			3	Description "Cave"	4 scats present. "Night roost" – Sept 20 Outside Brockman Syncline study area	50
CBRK-173	Yes	Note 6	3	17, 1, 1.5	350 scats present, "Day roost" – Sept 20	50
CBRK-174	Yes		3	Description "Cave"	F (BC email 22 Apr 21) 3,500 fresh Scats. "Potential maternity" – Sept 20. Limited foraging visits only in 2020/21 and 2021/22 wet seasons	50
CBRK-175		AB-BS-2	3 or 4	Description "Cave"	5 scats present. "Potential night roost" – Sept 20	50 Note 7

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
CBRK-176			3 or 4	Description "Cave"	10 scats present "Night roost" – Sept 20 350 m from AB-2	50
CBRK-177			3 or 4	Description "Cave"	350 m from AB-2. "Potential night roost" – Sept 20	50
CBRK-199	Yes		4	6, 2, 2.5	2 scats present	75
GBS_CA_01	Yes		4	Description "Cave"	= CBRK-062	75
GBS_CA_02	Yes		3	Description "Cave"	= CBRK-026	50
GBS_CA_03	Yes		3	Description "Vertical Cave"	= CBRK-116	50
GBS_CA_04	Yes		4	Description "Overhang."	No CBRK equivalent	75
GBS_CA_05	Yes		3	Description "Cave"	= CBRK-52	50
GBS_CA_06	Yes	Note 10	3 or 4	Description "Cave"	Cave. May19-T6. PGb noct. refuge. No CBRK equivalent	50
GBS_CA_07/13	Yes	Note 6	3 or 4	Description "Cave"	Scats present 2 adjacent caves. BAT01-0914. PGb noct. refuge. No CBRK equivalent	50*
GBS_CA_08	Yes	AB11 - TBC	Note 9	Description "Cave"	Scats present Near BAT02-0817. PGb noct. refuge. No CBRK equivalent	TBA
GBS_CA_09	Yes	AB11 - TBC	Note 9	Description "Cave"	Scats present Near BAT02-0817. PGb noct. refuge. No CBRK equivalent	TBA
GBS_CA_10	Yes	AB11 - TBC	Note 9	Description "Cave"	Scats present Near BAT02-0817. PGb noct. refuge. No CBRK equivalent	TBA
GBS_CA_11	Yes	AB11 - TBC	Note 9	Description "Cave"	Scats present Near BAT02-0817. PGb noct. refuge. No CBRK equivalent	TBA
GBS_CA_12	Yes	AB11 - TBC	Note 9	Description "Cave"	Scats present Near BAT02-0817. PGb noct. refuge. No CBRK equivalent	TBA
GBS_CA_14	Yes	AB11 - TBC	3	Description "Cave"	Scats present Near CBRK-77. BAT02-0817. Described as relatively shallow, ~10 m. 15-50 PGb calls pn indicates roosting.	50

Cave/site ID	Cave is within Stage 1 Dev. Env. border	Critical Habitat for MNES bats	Prelim. Cave Cat. Note 1	Cave characteristics: Depth (m), No of chambers, Ceiling height (m)	Comments Note 2 Note 3 Note 4	Recommended PPV limit mms ⁻¹ Note 1
GBS_CA_15	Yes	Note 9	TBA	Description "Cave"	Near BAT10-0817. Isolated cave 720 m from AB10, PLNb noct. refuge. No CBRK equivalent	TBA
GBS_CA_16	Yes	AB9	4	Description "Overhang."	= CBRK-87	50 Note 7
GBS_CA_17	Yes	AB9	2	Description "Cave"	= CBRK-76	10, Oct to Dec 25, Jan to Sept
GBS_CA_18	Yes	AB9	3	Description "Cave"	Next to CBRK-76 Scats present	10, Oct to Dec 25, Jan to Sept
GBS_CA_19	Yes		4		= CBRK-30/32 Cave is outside the development envelope for stage 1.	75
GBS_CA_20	Yes	Note 10	3 or 4	Description "Cave"	Cave. Sept19bat-03. PLNb noct. refuge. No CBRK equivalent	N/A
GBS_CA_21	Yes	Note 10	3 or 4	Description "Cave"	Cave. Sept19bat-09. PLNb noct. refuge. No CBRK equivalent	N/A
GBS_CA_22	Yes	Note 10	3 or 4	Description "Cave"	Cave. Sept19bat-13. PLNb noct. refuge. No CBRK equivalent	N/A
MAMbat81-01	Yes		3		= CBRK-121	50
MAMBAT93-01	Yes	Note 9	Description TBA	No description available	Isolated cave, category unknown. Detector failed to record – Biota report.	TBA
Upper Beasley River PLNB Roost (CBRK-200)		UBRR	PLNb Cat 2	N/A	Cat 2 PLNb roost confirmed	10
Lower Caves Ck Roost		LCCR	PLNb Cat 2 TBC	N/A	Cat 2 PLNb roost confirmed but not yet located immediately adjacent to Silvergrass West.	10