

# Ok Birim Tailings Storage Facility Project

Environmental and Social Impact Assessment

## Appendix F

Terrestrial biodiversity characterisation report



# Terrestrial biodiversity characterisation of the Ok Birim Tailings Storage Facility and Tailings Pipeline Projects



Site 1 camp in lowland rainforest in the Ok Birim proposed TSF footprint. Photo by Daniel Solomon Okena

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## Glossary, Acronyms and Abbreviations

|                                  |                                                                                                                                                                               |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AMSL                             | Above mean sea level                                                                                                                                                          |
| CBD                              | Convention on Biological Diversity                                                                                                                                            |
| Central cordillera               | Refers to the central mountainous spine of New Guinea that runs from the eastern edge of the Vogelkop Peninsula in Indonesian New Guinea to the eastern tip of mainland PNG.  |
| CEPA                             | Conservation and Environment Protection Authority                                                                                                                             |
| CITES                            | Convention on International Trade in Endangered Species of Wild Fauna and Flora                                                                                               |
| Conservation Significant species | Species listed in a threatened category or as Near Threatened or Data Deficient on the IUCN Red List, species protected under Papua New Guinea law and new to science species |
| CR                               | Critically Endangered (IUCN threat category)                                                                                                                                  |
| DBH                              | Diameter at breast height                                                                                                                                                     |
| DD                               | Data Deficient (IUCN threat category)                                                                                                                                         |
| DNA                              | Deoxyribonucleic acid                                                                                                                                                         |
| EN                               | Endangered (IUCN threat category)                                                                                                                                             |
| ESIA                             | Environmental and Social Impact Assessment                                                                                                                                    |
| FIMS                             | Forestry Inventory Mapping System                                                                                                                                             |
| FIMS code: Hm/Hs                 | Medium Crowned Forest                                                                                                                                                         |
| FIMS code: Hm9/Hs9               | Mixed Medium and Small Crowned Forest                                                                                                                                         |
| ITCS                             | Infrastructure Tax Credit Scheme                                                                                                                                              |
| IFC                              | International Finance Corporation                                                                                                                                             |
| IUCN                             | International Union for the Conservation of Nature                                                                                                                            |
| LC                               | Least Concern (IUCN threat category)                                                                                                                                          |
| NE                               | Not Evaluated for the IUCN Red List                                                                                                                                           |
| NT                               | Near Threatened (IUCN threat category)                                                                                                                                        |
| OTML                             | Ok Tedi Mining Limited                                                                                                                                                        |
| P1-listed weed                   | Highest priority weed species prohibited for movement within Australia                                                                                                        |
| PCon                             | Pyrite concentrate                                                                                                                                                            |
| PNG                              | Papua New Guinea                                                                                                                                                              |
| Restricted Range (RR)            | Restricted range species are those with an estimated global range of less than 50,000 km <sup>2</sup>                                                                         |
| TNRS                             | Taxonomic Name Resolution Service                                                                                                                                             |
| TPP                              | Tailings Pyrite Plant                                                                                                                                                         |
| TSF                              | Tailings Storage Facility                                                                                                                                                     |
| TSF footprint                    | Refers to the total area including buffer that will be occupied by the TSF                                                                                                    |
| TTC                              | Tetra Tech Coffey Pty Ltd                                                                                                                                                     |
| VU                               | Vulnerable (IUCN threat category)                                                                                                                                             |
| WMA                              | Wildlife Management Area                                                                                                                                                      |

# Executive Summary

Ok Tedi Mining Limited (OTML) is proposing the Ok Birim Tailings Storage Facility Project (the project), which includes the development of a tailings storage facility (TSF) approximately 1 km west of the confluence Ok Birim and Ok Tedi, and about 55 km south of the existing Ok Tedi Mine. The project also includes an approximately 87-km-long tailings pipeline from the tailings processing plant (TPP) at the mine to the TSF.

Tetra Tech Coffey has been contracted by OTML to characterise the terrestrial biodiversity values of the TSF footprint and proposed pipeline access road corridor. These two areas were surveyed by a team of taxon specialists. Survey 1 was conducted at two sites (Sites 1 and 2) between 08–19 August 2025 within the TSF footprint. Similarly, Survey 2 was conducted at another two sites (Sites 4 and 5) between 27 November–10 December 2025 within the proposed pipeline access road corridor. The team employed a broad range of methods at these four sites to rapidly document and characterise the flora, fauna and habitats. Camera traps were deployed for 37 days at a third locality (Site 3) in forest south of the TSF footprint after Survey 1 field team had departed. Similarly, at Site 5, camera traps were deployed for 52 days after Survey 2 field team had departed. Taxa assessed were flora, mammals (non-volant mammals and bats), birds, herpetofauna (frogs, reptiles) and odonates (dragonflies, damselflies).

The survey documented 913 species either directly or indirectly from local informants. Plants contributed most of the species (70%). Ninety one species of conservation significant flora and fauna were documented within the TSF footprint and the proposed pipeline access road corridor (Table 15). Sixty-seven of these are IUCN listed as Endangered, Vulnerable, Near Threatened or Data Deficient. Most of the IUCN conservation significant species were recorded from Site 1 (50 species), followed by Site 5 (20 species) then Site 4 (16 species) and Site 2 (10 species). No conservation significant species were detected from Site 3. Eight species of birds protected by PNG legislation were recorded from the surveyed areas and 19 species new to science or undescribed species mostly from flora, frogs and odonates were recorded from the areas surveyed.

## Flora

Six hundred and thirty-eight species across 113 plant families were recorded. Almost half of the plant species recorded (299) have not been evaluated (NE) by the IUCN and 286 species are Least Concern (LC) while seven species are Endangered (EN), 14 species are Vulnerable (VU), 25 species are Near threatened (NT) and seven Data Deficient (DD) species were recorded. Site 1 had the most threatened species (4, EN) and three VU species each from Site 1 and 2 and another four VU species each from Sites 4 and 5. Eight new to science species were also recorded.

## Non-volant mammals

Twenty-six species of native and six domestic/feral or exotic species of non-volant mammals were documented, mostly based on interviews with local informants. Seven species of small mammals were detected on camera traps, but no species were captured in Elliott traps. Snap traps captured two rodent species at Site 5. The highest diversity of non-volant

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mammals was recorded from Site 5 (22 species) followed by Site 1 (16), Site 2 (12), Site 4 (10) and Site 3 (4). The large rodent *Uromys caudimaculatus* and the bandicoot *Echymipera kalubu* were recorded from all five sites and were the species most frequently detected by independent camera events.

Three mammal species of conservation significance: *Dasyurus albopunctatus* (NT) from Sites 5, *Dorcopsulus vanheurni* (NT) from Site 5 and *Zaglossus bartoni* (VU) from Sites 1, 2 and 4 were recorded based on local informant interviews and *D. albopunctatus* was also recorded on a camera trap at Site 5.

However, the altitudes of the Ok Birim sites are substantially lower than any known records in Papua New Guinea for *D. vanheurni* and *Z. bartoni* so their presence requires confirmation through alternative methods (i.e., camera trapping).

Two invasive rat species (*Rattus rattus*, *Rattus exulans*) were also reported to be present in the areas surveyed by local informants with *R. rattus* at Sites 2 and 5 and *R. exulans* at Sites 4 and 5.

### Bats

Twenty-four species of bats were detected; 14 were identified from acoustic analysis of calls recorded on bat detectors, six by examination of animals captured in mist nets and three from both acoustic analysis and mist nets. One species was captured from a cave at Site 5 by local assistants. No species listed in an IUCN threatened category were encountered except for two Data Deficient species - *Nyctimene draconilla* from Site 5 and *Rhinolophus mcintyre* from Sites 4 and 5.

### Birds

116 bird species were documented, 104 from the TSF footprint and 70 from the proposed pipeline access road corridor. Five species in an IUCN Red list category higher than Least Concern were recorded. These are; Sclater's Crowned Pigeon, Forest Bittern and Palm Cockatoo (all NT); Papuan Eagle and Pesquet's Parrot (both VU). Seven species, including three Birds of Paradise are Nationally Protected. No new to science species were documented.

### Herpetofauna

Fifty-six species of native herpetofauna were recorded, 32 species of frogs and 24 species of reptiles. All the frogs are listed as LC by the IUCN except *Amniphylla longicrus* (DD). However, six frog species appear to be undescribed (previously known from elsewhere but without a name) or new to science (newly discovered during this survey): *Choerophryne* cf. *gracilirostris*, *Hylophorbus* sp. 1, *Hylophorbus* sp. 2, *Oreophryne* sp. 1, *Sphenophryne* cf. *cornuta*, *Xenorhina* cf. *pohleorum*, and *Spicocalyx* cf. *genimaculata*. Six frog call types documented during the survey could not be associated with any known species and may also represent new to science frogs. The exotic Cane Toad (*Rhinella marina*) was encountered at Site 1 only.

