Action Plan for the Management of Significant Bats at the Warrawoona Gold Project

CRL-ENV-PLN-008-20

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Action Plan for the Management of Significant Bats at the Warrawoona Gold Project
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EPBC:	2019/8584
Proponent:	Calidus Resources
Proposed Action:	To develop and operate the Warrawoona Gold Project, mining and processing operation approximately 20 km south of Marble Bar in the Pilbara Region of Western Australia [See EPBC Act Referral 2019/8584 and variation request accepted on 12 May 2020].

Rev	Revision Details	Prepared	Reviewed	Authorised	Date
Rev0	Final Draft issued to AWE	R. Bullen – Bat Call WA K. George – Rapallo	K. George - Rapallo	P. Brennan - Calidus	4/12/20
Rev1	Updated with feedback from AWE		R. Bullen – Bat Call WA K. George – Rapallo	P. Brennan - Calidus	14/12/20
Rev 2	Updated with LCL's UCL's on pre-mining baseline data and initial bat baseline Arsenic levels	P. Brennan – Calidus R. Bullen – Bat Call WA		P. Brennan - Calidus	14/6/21

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

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1 Purpose

The purpose of this plan is to provide the detail on each action required to comply to the proposed EPBC conditions attached to the approval of EPBC 2019/8584 with regards to the Warrawoona populations of the Pilbara Leaf-nosed bat (PLNb) and Ghost bat (PGb). This plan falls under the Significant Species Management Plan CRL-ENV-PLN-006-19 that summarises the baseline data and the monitoring and management of conservation significant vertebrate fauna species that may occur on the Warrawoona Gold Project.

This plan details the following:

- Activity Monitoring of the Pilbara Leaf-nosed bat at Warrawoona (Section 2)
- Activity Monitoring of the Ghost bat at Warrawoona (Section 2)
- Microclimate Monitoring of Bow Bells and Klondyke Queen Roost (Section 3)
- Groundwater level monitoring at the Bow Bells roost (Section 4)
- Structure monitoring of the Klondyke Queen Roost (Section 5)
- Noise and Vibration Monitoring (Section 6)
- Determination of baseline arsenic levels in the local populations of Ghost bat and Pilbara leaf-nosed bat (Section 7)
- Early warning trigger levels, and corrective actions to prevent impacts to the Pilbara leaf-nosed bat and Ghost bat from microhabitat change at Bow Bells Roost (Section 8)
- Adaptive management strategies to prevent disturbance to the Pilbara leaf-nosed bat and Ghost bat from blasting and mining activities (Section 9)
- The criteria which, if met, require Calidus to construct and commission an artificial roost to provide alternative roosting habitat for the Pilbara leaf-nosed bat and Ghost bat (Section 10)
- A summary of the proposed Triggers and Action Plan (Appendix 1)

2 Activity Monitoring of the Pilbara Leaf-nosed bat and Ghost bat at Warrawoona

The Ghost bat and the Pilbara leaf-nosed bat have been detected at a number of sites at Warrawoona since the middle of the twentieth century. Recent surveys and monitoring have shown that both species have permanent but variable colonies present (Biologic 2019a). The two primary roost sites are the Klondyke Queen and the Bow Bells South historical mines, and a third significant foraging area is the nearby Copenhagen open cut. Surveillance and monitoring of both species have been underway in a systematic manner since 2017 and continuous monitoring since November 2019 at the three sites. In addition, surveying conducted in 2017 and 2018 indicated that there are a number of other significant sites for these two species, including the nearby historic Comet Mine (Table 2.5.1).

The monitoring program includes:

- Pre-mining baseline data collected in a continuous manner at Klondyke Queen, Bow Bells South and Copenhagen historical mines based on echolocation call levels, underway since November 2019.
- Pre-mining baseline data collection in a systematic manner at a series of sites within the management area and at two regional control sites based on echolocation call levels, underway since 2017.
- Ongoing continuous monitoring of Pilbara leaf-nosed and Ghost bat population levels during and after the cessation of mining in the Klondyke Open Pit; and
- Review of trends in species population levels in a near real-time manner.

2.1 Baseline data collection

Baseline surveillance began in 2017 followed by monitoring that began in November 2019 with the installation of permanent bat echolocation call detectors. The monitoring includes the nightly recording of Pilbara leaf-nosed bat and Ghost bat activity at the entrances to the Klondyke Queen and Bow Bells South main adits where the presence of permanent diurnal roosts have been confirmed.

These data sets, up until the commencement of mining, form the basis against which future call variations will be compared. Continuous recording of activity at the Bow Bells shaft entrance was added in September 2020. Continuous monitoring of Pilbara leaf-nosed bat activity at the eastern most corner of the Copenhagen flooded pit also began in November 2019. All four locations have also been periodically surveyed for the bat species activity between 2017 and 2019.

An example of a call count run chart from the Bow Bells South adit is given in figure 2.1.1 showing all data collected during 2020.

The call activity data (to be routinely collected quarterly) is used to prepare and update control charts for the four sites. These charts will present for each site and for each species the ongoing monthly mean (average) and standard distribution (SD) of the call numbers. These values are plotted on typical statistical process “control chart” (Schonberger 1986, pp130-131) against time (see figure 2.3.1 below). The total pre-mining baseline long-term data set for each site is then averaged and Upper and Lower Control Limits (UCL/LCL) calculated and trigger and threshold

values set. Condition 8 of the EPBC Conditions of Approval requires Calidus to update this APMSB with LCL's and UCL's prior to the commencement of mining. Section 8 shows the LCL's and UCL's for PLNb's at Bow Bells and PGb's at Klondyke Queen.

For each site, the average of each month during the pre-mining baseline period (November 2019 – May 2021) will then be compared to the sites UCL and LCL trigger values, see sect. 2.2 below. For survey events that exceeded the trigger values, further interrogation of the call data will be undertaken to understand what may have caused the variation. These assessments shall be ongoing and be assessed quarterly.

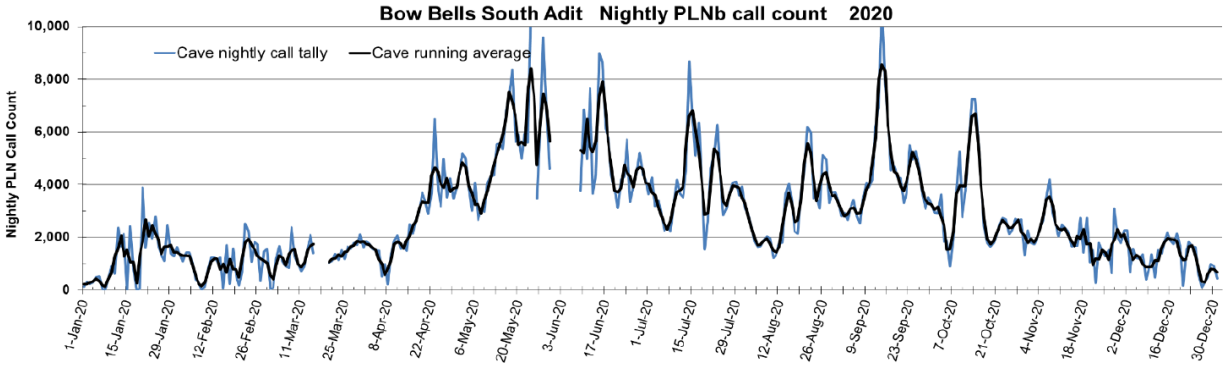


Figure 2.1.1: Example echolocation call run chart (updated for full 2020).

2.2 Natural Fluctuations

Between 2017 and 2021, accurate censuses of the Warrawoona population of Ghost bats has shown the colony to vary naturally between be 0 and 475 in those years. The most recent census in May 2021, recorded no PGb's leaving the Klondyke Queen over two successive nights of manual observation and the roost is currently considered to be abandoned.

The reduction in PGb's since monitoring commenced is thought to be attributable to:

- a high level of rainfall during the 2020/21 wet season after successive prior years of lower than average rainfall (Figure 2.2.2), improving foraging areas elsewhere leading to dispersal throughout the region. GPS and VHF tracking studies have shown that both bat species do not forage at Warrawoona, travelling to areas to the north and south of the Project site;
- a large bush fire that occurred during 2020 removing some local foraging areas; and
- natural predation which possibly compounded an already declining population due to the previously mentioned factors.