The reptile fauna at all sites is dominated by common, widespread species; none of the reptiles is listed in an IUCN category other than LC. One species of skink (*Sphenomorphus* sp.

1) encountered at Site 5 does not appear to match any known species and may be new to science but only one specimen was captured, and further studies are required to confirm its taxonomic status. Local informants reported that the Pig-nosed Turtle (*Carettochelys insculpta*; IUCN Endangered), Southern New Guinea Giant Softshell Turtle (*Pelochelys bibroni*; IUCN Vulnerable) and the Freshwater Crocodile (*Crocodylus novaeguineae*) occur in the Ok Birim and Ok Tedi, but are not known from waterbodies within the TSF footprint. However, they reported that Freshwater Crocodiles are commonly encountered in waterbodies in the vicinity of Site 4 and that both *Pelochelys bibroni* and the small turtle *Emydura subglobosa* occur within the Ok Ma and adjacent streams. Further assessment of the likelihood of *Pelochelys* occurring in the vicinity of the proposed pipeline access road corridor should be undertaken if damage to potential nesting sites in the riparian zones of larger stream channels is likely.

### **Odonata**

Fifty-two species of odonates (dragonflies and damselflies) were recorded during Survey 1 and Survey 2, which include 25 species of damselflies and 27 species of dragonflies. Four species of damselflies are classified as Data Deficient by the IUCN: *Argiolestes muller*, *Podopteryx roseonotata*, *Nososticta ovimacula* and *N. rangifera*; all but *Podopteryx roseonotata* (which probably breeds in treeholes) are stream dwelling species. Six species of damselflies in the genera *Teinobasis* (X2), *Idiocnemis*, *Nososticta*, *Palaiargia* and *Papuargia* appear to be new to science. All except the two *Teinobasis* species (breeding habits unknown) occupy clear-flowing streams.

### **Significant habitats**

Forest streams at Sites 1, 2 and 5 are identified as a significant habitat for a unique assemblage of poorly known and new to science damselflies.

Site 5 is in the vicinity of the Lukwi cave system. One sinkhole, Barawokwi, is 200 m southeast of the camp area. It was visited during the surveys and one bat species; *Dobsonia moluccensis* was caught there. Local informants reported that many bats use the cave and that numerous additional caves and sinkholes are present further from the Site 5 camp.

### **Current threats**

Local informants from the vicinity of the TSF footprint were observed using air guns to hunt local wildlife. They reported that use of air guns is widespread in the area, and that their use has increased the success rate of hunting to about 99%. This increase in hunting pressure may have contributed to the low numbers of terrestrial and arboreal mammals encountered at the TSF footprint and the proposed pipeline access road corridor. However, it does not assist with explaining the low detection rates for mammal species at Site 4, which is remote from large human populations.

Heavy machinery and other vehicle movements were observed along the Infrastructure Tax Credit Scheme (ITCS) road in the vicinity of the TSF footprint, which is currently under construction towards the Indonesian border. This road will provide improved access to primary forest habitats to the west of the TSF footprint and may increase hunting pressure by local hunters with air guns along this corridor.

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# 1. Introduction

The Ok Birim Tailings Storage Facility Project (the project) is located in the remote and relatively undeveloped northwest corner of Western Province (Figure 1), south of the Central Cordillera of Papua New Guinea (PNG). The proposed TSF is approximately 1 km west of the confluence of the Ok Birim and Ok Tedi, about 50 km south of the existing Ok Tedi Mine and 90 km by road from the mine via the Kiunga–Tabubil Highway, which is maintained by Ok Tedi Mining Limited (OTML).

The Ok Tedi Mine is a large-scale open pit mining that mines copper, gold and silver using conventional methods. Ore is mined and processed on-site and treat up to 24 million tonnes per annum (Mtpa). The copper, gold and silver concentrate is transported via 156-km-long pipeline alongside the Kiunga—Tabubil Highway to Kiunga port facilities for shipment to Port Moresby and eventually to overseas markets.

The pyrite concentrate (PCon) produced at the tailings pyrite plant (TPP) near the mine is transported via an existing 125-km-long pipeline to subaqueous storage pits on the west bank at Bige stockpile areas within OTML's existing ancillary lease boundary. These pits are designed and operated to permanently submerge sulphide-rich material to prevent oxidation and acid generation. Residual tailings produced at the TPP are discharged via a 1.5-km-long existing pipeline into tributaries of the upper Ok Tedi, where they are carried downstream and settled in a dredged slot near Bige. Dredged material is hydraulically placed into long-term engineered stockpiles on the east and west banks of the Ok Tedi where they are rehabilitated (Caplan et al 2024).

Both the project and the existing Ok Tedi Mine are located entirely within the upper Ok Tedi catchment. The project area experiences high rainfall and is dominated by dense, relatively intact, tropical vegetation. Terrain varies from steep-sided valleys and rugged mountains near the existing mine site, transitioning towards more gently undulating land and low-lying floodplains around the proposed TSF site.

Project activities will primarily occur in 1900 ha in the following two areas.

- TSF footprint – encompasses the TSF impoundment footprint, hydro-cyclone house, laydown area and associated ancillary infrastructure. The TSF site is located in a sub-catchment of the Ok Yep, approximately 1 km west of the confluence of the Ok Birim and Ok Tedi. It is generally flat with undulated shallow valleys ranging in elevation from approximately 40 to 80 above mean sea level (AMSL).
- An 87-km-long tailings delivery pipeline, with approximately 80% buried and 20% above ground, from the existing TPP at the Ok Tedi Mine to the proposed TSF site, including associated pumping and piping distribution systems (i.e., one pump station at the mine site and two intermediate choke/valve stations) together with a pipeline access road including three bridges and several minor water/ravine crossings.

Key proposed access roads, bridge and water crossings of these two are summarised as follows:

- The TSF footprint will intersect the new ITCS Road. To maintain continued use of this road during construction and operation of TSF Cell 1 (northern cell), the ITCS Road will initially remain in its current alignment. In 2041 (Operational Year 12), the ITCS Road will be re-aligned over the crest of the southern embankment of Cell 1 to enable construction of TSF Cell 2.
- The proposed alignment for the pipeline access route provides a more direct connection between the existing Ok Tedi Mine and the proposed TSF site, approaching from the north through undeveloped areas, and including up to seven water crossings.
- Temporary minor access roads and tracks will be required for site access and supply during the construction phase around the TSF and along the tailings pipeline and associated access road. These roads/tracks are planned to be cut to final design width but initially constructed as temporary facilities, with sections upgraded as required for the ITCS Road re-location associated with the TSF footprint. Final locations will be confirmed through further studies and will be located within already disturbed areas to the extent possible.
- Additional four-wheel drive access tracks will be established around the TSF site and along sections of the pipeline and choke/valve stations that do not follow existing roads or tracks.

## **2.1. Scope of this Survey**

Tetra Tech Coffey (TTC) has been engaged by OTML to prepare the Environmental and Social Impact Assessment (ESIA) for the Ok Birim Tailings Storage Facility Project. The scope of this study is to characterise terrestrial biodiversity, habitats and conservation significant species within the project area to inform an impact assessment. The objective was to:

- Characterise the terrestrial biodiversity and habitat values of the project's area of influence

## **3. Study Methods**

### **3.1. Brief Description of the Project Areas**

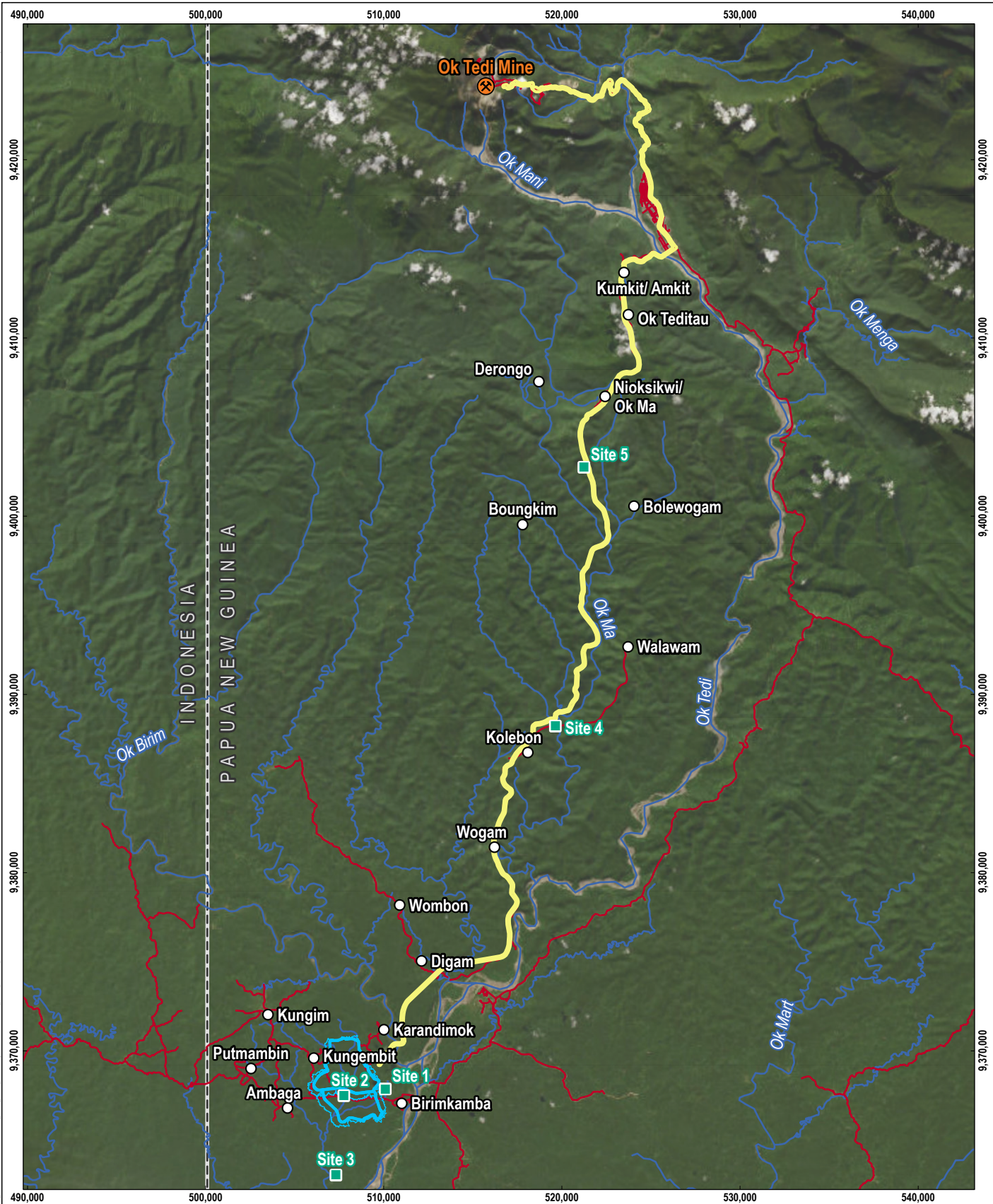
The proposed Ok Birim TSF project area is in lowland rainforest in Ningerum Local Level Government (LLG) of North Fly District in Western Province, Papua New Guinea. It is located between Ningerum township about 7 km to the northeast and the Indonesian border about 6 km to the west. The TSF footprint in this study is slightly further south from, but overlaps with, the previous proposed TSF footprint surveyed by BMT WBM (2015) (Figure 1). The northern part of the TSF footprint in this biodiversity characterisation study includes the southernmost parts of the 2015 TSF pre-feasibility study. The highest point reaches 97 m AMSL on the northeast towards the Ok Birim and Ok Tedi confluence while the southmost border is 71 m AMSL approximately 1 km from the Ok Tedi covering approximately 1,500 ha.

The terrain around the proposed TSF site is gently undulating and low-lying floodplains consisting of weathered to acidic soils (Bleeker 1983, Bellamy 1995). The vegetation is tropical lowland floodplain rainforest with small to medium crowned forest of 80–95 % canopy cover (BMT WBM 2015, 2015, Rau & Reagan 2008). Patches of swamp woodland also occur, characterised by sago palms and swamp adapted species like *Campospermum bervipetiolatum* and *Syzygium* species (BMT WBM 2015).

The TSF surveys were below 100 m AMSL while the proposed pipeline access road corridor surveys were conducted in the foothills between 200 and 460 meters AMSL along the Ok Ma. The forest between these elevations is intact lowland primary rainforest. In the understory vines, ferns, small forest streams and swampy areas are typical macrohabitats. At 200 m AMSL, small ridges traverse the survey area, with shallow, occasionally seasonal, forest streams that create a range of dry to semi-moist microhabitats. At 460 m AMSL between Ok Ma and Ok Maom is mix of intact and secondary forest resulting from shifting cultivation. Sago patches are also evident. Limestone and karst landforms are known to occur at this elevation that forms the Lukwi Caves (James et al 1989).

There are several hamlets and villages close to the proposed TSF footprint like Kungembit, Ambaga, Karandimok and Birimkamba. The main villages that the survey team interacted with along the proposed pipeline access road corridor were Kolebon and Bounkim. These villages are in Ningerum Local Level Government (LLG) where population density is five persons per km<sup>2</sup> (National Statistics website, retrieved on 09/02/2026). This makes the Ningerum LLG sparsely populated by national standards even though it has a population of 16,697. The nearby Star Mountains LLG where the tailings pipeline also runs through has a similar population density with a population of 10,270 people in Tabubil township alone.

The proposed TSF area is in a humid tropical climate zone where average annual rainfall at the nearest town of Ningerum, 7 km east of proposed TSF footprint exceeds 4,000 mm. Monthly humidity ranges from 86–89 % and average monthly temperature ranges from 22–30 °C (Climate Data website, retrieved on 11/02/2026). The climate further north at Tabubil and Star Mountains is cooler and wetter. At Tabubil, the monthly humidity ranges from 89–92% and the average annual temperatures ranges between 19–22 °C. The annual average rainfall in Tabubil ranges from 6000–8000 mm (Climate Data website, retrieved on 27/03/2026, Gregory 1995). There may be longer-term variations in the climate variables due to El Nino and La Nino events (Moi et al. 2001, Rau and Reagan 2008).



#### LEGEND

- Ok Tedi Mine site
- Village
- Terrestrial ecology survey site
- Road/track
- Watercourse
- International border
- Proposed infrastructure corridor
- Proposed TSF footprint



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SOURCE  
Proposed infrastructure from KCB and OTML.  
Topographic features from OSM. Provinces from NSO.  
DEM from SRTM. Imagery from ESRI.

OK TEDI MINING LIMITED

OK BIRIM TAILINGS STORAGE FACILITY PROJECT

#### FIGURE 1

Ok Birim proposed tailings storage facility (TSF) and the proposed tailings pipeline



DATE: 25.05.26 PROJECT: 754-MELN374244 FILE: 374244\_TS06\_F001\_GIS

## **3.2. Existing Data**

A bibliographic review of existing information on biodiversity values was undertaken prior to the field survey. The aim of this review was to generate a list of species of conservation significance that are known to, or are likely to occur, in the vicinity of the project area.

### **3.2.1. Previous Biodiversity Studies**

Three key previous biodiversity studies done in the TSF footprint and lowlands of the upper Ok Tedi area were consulted to review existing biodiversity. The studies include; pre-feasibility study of Ok Birim TSF (BMT WBM 2015), Bige tailings storage facilities (BMT WBM 2016) and Vegetation of the Ok Tedi–Fly River System (Rau and Reagan 2008).

### **3.2.2. Other Sources of Information**

In addition to data from previous surveys, the team drew on information provided in a range of other environmental datasets including: the Papua New Guinea Forest Inventory Mapping System (FIMS) (Hammermaster and Saunders, 1995), the IUCN Red List of Threatened Species (IUCN 2025), Birdlife International website, PNG Plant database, New Guinea Vegetation (Paijmans, 1976). Mammals of New Guinea (Flannery 1995), Bats of Papua New Guinea (Bonaccorso, 1998), Birds of New Guinea (Pratt and Beehler 2015), Biodiversity study of Hindenburg Wall (Richards and Whitmore 2015), the *Fauna (Protection and Control) Act 1966* and the *Protected Areas Act 2024* and Handbook of the Mammals of the World (Wilson & Mittermeier 2015).

## **3.3. Field Surveys**

### **3.3.1. Survey Schedule and Personnel**

Fieldwork was conducted over two periods in 2025 and referred to as Survey 1 and Survey 2. Survey 1 was conducted at the proposed TSF footprint from 04<sup>th</sup> of August through 27 September 2025 (Table 1). The survey team left the TSF survey sites on 20 August, but deployed camera traps at Site 3 from 21 August–27 September 2025. The setting up and removal of the camera traps were done by Ok Tedi's Senior Terrestrial Biologist (Bega Inaho).

Survey 2 was conducted along the proposed pipeline access road corridor from 24 November to 10 December 2025. The survey team left the field on 10 December and camera traps were deployed and remained at Site 5 from 05 December 2025–27 January 2026.