Run chart data collected (Figure 2.2.1) shows a declining population during all of 2020. Numbers have steadily decreased since baseline monitoring began in November 2019.

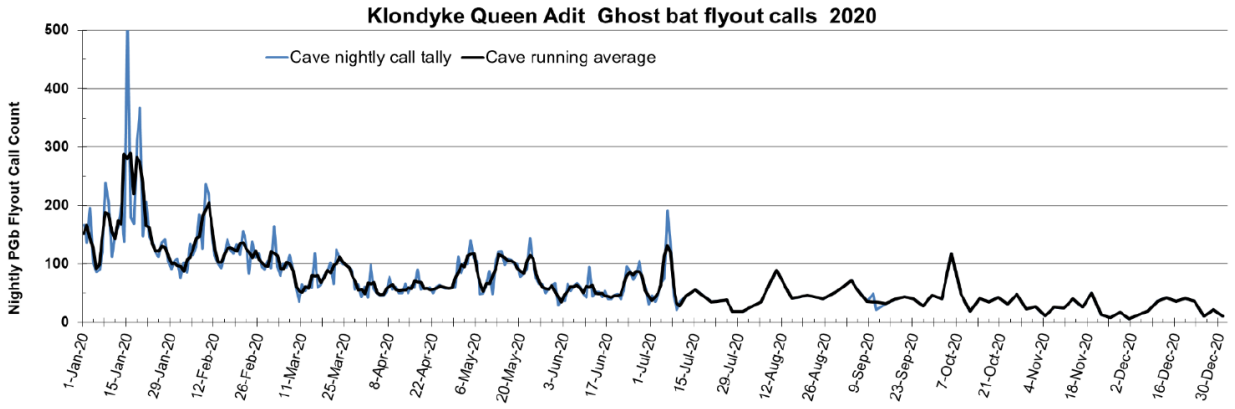


Figure 2.2.1: Echolocation call run chart for PGb at Klondyke Queen during 2020

Published data at Klondyke Queen and the Comet historic mine (permanent PGb roost located 20km from Klondyke Queen) both show significant variation of the colony sizes. Both sites show smaller colonies of approximately 50 – 100 throughout the 1980's and early 1990's (Figure 2.2.2). In subsequent years both colonies grew significantly. The Klondyke Queen peaked at a minimum of 475 individuals in early 2019 and has since reduced. Alternatively the colony at the Comet mine has steadily increased in the same period peaking at over 275 in May 2021.

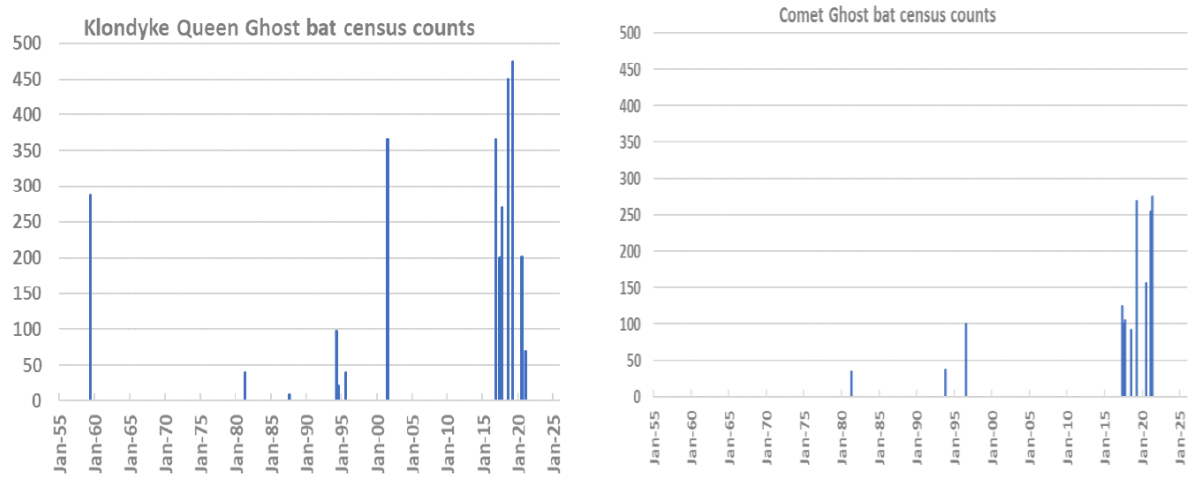


Figure 2.2.2: Reliable PGb census data for the Klondyke Queen and Comet historical mines

The above factors are thought to have not contributed to dispersal of the PLNb's at Bow Bells due to PLNb's not having the flight range of PGb's, and the presence of ground water in the Bow Bells workings creating humid conditions that PLNb's rely on due to their smaller body weight. There are only two known historic workings in the Warrawoona mining area which intersect the ground water table – Bow Bells and Klondyke Queen. PLNb's have not favoured Klondyke Queen due to predation threat from PGb's, and recent echolocation data shows minimal PLNb's utilising Klondyke Queen in the months up until May 2021, when PGb's have abandoned the roost. The most recent SM4 data (May 2021) shows PLNb counts increasing (Figure 8.1.3)

Predation from other species such as Pilbara Olive Python's (seen on IR lit camera inside the Klondyke Queen roost) and feral cats (also sighted) could also impact the population, particularly at Klondyke Queen which has a single 2m x 2m horizontal opening (adit) into the historic mine workings where the roost is located with no other entry/exit points available. At Bow Bells, a vertical

shaft allows the Pilbara-leaf nose bat's to enter/exit the roost area without the same risk of predation.

Due to the known pattern of movement of Pilbara Ghost bats (author's unpublished data), natural variations beyond these levels can be expected in future years.

Short term natural variation in these numbers can also be expected to occur. The bats are known to not leave the roost during periods of thunderstorms (lightning). There is evidence that bush fires have occurred in the areas around Klondyke Queen and Bow Bells, and although data has not been collected for these events, it would also be likely that the bats would not leave the roosts.

Holistic environmental conditions such as repeated years of lower rainfall (Figure 2.2.2) or the migration of cane toads that are lethal to Ghost bats could also threaten the species. An EPCA Compliance report filed by WA Main Roads (EPBC 2017/7880) for the Marble Bar Road Coongan Gorge realignment west of Marble Bar quotes the potential for Cane Toad impact on Northern Quoll (Main Roads, 2019) and a Cane toad has been previously found at Pilbara Mine site, although was thought to be transported to site (DBCA, 2015)

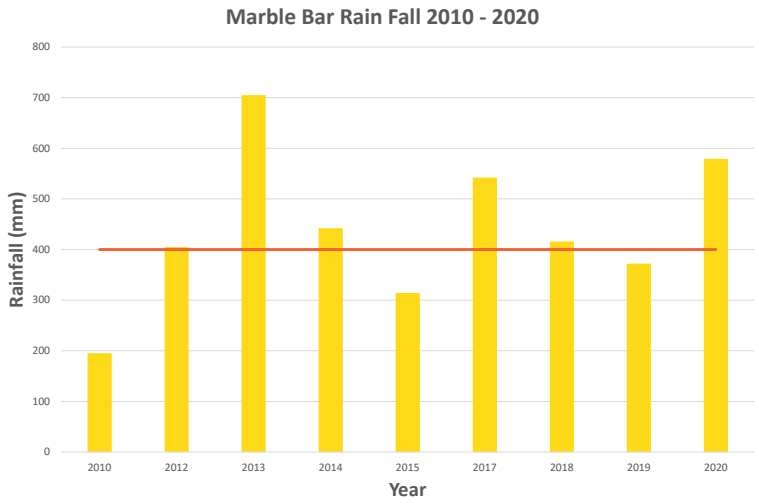


Figure 2.2.2: Marble Bar historic rainfall showing several years drought followed by wet 2020/21

2.3 Activity monitoring at the roosts

Continuous activity monitoring of the Pilbara leaf-nosed bat at the two roost locations began in November 2019 and this will continue throughout the life of the project and for 5 years after cessation of mining in Klondyke Open Pit.