**Table 1. Survey schedule for Ok Birim Survey 1 and Survey 2.**

| Date                   | Site                             | Activity                                                                    | Note                                                                |
|------------------------|----------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Survey 1</b>        |                                  |                                                                             |                                                                     |
| 4–7 August             | Tabubil                          | Team undertook gear checks, planning etc                                    | Bad weather and logistics prevented team going into the survey site |
| 08 August              | Ok Birim Site 1                  | Assembled gear, started survey                                              |                                                                     |
| 09–11 August           | Ok Birim Site 1                  | Survey                                                                      |                                                                     |
| 12 August              | Ok Birim Site 2                  | Team moved to Site 2                                                        |                                                                     |
| 13–15 August           | Ok Birim Site 2                  | Survey                                                                      |                                                                     |
| 16–19 August           | Ok Birim Site 2, South ITCS road | Survey                                                                      | Enock Kale and Penniel Lamei decamp and demob                       |
| 20 August              | Tabubil                          | Team decamped to Tabubil                                                    |                                                                     |
| 21 August              | Tabubil                          | Sorted and repacked gear                                                    |                                                                     |
| 21–22 August           | Respective homes                 | Team demobilised and returned to respective homes                           |                                                                     |
| 21 August-27 September | Ok Birim Site 3                  | Camera traps deployed at Site 3                                             | Cameras deployed after team had demobilised                         |
| <b>Survey 2</b>        |                                  |                                                                             |                                                                     |
| 24 November            | Tabubil                          | Team met with Ok Tedi Environment team                                      |                                                                     |
| 25 November            | Tabubil                          | Team met with Ok Tedi Environment team, undertook gear checks, planning etc |                                                                     |
| 26 November            | Site 4                           | Team travel to Site 4                                                       |                                                                     |
| 27–29 November         | Site 4                           | Survey                                                                      |                                                                     |
| 30 November            | Site 4                           | Survey, constructed helipad for demob                                       |                                                                     |
| 01 December            | Tabubil                          | Team decamped from Site 4 to Tabubil                                        |                                                                     |
| 02–03 December         | Tabubil                          | Team undertook gear checks, planning etc                                    |                                                                     |
| 04 December            | Site 5                           | Team travel to Site 5                                                       |                                                                     |
| 05–09 December         | Survey                           | Survey                                                                      |                                                                     |
| 10 December            | Tabubil                          | Decamped Site 5 for Tabubil                                                 |                                                                     |
| 11 December            | Tabubil                          | Debriefed Ok Tedi Environment team,                                         |                                                                     |

| Date                             | Site             | Activity                                          | Note                                        |
|----------------------------------|------------------|---------------------------------------------------|---------------------------------------------|
|                                  |                  | others left for respective homes                  |                                             |
| 12 December                      | Respective homes | Team demobilised and returned to respective homes |                                             |
| 05 December 2025–27 January 2026 | Site 5           | Camera traps deployed at site 5                   | Cameras deployed after team had demobilised |

Nine fauna and flora experts, seven from the New Guinea Binatang Research Center (NGBRC), one from Ecomate Management Limited (EML) and one from TTC conducted the field survey (Table 2). All the experts were PNG based.

**Table 2. Field taxon experts for Survey 1 and Survey 2.**

|   | Expert               | Taxon surveyed     | Survey involved | Qualification   | Organisation |
|---|----------------------|--------------------|-----------------|-----------------|--------------|
| 1 | Kenenth Molem        | Botany             | 1,2             | Parataxonomist  | NGBRC        |
| 2 | Penniel Lamei        | Botany             | 1               | Masters         | NGBRC        |
| 3 | Bonny Koane          | Birds              | 1               | Parataxonomist  | NGBRC        |
| 4 | Samuel Japi          | Birds              | 2               | Parataxonomist  | NGBRC        |
| 5 | Gendio Drumo         | Bats               | 1,2             | Parataxonomist  | NGBRC        |
| 6 | Daniel Solomon Okena | Non-volant mammals | 1               | PhD student     | NGBRC        |
| 7 | Junior Novera        | Non-volant mammals | 1               | PhD             | TTC          |
| 8 | Clifford Yaee        | Herpetofauna       | 1,2             | Masters Student | NGBRC        |
| 9 | Enock Kale           | Non-volant mammals | 1,2             | Masters         | EML          |

### 3.3.2. Survey Sites

Table 3 shows the locations of the survey sites and the oordinates are in WGS84.

**Table 3. Locality information for Survey 1 and Survey 2 sites.**

| Location | Longitude  | Latitude  | Altitude (AMSL) | Start          | Finish                                                | Survey |
|----------|------------|-----------|-----------------|----------------|-------------------------------------------------------|--------|
| Site 1   | 141.091150 | -5.718933 | 83              | 08 August 25   | 12 August 25                                          | 1      |
| Site 2   | 141.070111 | -5.722386 | 69              | 15 August 25   | 19 August 25                                          | 1      |
| Site 3   | 141.066125 | -5.762678 | 63              | 21 August 25   | 27 September 25                                       | 1      |
| Site 4   | 141.177960 | -5.532278 | 130             | 26 November 25 | 30 November 25                                        | 2      |
| Site 5   | 141.179503 | -5.392032 | 465             | 05 December 25 | 10 December 25 (camera traps retrieved 27 January 26) | 2      |

### 3.3.3. Survey Methods

Survey methods at the different sites are shown in Table 4.

**Table 4. Summary of taxon survey techniques for Survey 1 and 2.**

| Survey Method                 | Flora | Non-volant Mammals | Bats | Birds | Herpetofauna | Odonates |
|-------------------------------|-------|--------------------|------|-------|--------------|----------|
| Bioacoustic recording         |       |                    |      | x     | x            |          |
| Camera traps                  |       | x                  |      | x     | x            |          |
| Elliott traps                 |       | x                  |      |       |              |          |
| Hand nets                     |       |                    |      |       |              | x        |
| Local informant interviews    | x     | x                  | x    | x     | x            |          |
| Mist-nets                     |       |                    | x    |       |              |          |
| Point counts                  |       |                    |      | x     |              |          |
| Snap trap                     |       | x                  |      |       |              |          |
| Specimen collection           | x     |                    | x    |       | x            | x        |
| Traditional bandicoot traps   |       | x                  |      |       |              |          |
| Ultrasonic acoustic recording |       |                    | x    |       |              |          |
| Visual searches               | x     | x                  | x    | x     | x            | x        |

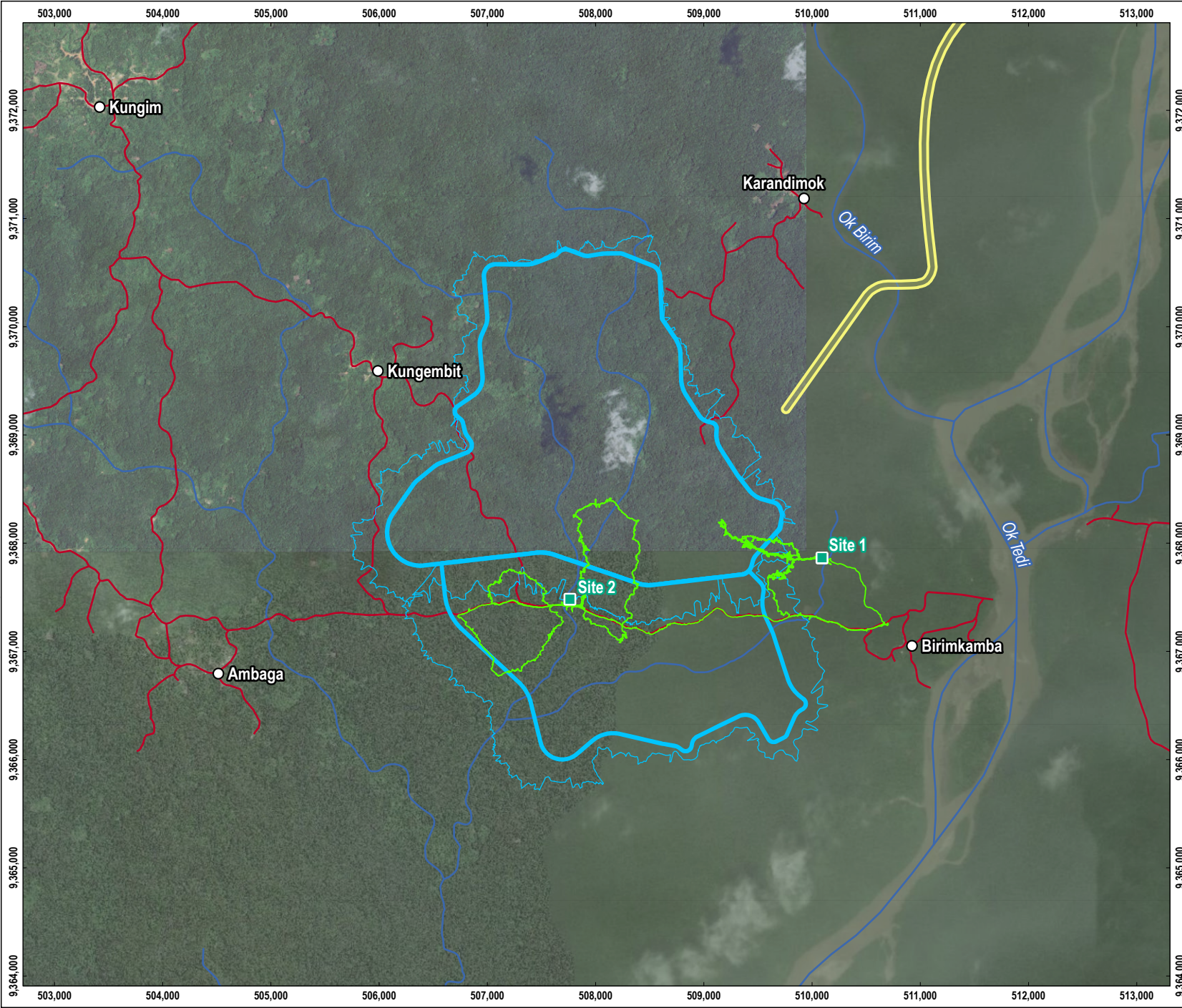
### 3.3.3.1. Vegetation and Flora

A comprehensive botanical survey was undertaken within the proposed TSF footprint forest areas (Figure 2) and the proposed pipeline access road corridor.

The assessment of sensitive flora was guided by a desktop review of previous botanical reports and regional species lists (section 3.4). This preparatory phase helped refine the survey focus toward taxa of high conservation value, newly discovered species and known invasive plants or weeds. Field teams documented all plant species encountered with special emphasis on:

- IUCN species
- Rare or localised taxa with restricted distributions
- Food plants critical to sensitive fauna (e.g., *Aristolochiaceae* vines, large *Ficus* spp.)
- Areas exhibiting signs of weed infestation
- Large trees utilised by arboreal or frugivorous fauna

Each observation was georeferenced using GPS and annotated with habitat context, phenological status and disturbance indicators. Voucher specimens were collected following appropriate standard protocols and are lodged with the Lae National Herbarium.



#### LEGEND

- Village
- Terrestrial ecology survey site
- Road/track
- Watercourse
- Plant survey track
- ▭ Proposed infrastructure corridor
- ▭ Proposed TSF footprint

**SOURCE**  
 Terrestrial biodiversity sampling sites from Ecomate.  
 Proposed infrastructure from KCB and OTML.  
 Topographic features from OSM. Admin boundary from NSO.  
 DEM from SRTM. Imagery from Google Earth and ESRI.



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**FIGURE 2**  
**Plant survey tracks relative to the proposed TSF footprint in Survey 1**



DATE: 11.06.26 PROJECT: 754-MELN374244 FILE: 374244C\_TSP6\_F002\_GIS

#### **3.3.3.1.1. Flora Collection Techniques**

The botanical survey team consisted of two experienced botanists and two local assistants. Fieldwork commenced each morning at 8.00 am with active botanical searches until approximately 3.00 pm, depending on terrain and weather conditions. Each day involved 6–7 hours of intensive survey effort, covering a range of forest microhabitats and vegetation zones described under section 4.1. Eighty-four manhours were spent surveying the plants at Site 1 and 168 manhours at Site 2. At each site, an additional 1–2 hours were dedicated to processing the plants. These included detailed plant descriptions, specimen pressing and drying, imaging cataloguing and digital data management. In summary, the survey employed three complementary methods;

- **Specimen collection and pressing**

Unknown or taxonomically significant plant species were collected and carefully pressed between sheets of newspaper in the field. These specimens were dried using a portable plant dryer to preserve morphological features essential for identification. Each specimen was labelled with collection details, including location, habitat type and collector initials (Plate 1).

- **Photographic documentation**

Unknown species and associated habitats were photographed.

#### **3.3.3.1.2. Flora Taxonomic Verification**

All specimens collected and photographed floras from Sites 1, 2, 4 and 5 were identified at Lae National Herbarium (LAE). In cases where reference collections were unavailable, online repositories such as JSTOR Global Plants (<https://plants.jstor.org/>) were consulted to verify identifications. JSTOR Global Plants is a digitised database that hosts an extensive collection of type specimens from across the globe, providing a valuable resource for taxonomic confirmation.

#### **3.3.3.1.3. Culturally significant plants**

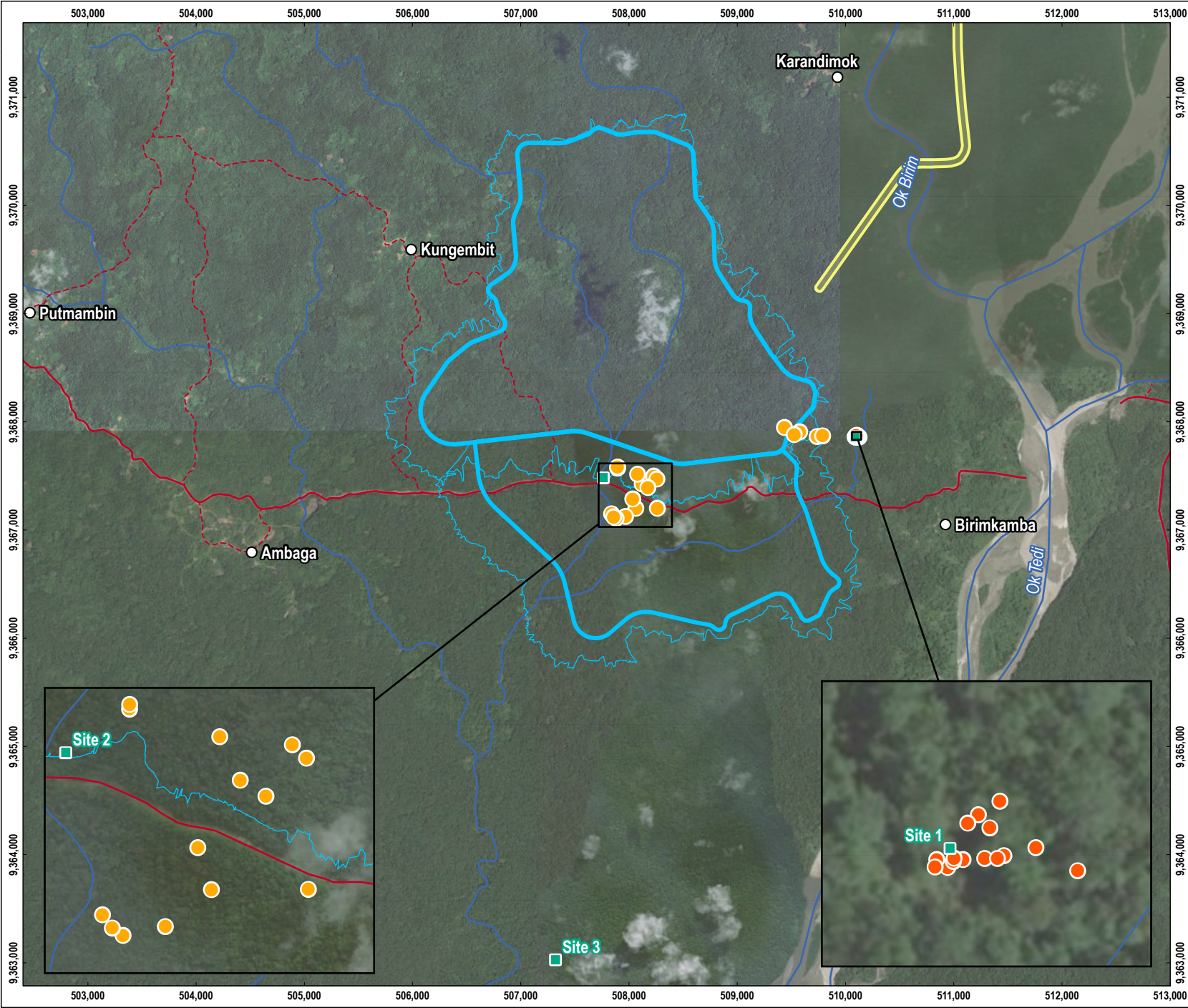
During the fieldwork, the assistants identified the culturally significant species then we interviewed them and determined how each plant species was used by the local communities.



**Plate 1. Plant processing for museum voucher specimen by Kenneth Molem and Penniel Lamei under full watch of their local assistant at Site 2. Photograph by Enock Kale.**

### **3.3.3.2. Non-volant Mammals**

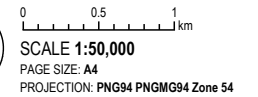
Elliott trapping and snap trapping targeted small mammals, while camera trapping (Reconyx®) targeted all terrestrial species (Figure 3). Local informant interviews were conducted to verify presence of species of conservation significance reviewed during literature review plus other species likely to be present in the proposed TSF footprint. Literature review was done prior to the fieldwork to concentrate survey efforts on verifying presence of conservation significance species likely to be present in the footprint area (section 3.4).