Bow Bells South has been shown to be the permanent diurnal and maternal roost for the Pilbara leaf-nosed bat and an occasional diurnal roost for the Ghost bat (Biologic 2019a). At this site the monitoring incorporates continuous echolocation call detection and periodic Infra-red lit video census of the number of bats present at the roost. Both methods are carried out at the adit portal and the shaft entrance above.

Klondyke Queen has been shown to be the permanent diurnal and maternal roost for the Ghost bat and occasional diurnal roost for the Pilbara leaf-nosed bat (Biologic 2019a). At this site the monitoring incorporates continuous echolocation call detection and periodic manual and Infra-red lit video census of the number of bats present at the roost. Echolocation call activity is monitored at the adit portal and census counts, are carried at the adit portal and the stope entrance above.

Once mining has commenced, call numbers for each site will be compared to trigger values based on the elapsed number of contiguous nights that the call counts are below the long-term LCL. Relevant management response suggested by incursions below these levels is provided in Appendix 1. During significant mining events that may directly impact the roosts, such as nearby blasting or the initial release into the tailings dam, real-time monitoring of the data will be undertaken to ensure that timely implication of management responses is applied should a steep reduction in activity levels be indicated by the data indicating population decrease.

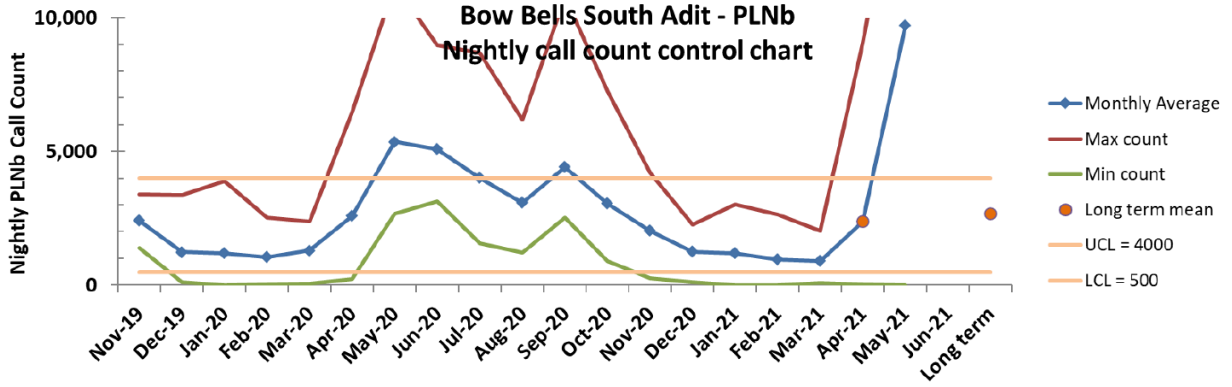
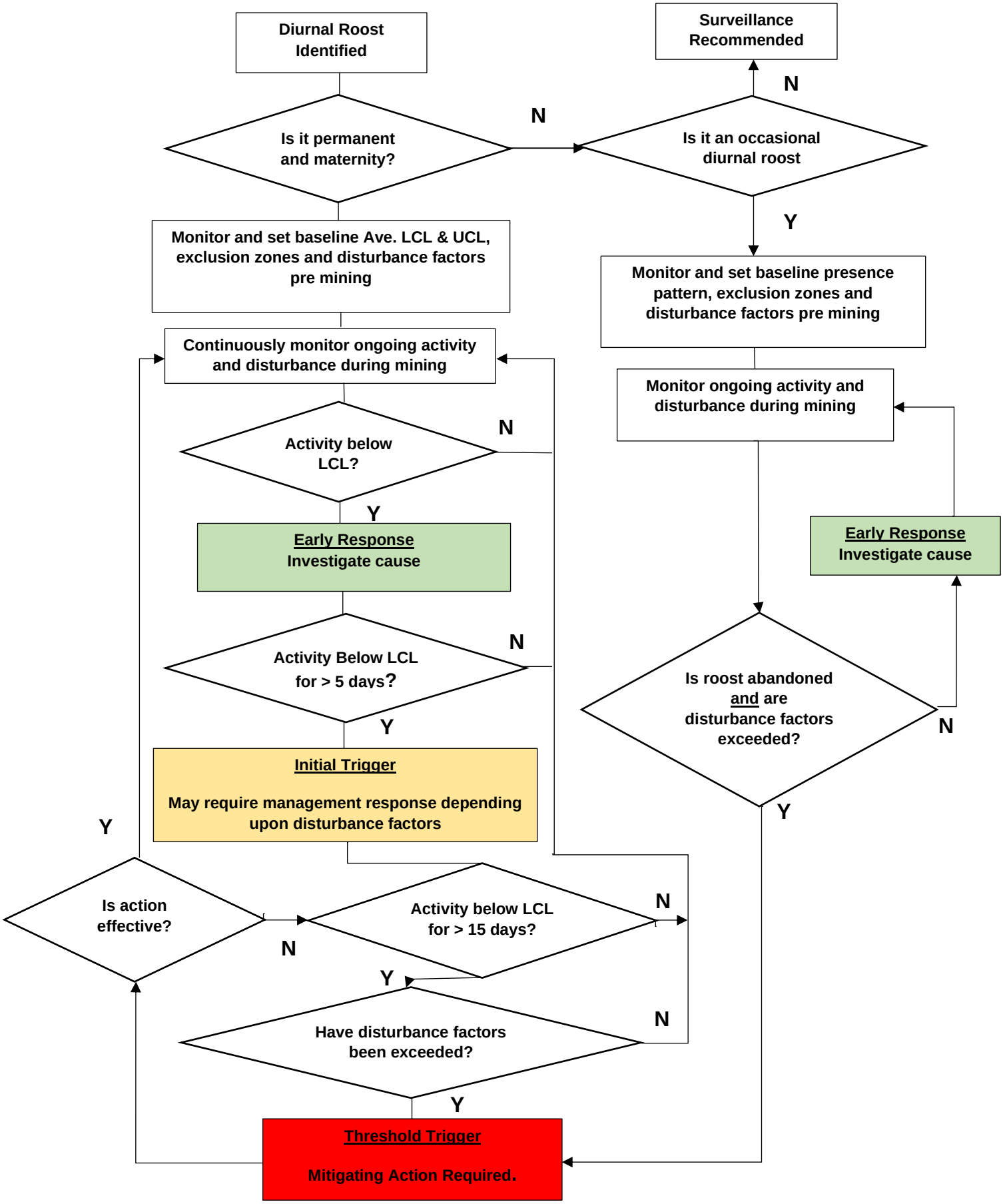


Figure 2.3.1: Example echolocation call control chart (updated)

Figure 2.3.2 maps the significant bat management process from roost identification to mitigation and management post major reduction in presence and activity. The permanent/maternity roost applies to the Ghost bats at Klondyke Queen and the Pilbara leaf-nosed bat at Bow Bells South. The occasional diurnal roost applies to the Ghost bat at Bow Bells South and the Pilbara leaf-nosed bat at the Klondyke Queen.

Figure 2.3.2 Bat roost activity monitoring flowchart



2.4 Activity monitoring at additional control sites

Baseline surveillance of Pilbara leaf-nosed bat and Ghost activity at eleven additional sites within the management area and at two regional control sites began in 2017. This includes periodic recording of Pilbara leaf-nosed bat and Ghost bat activity using echolocation call detectors at the entrances to the adit/shaft of each site. Five of these sites have been closed to facilitate mining operations. The assessments at the remaining eight shall continue annually.

2.5 Summary of activity Monitoring

Table 2.5.1. Summary of bat activity monitoring actions.