-  Village  
 Terrestrial ecology survey site  
 Volant mammal trapping point  
 Non-volant mammal trapping point  
 Track  
 Road  
 Watercourse  
 Proposed infrastructure corridor  
 Proposed TSF footprint

SOURCE

Terrestrial biodiversity sampling sites from Ecomate.  
Proposed infrastructure from KCB and OTML.  
Topographic features from OSM. Admin boundary from NSO.  
DEM from SRTM. Imagery from Google Earth and ESRI.



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### FIGURE 3

### Map of mammal trapping points in Ok Birim tailings storage facility



0 DATE: 11.06.26 PROJECT: 754-MELEN374244 FILE: 374244C\_TS06\_F003\_GIS

#### **3.3.3.3.1. Elliott and Snap Trapping**

In Survey 1, Elliott traps were baited with mixed bait consisting of rolled oats, local sweet potatoes, fresh corn, peanut butter and both ripe and green bananas. Traps were laid out at 10 m spacing along two transects each at site 1 and 2 (Plate 2a). Fifty traps were placed on tracks used by small mammals and were covered with leaves to blend with the microhabitat and reduce effects of trap shyness. However, for the first night at site 1, only 19 traps were deployed due to heavy rain. The two transects at site 1 were 320 m and 180 m long respectively. Traps along the 320 m transect followed an existing forest track. The other two transects at site 2 were 500 m in length in a more uniform, typical lowland rainforest habitat. The traps were checked daily and baits soiled by ants or destroyed by heavy rain were replaced accordingly.

In Survey 2, four methods were employed to document non-volant mammals at Sites 4 and 5 - snap traps, camera traps, traditional bandicoot traps and local informant interviews. No Elliott traps were used because of nil success at Sites 1 and 2.

Thirty-three snap traps were laid out at 10 m intervals along one 330 m transect. The traps were laid out in microhabitats such as the bases of large trees, under fallen logs and even affixed on climbing lianas that extends into the forest canopy. Trapping was conducted in primary forest at Site 4 and in both primary and secondary regrowth forest at Site 5. The traps were baited with ripe banana, sweet potato, and peanut butter. Two types of snap traps were used; wooden snap traps that are designed to bait with food that has strong odor such as peanut butter, but do not have sufficient space to hold additional baits (Plate 2b). Only peanut butter was used for this wooden trap. The plastic snap trap had enough space to hold additional bait, so sweet potato and peanut butter baits were used (Plate 2c). The traps were checked every morning and baits were replaced if taken or soiled by ants or washed away by rain. Trapping at Site 4 was conducted from 27<sup>th</sup>–29<sup>th</sup> December 2025 while trapping at Site 5 was conducted from 5<sup>th</sup>–8<sup>th</sup> December 2025.

#### **3.3.3.3.2. Camera Trapping**

In Survey 1, ten camera traps (Reconyx®) were set at 20 m intervals along Elliott trap transects at sites 1 and 2 (Plate 2d). Active animal tracks or intersections of two such tracks were identified and the camera traps were affixed and fixed onto small poles facing the bait that were spread over the animal track. The camera traps were baited with the same mixture of baits used for Elliott trapping but tinned fish were added in addition to lure carnivorous species that might be present in the habitat.

From 21 August to 27 September, nine camera traps (Reconyx®) were deployed by OTML staff (Bega Inaho) at Site 3 further south of sites 1 and 2 to document presence of terrestrial mammals and other fauna like birds and herpetofauna. Sweet potato cut into small blocks were used as bait and placed in front of the camera. The cameras were loaded with secure digital (SD) cards which were removed after the survey. Images of terrestrial mammals were identified straightaway but images of other vertebrates were passed onto the respective experts for identification.

In Survey 2, six camera traps at Sites 4 and eight cameras at Site 5 were affixed onto poles about half a meter above the ground and facing the baits. The bait consisted of sweet potatoes, ripe bananas, fresh peanuts, corn and some tinned meat, which were placed

between 1-2 m from the cameras. Some camera traps were set on lianas that extend into the forest canopy to capture arboreal mammals. The camera traps were set on one spot and recorded for 24 hours to increase the chances of capturing both diurnal and nocturnal mammals. At Site 5, the eight camera traps were deployed by Bega Inaho of Ok Tedi Environment Department for a further 52 days (between 06 December 2025–27 January 2026). The location of each camera trap was tagged with brightly colored flagging tapes for ease of locating them. At the end of the survey, SD cards from the cameras were removed and mammals photographed were identified straight away but images of other vertebrates were passed onto the respective experts for identification.

#### **3.3.3.2.3 Traditional Bandicoot Traps**

The two local assistants built three traditional bandicoot traps at Site 5 to contribute to the survey effort.

#### **3.3.3.2.4. Local informant Interviews**

In Survey 1, two local assistants who are familiar with local fauna were interviewed at Sites 1 and 2 (Plate 2e). The images of mammal species in the *Mammals of New Guinea* (Flannery, 1995) were used during the interview to investigate local knowledge on each of the species. A species list for each of the sites was generated as different assistants were engaged at each site. Interviews also covered topics relating to protein needs of the local communities that are sourced from the forest.

In Survey 2, two local assistants who are familiar with local fauna were interviewed at Sites 4 and 5. The assistants were shown the images of mammals from the *Mammals of New Guinea* (Flannery, 1995). Species without images were omitted from the interview. Some common species without images were explained using obvious field characters and were listed if a consensus was reached with the informants. Species that were confidently described by the assistants in their local language and were likely to be present in the habitat surveyed were listed as present or likely to be present. A number of species that were reported during interviews that are highly unlikely to occur were omitted from the species lists.

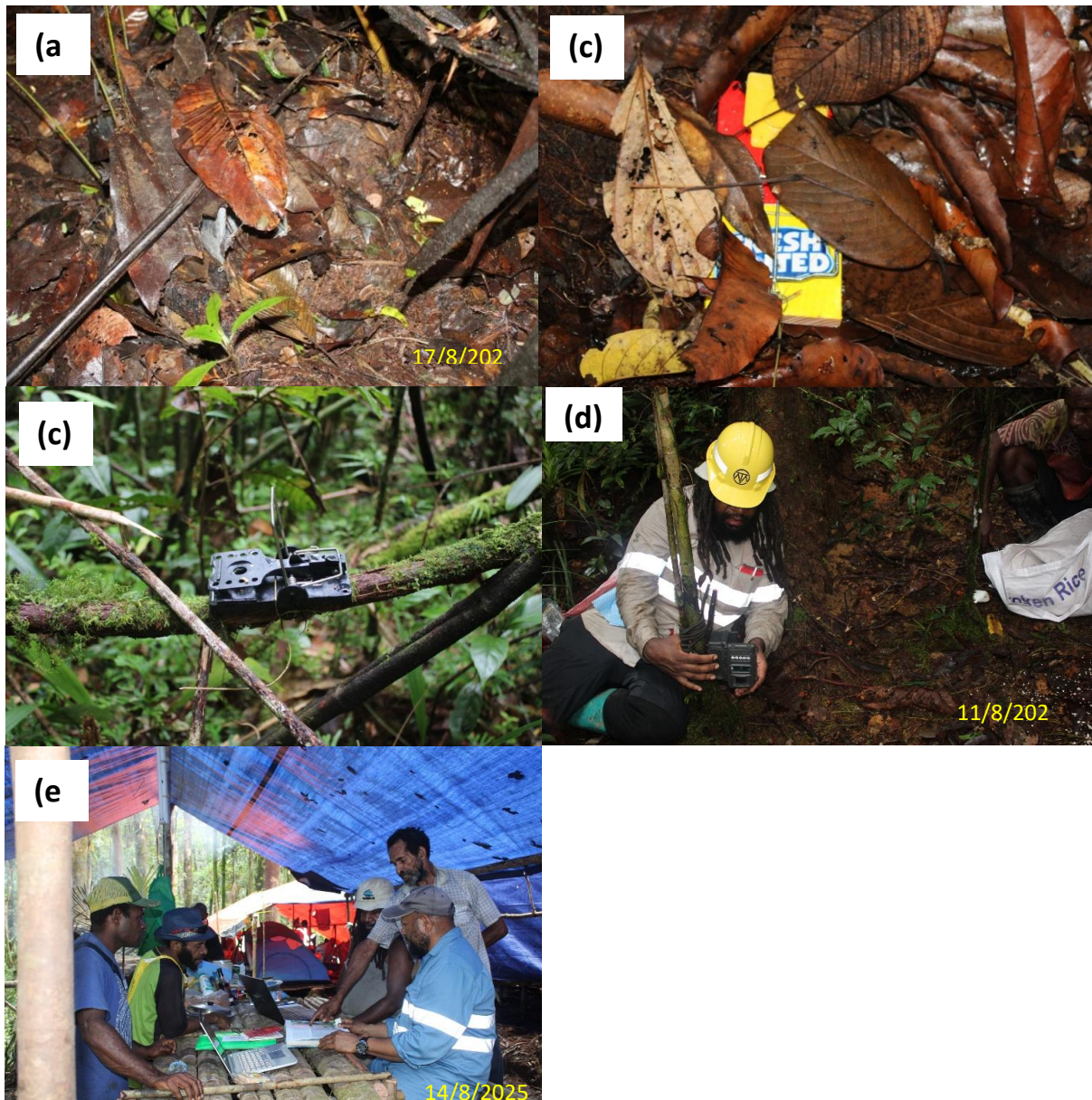


**Plate 2. Non-volant mammal trapping.** An Elliot trap set for trapping at Site 2 (a), Daniel Solomon Okena setting a camera trap at Site 1 (b) and Enock Kale and Daniel Solomon Okena interviewing local assistants at Site 2 (c). Photographs a & b by Enock Kale, c by Daniel S. Okena.

### 3.3.3.3. Bats

Three methods were used to detect the bats at all the sites except at site 3; mist-netting, acoustic surveys (Figure 4) and interviewing locals. Additionally, cave searches were conducted at Site 5. Mist net and acoustic survey locations were marked with a GPS.

#### 3.3.3.3.1. Mist-netting

At site 1 and 2, two long (16 m x 3 m) and one short net (12 m x 3 m) were set under forest canopy along flyways, human tracks, across streams and the ITCS road. The nets were exposed for 4–5 hours daily from 5:00 or 6:00 p.m.–10:00 p.m. depending on the weather.

The nets were checked every 30–40 minutes. The mist nets ran for three nights at Site 1 and six nights at Site 2.

At Site 4 and 5, two shorter mist nets (12 m x 3 m) were used. The mist nets were set on one transect under forest canopy in suitable locations for bat activity. Mist netting at Site 4 was conducted for three nights (27<sup>th</sup> – 29<sup>th</sup> November 2025) and at Site 5 for five nights (5<sup>th</sup> – 9<sup>th</sup> December 2025). At each site, the mist nets were relocated every night to different spots along the transect. The mist nets were operated for 5 hours each night, opened at 5:00 pm then monitored for 30–40 minutes and closed at 10:00 pm.

All bats captured were removed and kept in calico bags and were examined at the camps the following day. The bats trapped were spot identified to species level. All bats caught were released immediately after processing them.

#### **3.3.3.3.2. Acoustic Survey and Analysis**

At Site 1 and 2, three hand-held bat detectors (Titley Scientific AnaBat Walkabout) were used to record bat echolocation calls randomly. Each detector was strapped around a tree or a sapling at about 2 m high with the detectors set at 10–15 m apart. At Sites 1 and 2, recordings started at 5:00 p.m. to 5:00 a.m. for a total of 12 hours each day. The detectors were relocated to new locations every night with three nights at Site 1 and six nights at Site 2. At Sites 4 and 5, the detectors recorded from 6:00 pm to 6:00 am. The memory cards were checked each morning and total call files recorded were noted before relocating to new locations. At Site 4, the detectors were deployed for three days and five nights at Site 5. The detectors were relocated to new locations every night that were likely to be used as flyways by the bats. At the end of the survey, all the bat call data were sent to Dr. Kyle Armstrong of Specialised Zoological (<http://szool.com.au>) in Australia for analysis. Dr. Armstrong is a specialist on bat calls who has extensive experience working on PNG bats and has the expertise to analyse their calls (see Appendix 2 and Appendix 3).

#### **3.3.3.3.3. Cave Searches**

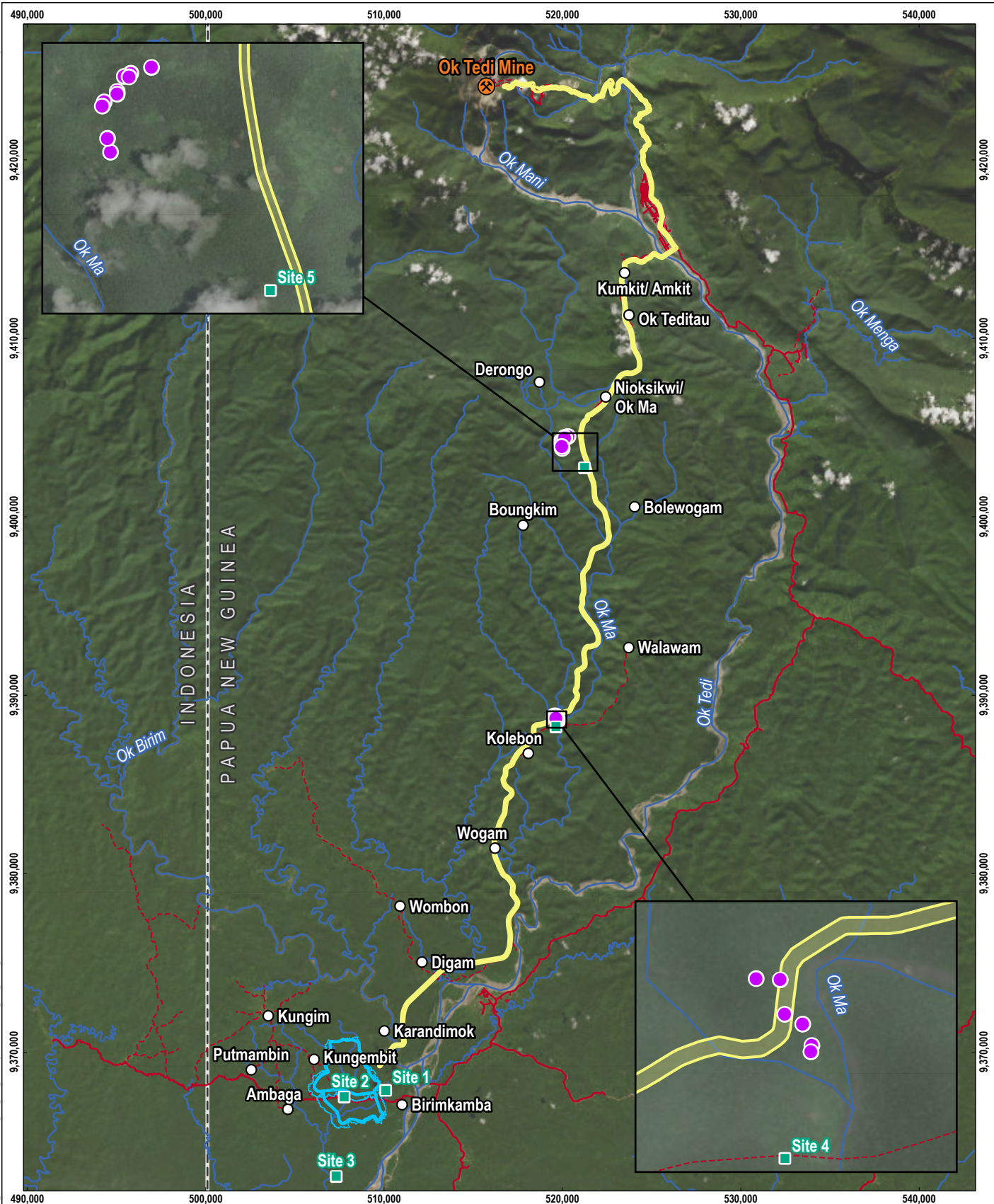
Caves were only encountered at Site 5, where a sinkhole called “Barawokwi cave” by local informants was located about 200 m southeast of the camp. It is unclear whether it is one of the Lukwi caves. This sinkhole was visited on 08<sup>th</sup> December 2025, but the entrance was too steep to enter safely, so it was not searched. Instead, locals waited at the entrance in the evening with spikey rattan stems tied to a pole with which they entangled the bats as they exited the sinkhole.

#### **3.3.3.3.4. Local Informant Interviews**

Although interviews were conducted at the TSF sites and sites 4 and 5, data collected were not reliable; therefore, they are not reported here.

#### **3.3.3.4. Birds**

Five methods: call playback, forest walks, point count, camera traps and local informant interviews were used to survey the birds at all sites (Figure 5). Several birds were also detected on the camera traps at Site 3.



#### LEGEND

- Ok Tedi Mine site
- Village
- Terrestrial ecology survey site
- Mist net / bat detector site
- Road
- Track
- Watercourse
- International border
- Proposed infrastructure corridor
- Proposed TSF footprint



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SOURCE  
Terrestrial biodiversity sampling sites from Ecomate.  
Proposed infrastructure from KCB and OTML.  
Topographic features from OSM. Admin boundary from NSO.  
DEM from SRTM. Imagery from ESRI.