Site	Continuous PLNb Echolocation call monitoring	Continuous PGb Echolocation call monitoring	Annual PLNb and PGb manual or video census	Annual PLNb and PGb call surveillance	PLNb and PGb call surveillance during significant mining operations	PLNb and PGb call surveillance prior to closure
Klondyke Queen Adit	Yes	Yes	Yes		Yes	
Klondyke Queen shaft			Yes		Yes	
Bow Bells South adit and shaft entrances	Yes	Yes	Yes			
Copenhagen open pit	Yes					
Britannia				Yes, pre-closure		Yes
Bow Bells Block 1				Yes		
Criterion				Yes		
Cuban shaft				Yes, pre-closure		Yes
Dawson City				Yes		
Gift shaft				Yes		
Klondyke Boulder				Yes		
Klondyke Queen 488				Yes, pre-closure		Yes
Kopckes Reward				Yes, pre-closure		Yes

Site	Continuous PLNb Echolocation call monitoring	Continuous PGb Echolocation call monitoring	Annual PLNb and PGb manual or video census	Annual PLNb and PGb call surveillance	PLNb and PGb call surveillance during significant mining operations	PLNb and PGb call surveillance prior to closure
Mullins adit				Yes		
St George 3				Yes, pre-closure		Yes
Comet – regional control site			Yes	Yes		
Trump – regional control site				Yes		

3 Microclimate Monitoring of Bow Bells and Klondyke Queen Roost

The microclimates within both Klondyke Queen and Bow Bells South are dominated by the depth of the respective adit/shaft complexes, by the presence and depth of ground water in the lower levels and by the ambient rainfall received at Warrawoona. At both sites the adit/shaft complexes are too deep to safely enter and place hygrometer data loggers within the roost cavities. Therefore, the internal temperatures and humidity levels are assessed by placing the data loggers as deep as is safely possible into the adits. The data loggers at these locations continuously record temperature and humidity for comparison with ambient conditions.

Microclimate monitoring in the adits of both Klondyke Queen and Bow Bells South began in January 2020 when data loggers were placed in the mid-adits of both sites. These were positioned approximately 15 m inside each adit. These locations were moved in July 2020 to a site approximately 50 m into the Klondyke Queen adit and into the Bow Bells South shaft approximately 15 m below the adit level. These locations were moved again in January 2021 to sites as deep as practicable within both mines where safe and systematic access to the data loggers is possible. At both sites this was achieved by lowering the data loggers into the depths of the shafts (inner most at Klondyke Queen) from a safe location on the surface above.

An example of continuously recorded microclimate data collected between July and December 2020 in the Bow Bells shaft is presented in Figure 3.1

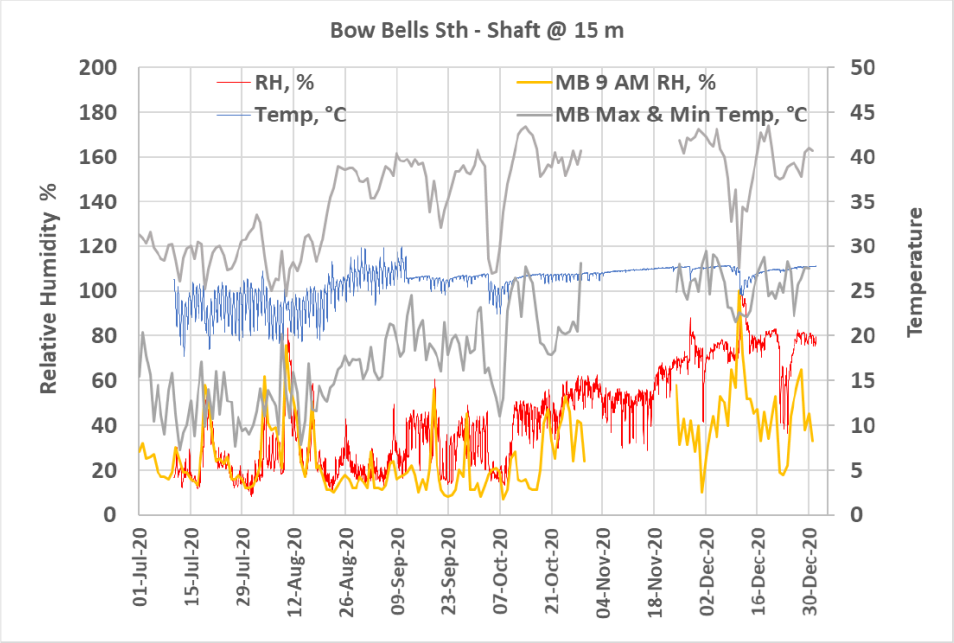


Figure 3.1: Temperature and relative humidity recorded in the Bow Bells South shaft at a depth of 15 m below the adit intersection. MB denotes data from the Marble Bar Bureau of Meteorology station 4106.

The recordings at both sites will be periodically downloaded and assessed for the stability of the respective microclimates. These assessments shall be quarterly.

In addition to the above, the respective ground water levels will be measured quarterly; see Section 4 below. If the fluctuations in ground water suggest a possible drying of the lower levels may be taking place, e.g. as a result of dewatering or an extended low rainfall period, then more frequent surveillance of the microclimate data shall be undertaken.

4 Groundwater level monitoring at the Bow Bells roost

Results of numerical hydrogeological modelling has indicated that the maximum water table drawdown at Bow Bells South roost will be one to two meters if at all, and that underground workings will still have a significant saturated thickness. The earliest Bow Bells would be affected is four years from the commencement of mining at the Klondyke Pit. The model is also conservative in regard to recharge as it does not allow for large recharge events such as tropical cyclones which cross the Pilbara coast. Based on the conservatism built into the numerical model, it is considered unlikely that any drawdown will occur at Bow Bells South within the project life (GRM 2019).

To monitor this during operations, Calidus will install two regional groundwater monitoring bores between the Klondyke Pit and the Bow Bells workings to monitor long-term groundwater trends, any drawdown impacts from Klondyke dewatering and regional water supply. Water level and quality at this bore will be measured quarterly. These data together with data from the other monitoring bores will be used to annually recalibrate the ground water drawdown model, revise the projected cone of depression and its proximity to Bow Bells.

Should the monitoring data and the recalibrated model indicate that groundwater levels in the Bow Bells South workings are likely to be impacted at any time by mine dewatering to the extent that

water levels are at risk of falling below the base of the mine workings, Calidus will commission a programme of works to install a nearby groundwater supply with associated pipework infrastructure to provide a small, permanent makeup flow to the Bow Bells South workings to maintain internal humidity levels for the remaining life of the project. The optimum rate of flow to the workings will be determined from an eco-hydrogeological study which would be undertaken by Calidus.

The actual depth of the shaft(s) at Bow Bells South that contains the bat's roost is unknown but is believed to extend a significant depth below the current water table. The water table level in the monitoring bore, together with the humidity measurements made in the shaft will directly inform the continued presence of ground water within the lower levels of the mine.

5 Structure monitoring of the Klondyke Queen Roost

A 200 m buffer has been provided at the western end of the open pit nearest Klondyke Queen and the in-ground vibration level during blasting and other construction activities has been set at 10 mms^{-1} peak particle velocity (PPV). Blast designs are committed to comply with the 10 mms^{-1} limit unless further field work is conducted to establish site blast vibration constants and higher safe PPV limits. An assessment of blasting impacts to the habitats and a subsequent geotechnical review endorse that these parameters are unlikely to compromise the integrity of the workings (CRL-ENV-PRO-017-19). A seed drill and blast program may be carried out prior to full scale production blasting to evaluate actual site blast vibration attenuation constants.

Due to the prohibition of entry into the adit, prior to the commencement of blasting, a visual assessment and a comprehensive photographic record of the adit, stope and shaft entrances shall be made and the areas within the entrances that are visible. As production blasting approaches the western end of the pit, and/or as in-ground vibration levels begin to approach the maximum limit, following each blast event within 500m a visual assessment shall be made by a suitable qualified officer (nominally the Quarry Manager or Alternate Quarry Manager) at the various entrances to ensure that no evidence of significant rockfall, additional cracking or movement of the strata is evident.

6 Noise and Vibration Monitoring

A permanent blast monitoring station has been established (CRL-ENV-PRO-017-19) at close proximity to the Klondyke Queen adit (within 10m) to ensure that data collected are relevant to the internal bat roost habitat. The monitor must record both dB A (maintaining a 70 dB A limit) within the Klondyke Queen adit and ground vibration for all blasts within 1,000 m of the Klondyke Queen. The resultant data from the initial blasting program plus blast parameters shall be used to develop site prediction equations for in-ground vibration transmission and sound propagation. Initial site blasting should commence a minimum of 1,000 m from both the Accommodation Village and the bat roosting habitat, until the site prediction equations are established with a high level of confidence.

7 Determination of baseline arsenic levels

The Copenhagen pit lake when sampled in March 2019 recorded arsenic levels of 0.56-0.58 mg/L. The continuous SM4 data from the Copenhagen pit lake (since November 2019) indicates that Pilbara leaf-nosed bat activity is fairly constant at low levels. Echolocation call surveillance and two VHF tracking studies conducted at Warrawoona found that the Copenhagen pit lake vicinity is visited by a small proportion of the Pilbara-Leaf nosed bat colony (Biologic, 2019a, 2019b, 2019c),

with consistently low numbers of ultrasonic calls recorded at the site. Ghost bats have not been observed at the pit lake and have not been recorded during the echolocation or VHF studies but are believed to occasionally forage there (Bob Bullen pers com). Observations in July 2020 confirmed that bats (species unable to be determined) do drink from the pit lake, given the pits low salinity measured as 493ppm in 2019. Unfortunately, there is no data on the lethal dose or the potential accumulation of arsenic in the two listed species.

The only conclusions that can be drawn currently are that the levels of arsenic within the Copenhagen pit lake (30 years post closure) do not appear to be impacting the Warrawoona populations of Ghost and Pilbara leaf-nosed bat, in the form of acute poisoning. Early records of Pilbara Leaf-nosed Bat at Klondyke predate the Copenhagen pit with the species being present in numbers in 1981 (the first Pilbara Leaf-nosed Bat record at Klondyke), 1992, 1994 and 1995 (Biologic 2019a). The Ghost Bat was first confirmed at Klondyke Queen in 1957 and since this time the species' presence at Klondyke has been confirmed consistently in fluctuating numbers (Biologic 2019a).

For mammals, the lethal dose of arsenic varies from approximately 15 mg/kg taken orally to a low of 0.6 mg/kg/day of inorganic arsenic and lower for long term cancer risk. The Klondyke pit lake is expected to reach salinity levels that exceed that tolerated by bats within 3 to 4 years of mine closure. Before this salinity is reached using the conservative measure of Copenhagen Arsenic at 30 years post closure (0.56-0.58mg/L) in the Klondyke pit for acute poisoning to occur, a Ghost Bat would have to drink approximately 75ug of arsenic each day, which represents the approximate weight of a Ghost Bat (130 g) in water from the Copenhagen pit lake. It is thought that Ghost Bats drink less than that from an open pool during their nightly foraging activities (Bob Bullen pers com 7 October 2019)

Considering the listed status of Ghost and Pilbara leaf-nosed bats as Vulnerable, Calidus has committed to determining the baseline arsenic levels in the population prior to any formation of a pit lake at Klondyke Queen post mining. This commitment includes research into and selection of a suitable, non-invasive monitoring technique, possibly using bat hair samples or other acceptable tissue. Calidus will advise AWE of the final technique to be used, with a trial completed in early 2021.

The trial involved taking hair samples from the backs of four Ghost bats at the Klondyke Queen mine in January and February 2021. For comparison, fur from six Ghost bats collected in 2016 from sites in the Hamersley Range were also analysed. Due to the size of the PLNb, collection of hair samples was not possible and animal ethic precluded collection of samples of other tissues. As a surrogate for the PLNb that forage on similar prey and roost in similar underground structures, wing membrane punches were taken from a total of nine individuals of two common and unlisted obligate cave roosting insectivores. These were the Common sheath-tailed bat (*Taphozous hilli*) and Finlayson's cave bat (*Vespadelus finlaysoni*). Specimens of both were collected from the Bow Bells historic mine in January 2021 using 3 mm biopsy punches. All trapping, handling and release of bats was carried out under DBCA licenses.

The arsenic levels detected in each sample are presented in Table 7.1. As there are no known arsenic levels for bats, annual testing will be carried out to understand the baseline trend throughout the operating mine life to ensure the results are statistically significant. Samples will be taken from additional control sites closer to Warrawoona such as Comet.

The arsenic levels detected in the two Ghost bat samples showed great variability. The Hamersley Range samples at 0.81 mg/kg were low and within the background level whereas the Warrawoona samples were high at 17 mg/kg. This variation in the species is believed to reflect the concentration

of the natural background arsenic levels from the two widely varying regions of the Pilbara. The Hamersley Range ironstones typically have low arsenic levels whereas the ground water samples around Warrawoona all contain background levels of Arsenic which is naturally occurring and meets stock water limits. Further, arsenic in ground water of the historic mine workings may remain at trace levels in the fur of those Ghost Bat's sampled at Klondyke Queen.

Table 7.1 Arsenic levels measured from various baseline samples

Report	Sample	Description	Result – mg/kg
20S3074 RO	#1 dated Dec 2020	Dog hair	0.08
20S3074 RO	#2 dated Jan 2021	Insectivorous bat combined species wing membrane punches from Warrawoona.	4.1
20S3074 RO	#3 dated May 2016	Ghost Bat fur from Hamersley Range	0.81
20S3412 RO	#1 dated Feb 2021	Dog hair control sample	0.04
20S3412 RO	#2 dated Jan 2021	Ghost Bat fur from Warrawoona Klondyke Queen	17.0

These assessments shall continue for 5 years post closure or until it can be demonstrated that the bats are not drinking the pit lake water the pit lake is back filled or other methods of arsenic mitigation are used (Calidus will advise AWE).

8 Early Warning Trigger Levels and Actions

Proposed Performance objectives, targets and management actions for this plan are summarised in Appendix 1.

Proposed LCL's and UCL's are as per the following tables and run charts as explained in Section 2.1. These are based on pre-mining baseline monitoring echolocation calls from November 2019 to May 2021.

As discussed in Section 2.2, due to the observed natural reduction of Ghost Bats at Klondyke Queen since monitoring began in November 2019, LCL's have been set at 0. Other management actions are focussed on preservation of the roost – blast vibration limits, minimum 200m buffer from mining areas within the 32ha mining exclusion zone, such that when the roost is required by the Colony, it remains in a favourable condition.

8.1 Pilbara Leaf Nose Bats

Table 8.1.1 Pilbara Leaf Nose Bat's UCL's and LCL's

Site	Mean call count	UCL	LCL
Bow Bells South Adit	2,350	4,000	500
Bow Bells South Shaft	1,450	2,750	100
Klondyke Queen Adit	100	200	0
Copenhagen	85	180	10
Colony – KQ adit and BBSth adit and shaft	3,900	6,950	600

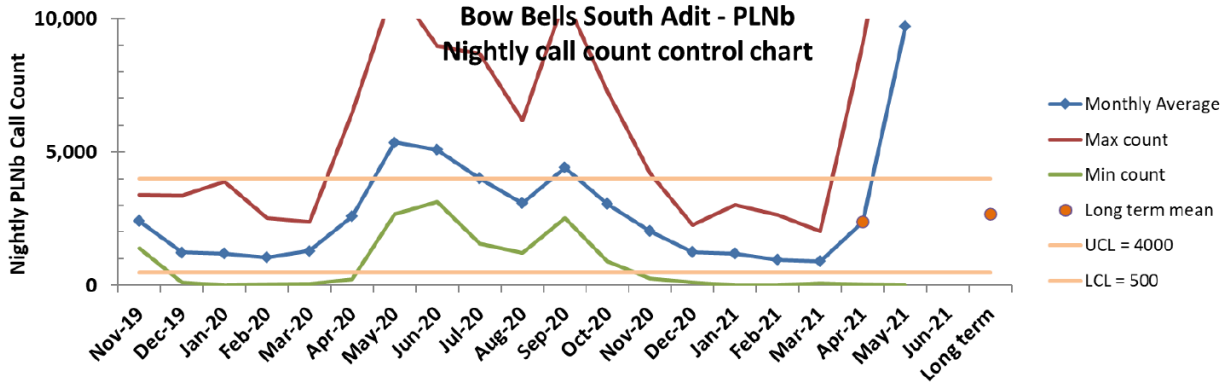


Figure 8.1.1 PLNb Bow Bells Adit echolocation call control chart

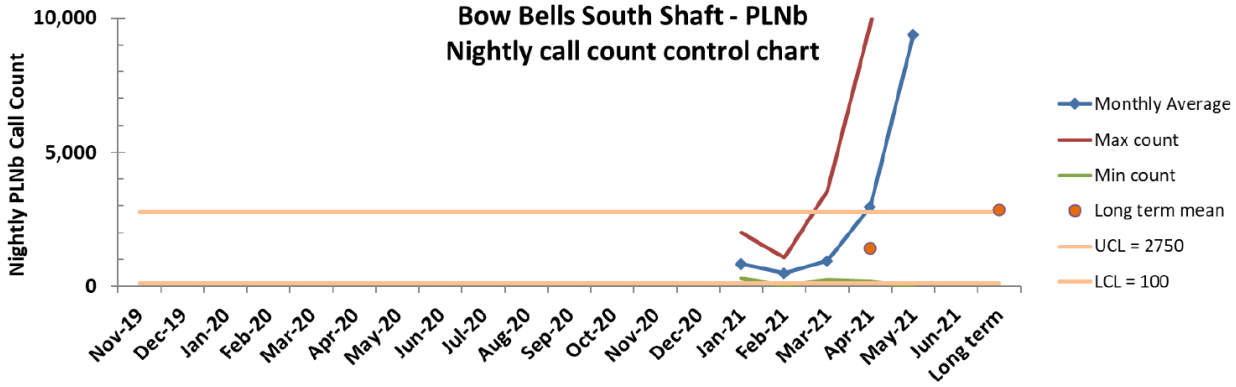


Figure 8.1.2 PLNb Bow Bells Shaft echolocation call control chart

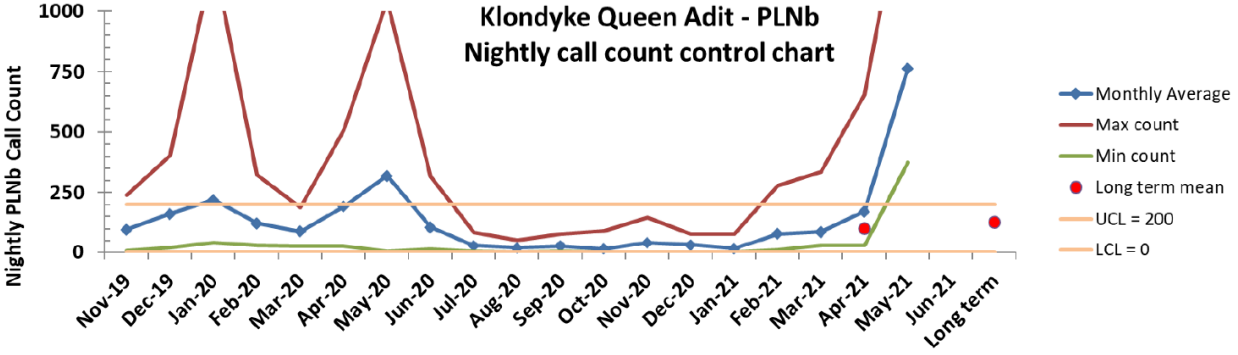


Figure 8.1.3 PLNb Klondyke Queen echolocation call control chart

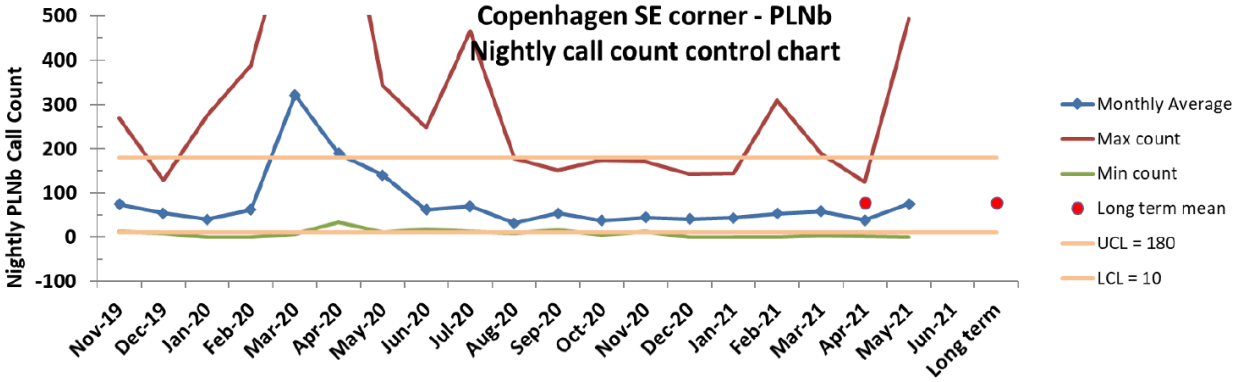


Figure 8.1.4 PLNb Copenhagen echolocation call control chart

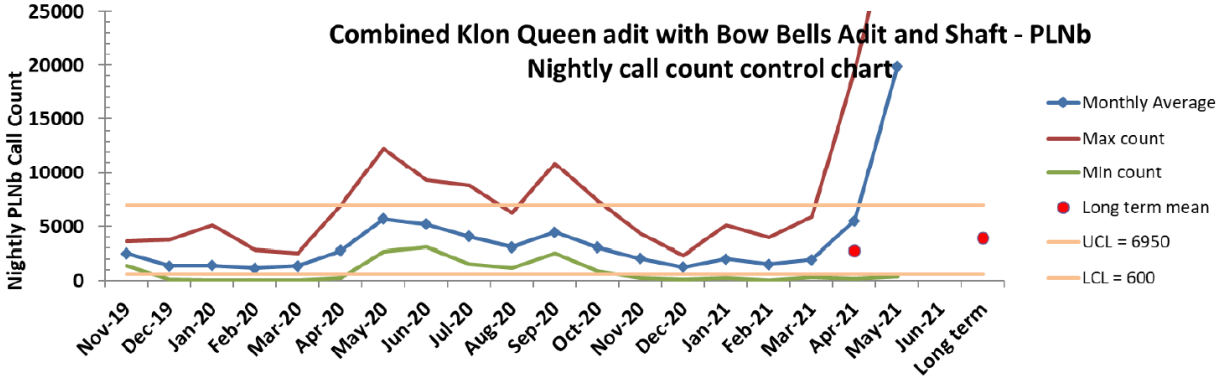


Figure 8.1.5 PLNb Combined KQ with Bow Bells Adit and Shaft echolocation call control chart

8.2 Pilbara Ghost Bats

Table 8.2.1 Ghost Bat UCL's and LCL's

Site	Mean flyout call count	UCL	LCL
Klondyke Queen Adit	80	145	0
Bow Bells South Adit	12	25	0
Bow Bells South Shaft	5	10	0
Colony – KQ adit and BBSth adit and shaft	100	180	0

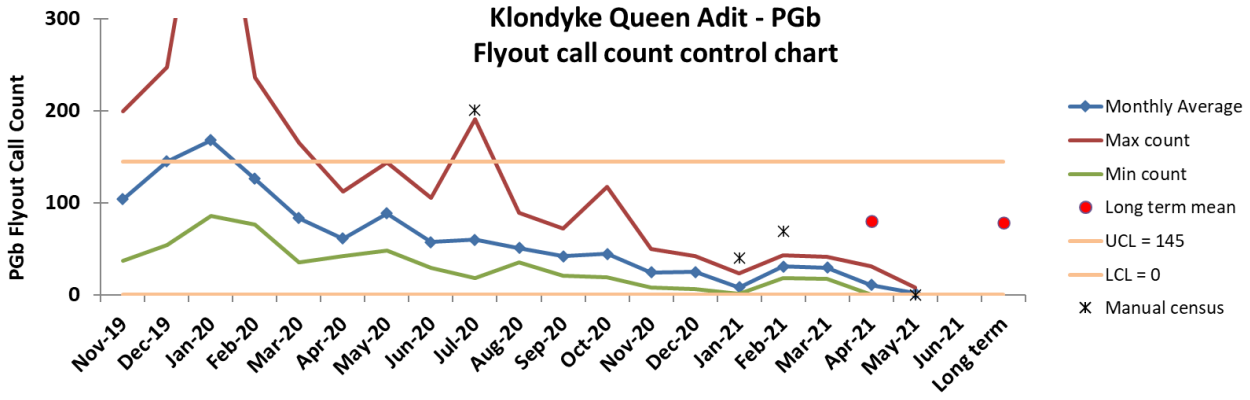


Figure 8.2.1 PGb Klondyke Queen echolocation call control chart

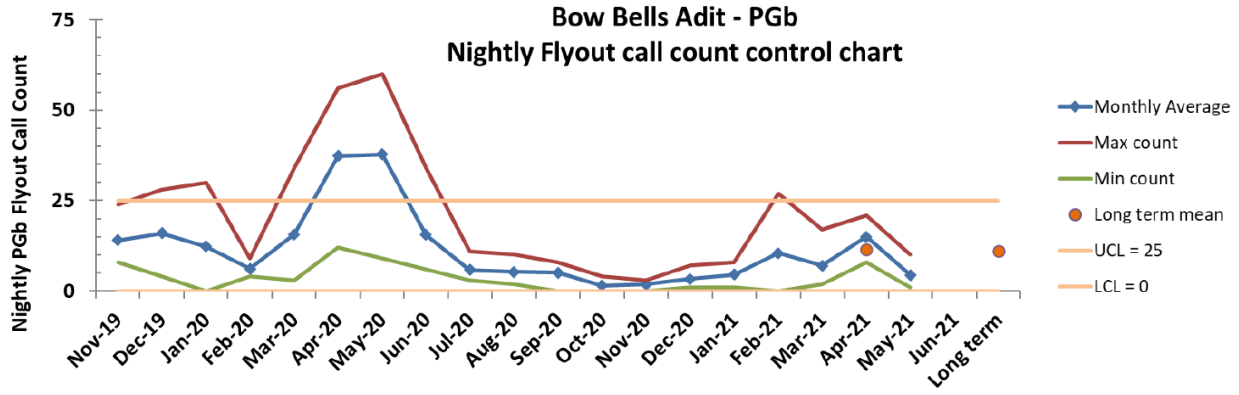


Figure 8.2.2 PGb Bow Bells Adit echolocation call control chart

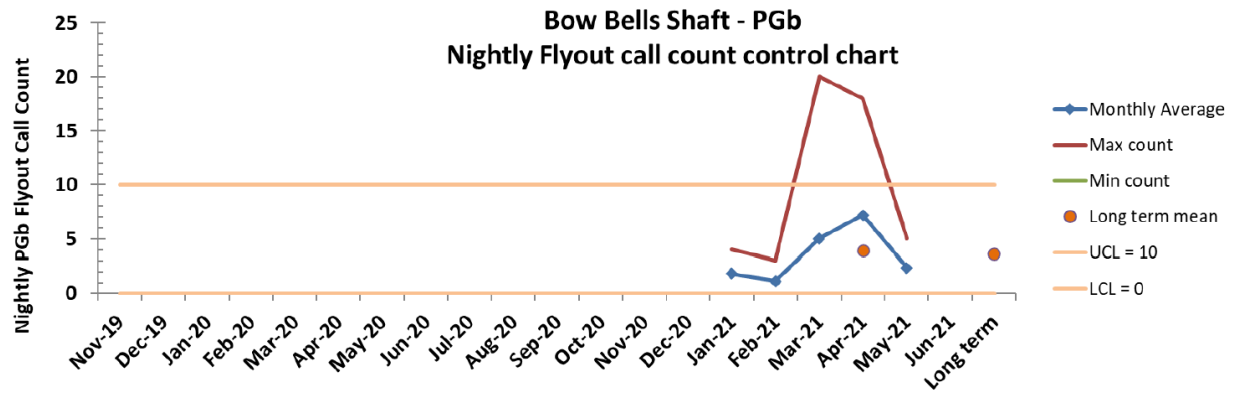


Figure 8.2.3 PGb Bow Bells Shaft echolocation call control chart

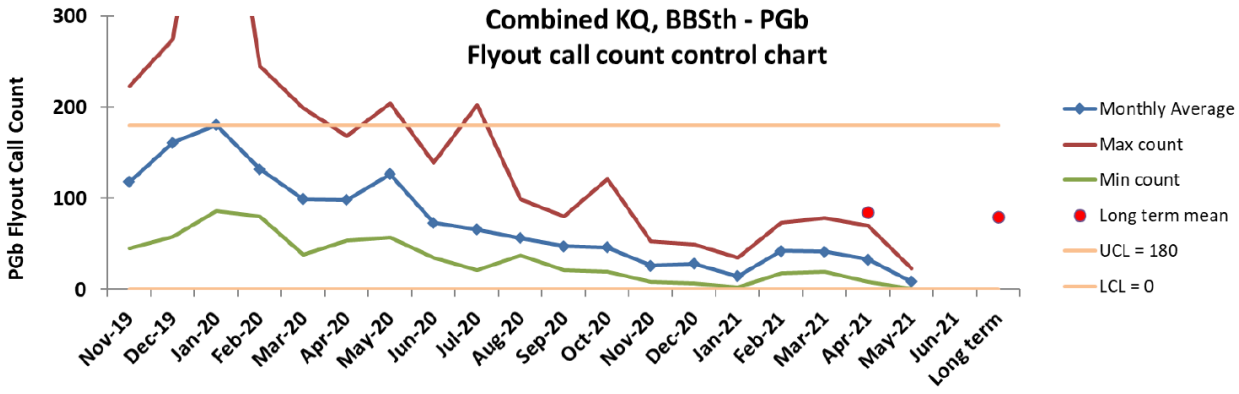


Figure 8.2.4 PGb Combined KQ with Bow Bells Adit and Shaft echolocation call control chart

9 Adaptive management Strategies.

Management measures are detailed in section 8 of the Significant Species Management Plan (CRL-ENV-PLN-006-19). Standard management measures are listed in section 8.1 and measures applicable to the bat species are listed in section 8.2.2. During the life of the mining operations, these measures will be updated as required based on the ongoing monitoring of the health of the bat colonies using an adaptive management procedure based on a four-step process, summarised as “Plan, Do, Check and React”. Activities will begin with the planning and implementation of the measures with feedback based on the “check” step (i.e., the various monitoring programmes) followed by modification of management measures as required, the “react” step.

10 Contingency – Artificial Roost

Calidus will submit a design for an Artificial Pilbara Leaf-nosed bat roost to the Department of Agriculture, Water and the Environment (AWE) for approval within two years of the commencement of mining. As per Section 4, the earliest Bow Bells will be impacted, if at all, is 4 years from the commencement of mining. The two-year time frame allows Calidus to investigate potential sites, complete geotechnical and hydrological studies and apply for Western Australian statutory approvals required for mining. During this period the hydrogeological model will be updated annually to take account of bore monitoring and seasonal recharge events (wet season summer 2021 and 2022).

11 Definitions

Term	Definition
Adit	A horizontal man-made tunnel extending underground from an entrance portal
Census	The accurate measurement of the minimum number of bats diurnally roosting at a site
Colony	The assemblage of bats of a single species that occur at Warrawoona and diurnally roost within the sites available
Diurnal	Of or during the day
Early Response (trigger)	An arising that necessitates an investigation of its cause
Initial Trigger	An arising that may require management response depending upon disturbance factors
Lower Control Limit (LCL)	Lowest nightly bat call total that suggests a departure from long term normal colony activity variation.
Roost	The underground area where bats remain during daylight hours
Shaft	A man-made mine that extends vertically to extract ore
Site	Mine or cave where bats roost diurnally and/or nocturnally
Stope	Open voids formed by extracting ore from an underground mine
Threshold trigger	An arising that may require mitigating management action
Upper Control Limit (UCL)	Highest nightly bat call total that suggests a departure from long term normal colony activity variation.
Quarry Manager	Statutory appointed position required under WA Mines Safety and Inspection Act administered by DMIRS (WA)

12 Related Documentation

CRL-ENV-PLN-006-19. Significant Species Management Plan. Rev 3.3 dated September 2020

CRL-ENV-PLN-017-19. Environmental Blast Management Procedure. Rev 2 dated September 2019

CRL-ENV-PLN-021-19. Groundwater Monitoring Procedure. Rev 2 dated September 2019

CRL-ENV-PRO-022-1919. Metalliferous Drainage Management Procedure Rev 2 dated October 2019

13 References

Biologic (2019a). Warrawoona Gold Project: Conservation significant bat species impact assessment. Unpublished report for Calidus Resources Ltd, rev 1 dated September 2019.

Biologic (2019b). Warrawoona Gold Project: VHF bat foraging studies. Unpublished report for Calidus Resources Ltd, rev 2 dated May 2019.

Biologic (2019c). Warrawoona Gold Project: 2019 VHF bat foraging studies. Unpublished report for Calidus Resources Ltd, rev 2 dated September 2019.

Biologic (in prep). Warrawoona targeted bat assessment – July 2020. Unpublished draft report for Calidus Resources Ltd in preparation.

DBCA (2015). Cane toad found at Pilbara mine Site. https://www.dpaw.wa.gov.au/news/item/1386-cane-toad-found-at-pilbara-mine-site

GRM (2019). Groundwater Resource Management, Hydrogeological Investigations 2019 Warrawoona Gold Project. Unpublished report for Calidus Resources Ltd J1827R03 dated July 2019.

Main Roads Western Australia (2019). EPBC 2017/7880 Annual Compliance Report. Marble Bar Road Coongan Gorge Realignment and MO30 Material Pit Expansion: Pilbara Region WA. 16 October 2019

14 Appendix 1 – Warrawoona Triggers and Actions Table

Number	Trigger and threshold	Management Actions	Monitoring
Outcome: Minimise disturbance to Pilbara Leaf-nosed bats as a result of the project.			
Target: No abandonment of Bow Bells South roost by Pilbara Leaf-nosed bats as a result of the project. Activity: Dewatering			
1.	**Trigger Criteria**: <u>Humidity</u> Percentage humidity records at Bow Bells South workings are not to fall below the baseline average (***to be set prior to Klondyke Open pit dewatering activities commencing using baseline data collected up until that time***) <u>Groundwater Drawdown</u> Modelling indicates drawdown cone of depression is approaching the Bow Bells South workings (modelling indicates will not be impacted until Year 4 from commencement of dewatering, if at all) ***Monitoring bores to be installed between Klondyke Open Pit and Bow Bells South*** <u>Pilbara Leaf-nosed bat Activity</u> Bow Bells Pilbara Leaf-nosed bat Activity long-term Lower Control Limit (as per Table 8.1.1)	**Trigger level actions:** Scenario: Initial trigger is passed. Upon a decrease in humidity (***baseline average and standard deviation to be set prior to Klondyke Open pit dewatering activities commencing*****)** at Klondyke Queen, the Warrawoona Pilbara Leaf-nosed bat population is not acting as predicted by moving to Bow Bells South (***as determined from SM4 run charts with LCL***). **PILBARA LEAF-NOSED BAT THRESHOLD TRIGGER CONTINGENCY STRATEGY** **Phase 1A: Roost Investigation –** Could the Pilbara Leaf-nosed bat be roosting elsewhere to Bow Bells South? • Review of Pilbara Leaf-nosed bat activity data (SM4 data) to determine if there is a reduced bat activity response to the decrease in humidity. This review would occur within 7 days of the trigger event. • If no change to the Pilbara Leaf-nosed bat activity at Klondyke Queen and Bow Bells South keep monitoring but no further action. • If a decrease to the Pilbara Leaf-nosed bat activity at Klondyke Queen and an increase at Bow Bells South keep monitoring but no further action. • If annual regional survey and annual census show impact to population and is not a seasonal variation	Humidity levels in the Klondyke Queen and Bow Bells South workings (continuous monitoring via HOBO units) Permanent echolocation call detectors (continuous near real time monitoring via SM4 units) recording Pilbara Leaf-nosed Bat and Ghost Bat activity at Bow Bells South and Klondyke Queen. Interpretation by Calidus consultant Ecologist. Annual regional survey count conducted to confirm the entire colony is at Bow Bells South and Klondyke Queen and not roosting elsewhere. Annual Infra-Red manual count (census) to calibrate SM4 data Quarterly Groundwater standing water levels at Klondyke Queen shaft, monitoring bores at Klondyke and the workings at Bow Bells South (quarterly monitoring via manual dipping once dewatering has commenced) Ground water model recalibrated each year. Model does not take into account seasonal recharge from episodic events such as cyclones (Hydrogeological model)

Number	Trigger and threshold	Management Actions	Monitoring
		driven by climatic variation, then instigate Pilbara Leaf-nosed bat Contingency Strategy (Phase 2) **Phase 2:** If the Roost Investigation demonstrates the Pilbara Leaf-nosed bat are not roosting elsewhere, build Pilbara Leaf-nosed bat Artificial Roost. The Artificial Roost Construction would be completed within 6-12 months of the Trigger Event, assuming timely WA State Mining Approvals (DMIRS Mining Proposal and Project Management Plan) **Location, design and costing for Artificial Roost to be submitted to AWE for approval** within two years of the commencement of mining **(earliest Bow Bells South is affected, if at all, is Year 4)** **Scenario: Groundwater Drawdown modelled to impact Bow Bells South as determined by annual recalibration of hydrogeological model (and verified with quarterly dips of monitoring bores)** • Incident investigation and review of management actions (Initial trigger) • Instigate Pilbara Leaf-nosed bat Contingency Strategy (Threshold trigger) **Phase 1:** Make-up water into Bow Bells South to restore humidity to acceptable level (level set as above) - review and evaluate action via the humidity monitoring and Pilbara Leaf-nosed bat activity data. Adapt the action of makeup - up water into Bow Bells South should data show humidity not returning to the acceptable level (determined as above). Make up water to be introduced within 14 days of change of water level detected from quarterly dips of watering bore(s)	

Number	Trigger and threshold	Management Actions	Monitoring
		If evaluation of the humidity monitoring and Pilbara Leaf-nosed bat activity data shows make-up water into Bow Bells South is not displaying a recovering trend then: **Phase 2:** Build Pilbara Leaf-nosed bat Artificial Roost. The Artificial Roost Construction would be completed within 6-12 months of the Trigger Event, assuming timely WA State Mining Approvals (DMIRS Mining Proposal and Project Management Plan)	

Number	Trigger and threshold	Management Actions	Monitoring
Outcome: Minimise disturbance to Klondyke Queen historic workings as a result of the project.			
Performance Indicator: No permanent damage to Klondyke Queen historic workings as a result of the project. Activity: Blasting			
2.	**Trigger Criteria**: <u>Blast vibration Monitoring</u> Vibration limit of greater than 10mms^{-1} is recorded on the blast vibration monitor at Klondyke Queen	**Initial Trigger level actions:** • Incident investigation and review of management actions. **Threshold Trigger level actions** • Review blasting methodology, design, controls and limits to reduce the parameter that monitoring data indicates is in exceedance and implement change. eg. if there is an exceedance of Environmental Blasting Criteria (as defined in Environmental Blast Management Procedure - CRL-ENV-PRO-017-19) then the action is to refine the design to prevent exceedance at the next blast).	<u>Ghost bat Monitoring</u> 1. Permanent echolocation call detectors recording Ghost bat activity at Klondyke Queen 2. Visual Roost Monitoring during the blast by IR video to see if there is a Ghost bat response during blasting (to be completed in early stages of mining where blasting will commence 1,000m from Klondyke Queen or as advised by ecologist) <u>Blast Monitoring</u> Permanent Blast monitoring station at the Klondyke Queen to monitor: (i). peak particle velocity (PPV – mms^{-1}) (ii). wave form trace; and <u>Meteorological Monitoring</u> To ensure the blast is fired when the prevailing winds are blowing away from the Klondyke Queen • Temperature • Wind Speed and Direction <u>Structural Monitoring</u> Klondyke Queen inspected after all blasts within 500m <u>Noise Monitoring</u> To ensure noise levels within the roost are below 70dB