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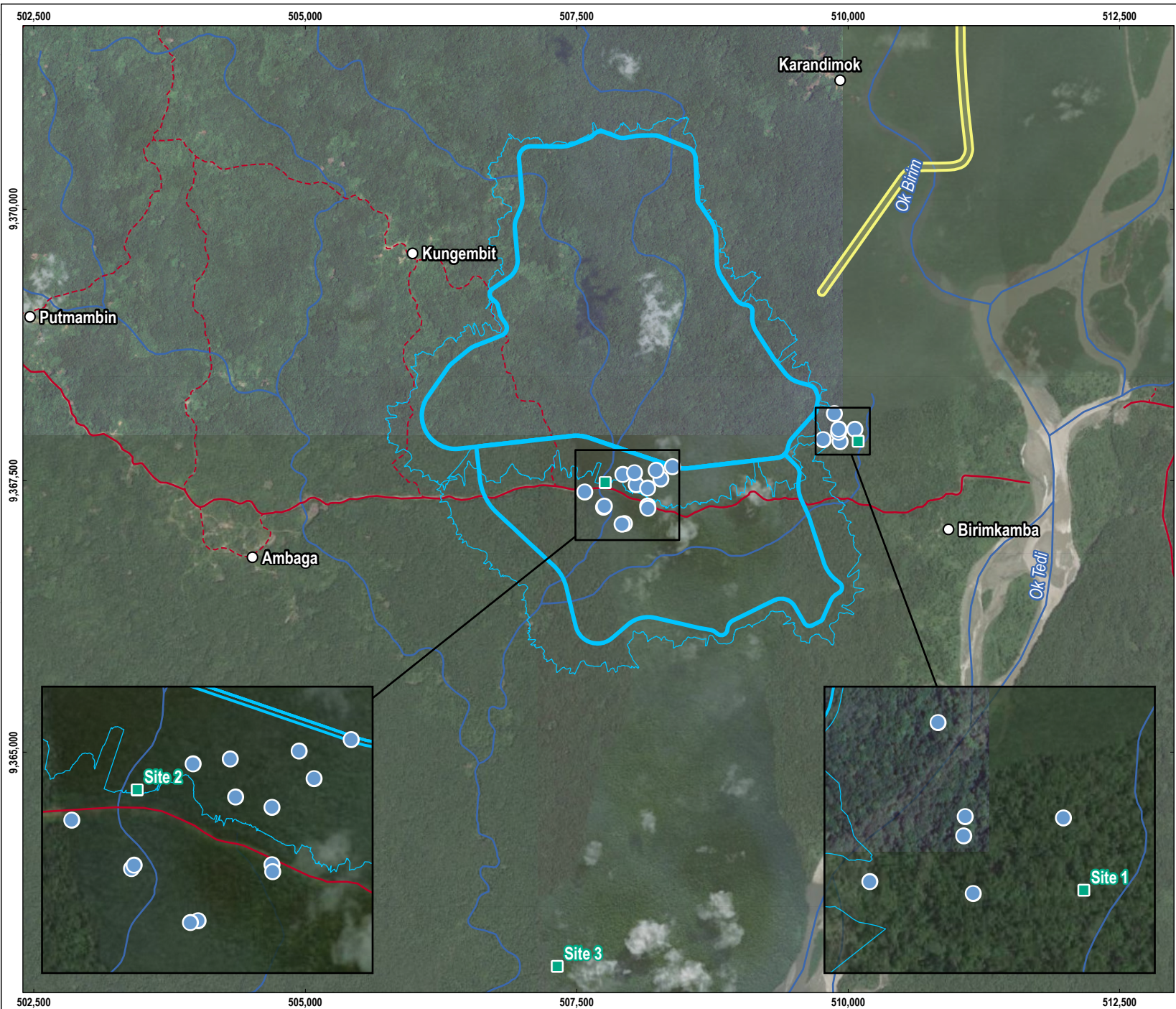
#### FIGURE 4

Map showing locations where mist-net and bat detectors were used



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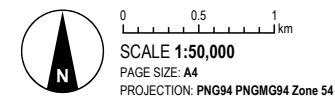
DATE: 25.05.26 PROJECT: 754-MELN374244 FILE: 374244\_TS06\_F004\_GIS



## LEGEND

- Village  
 ■ Terrestrial ecology survey site  
 ● Bird survey point  
 - - - Track  
 — Road  
 — Watercourse  
 ■ Proposed infrastructure corridor  
 ■ Proposed TSF footprint

**SOURCE**  
Terrestrial biodiversity sampling sites from Ecomate.  
Proposed infrastructure from KCB and OTML.  
Topographic features from OSM. Admin boundary from NSO.  
DEM from SRTM. Imagery from ESRI.



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**FIGURE 5**

**Map showing bird survey points in the TSF footprint**



DATE: 11.06.26 PROJECT: 754-MELEN374244 FILE: 374244C TS06 F005 GIS

#### **3.3.3.4.1. Call Recording and Playback**

A wildlife acoustic song meter (SM3 Bioacoustics) was used to record calls. The recorder was tied to a tree ~1–2 m above the ground (Plate 3a). At sites 1 and 2, the song meter recorded for 12 hours each day, before it was moved to a new location the next day. The song meter was left in the forest from 6:00 am–6:00 pm for the duration of the field days. At sites 4 and 5, the song meter was set up on one location and recorded for 48 hours non-stop until the last day of field day at each site. Calls were replayed and birds were identified to species.

#### **3.3.3.4.2. Forest Walks**

Random walks were done to record birds from calls or spot the birds. This method serves as a backup for call records and point counts. The random walks were done every afternoon from 1:00–5:00 pm at sites 1 and 2 and from 1:30–5:30 pm at Sites 4 and 5. Binoculars were used in spotting the birds. Birds of New Guinea bird guide book was also used to confirm the species (Pratt & Beehler 2015).

#### **3.3.3.4.3. Point Counts**

At sites 1 and 2, five point count stations were established at 150 m intervals on a track at each site. Between 6.30–9.40 am, 5 to 15 minutes were spent at each spot and every bird species seen or heard was recorded. At sites 4 and 5, seven stations were established at 150 m intervals.

#### **3.3.3.4.4. Camera Trapping**

A number of images of birds were captured on the camera traps that were set for non-volant mammals. Birds photographed during Survey 1 were identified using Pratt & Beehler (2015), while those from Survey 2 were identified by Iain Woxvold.

#### **3.3.3.4.5. Local Informant Interview**

The two local assistants and other informants at each site were shown pictures of birds in New Guinea bird guide (Pratt & Beehler, 2015) and were asked to identify birds occurring in the TSF foot print area (Plate 3c).



**Plate 3. Survey of birds at Site 1 and Site 2. Inspecting song recorder at night by two local assistants (a), King Bird of Paradise (*Cicinnurus regius*) (b) and Bonny Koane interviewing two local assistants (c). Photographs a, b by Bonny Koane, Photograph c by Enock Kale.**

### **3.3.3.5. Herpetofauna**

Herpetofauna surveys were conducted for three full days (9<sup>th</sup> to 11<sup>th</sup> August 2025) with an extra night of bioacoustic recorders (BAR) recording (8<sup>th</sup> August) at site 1 and for seven days and nights (13<sup>th</sup> to 19<sup>th</sup> August 2025) at site 2 (Figure 6). Detailed descriptions of the habitats of both sites and including Sites 4 and 5 are provided in Section 4.1.

#### **3.3.3.5.1. Active Searches**

A minimum of two searchers were involved in every survey. Field methods followed standard protocols established and accepted for Rapid Biological Assessments in New Guinea (Richards & Dahl 2011; Catenazzi et al. 2016). Records from opportunistic collections by other team members, local assistants and villagers were also incorporated. Intensive searches for frogs and reptiles were conducted along the trails illustrated in Figures 6. During the day, searches focused on heliothermic (basking) reptiles along trails through forest, clearings, along streams and riverbanks where small lizards were collected by hand or were stunned with a large rubber band. Large lizards and snakes were collected by hand. Non-basking reptiles were sampled by searching in deeply shaded forest, during rain or at dusk. Nocturnal reptiles, including geckos and snakes were detected by walking along forest trails at night with a headlamp.

Frogs were sampled at night by conducting visual-encounter and aural surveys along the same forest trails and at all accessible aquatic habitats. Waterbodies examined included seepages, small closed-canopy streams, larger streams, pools and flooded ditches. Because a large proportion of New Guinean frogs have life cycles that are independent of free-standing water (Anstis et al. 2011), extensive visual and aural searches along trails in forest away from water were conducted. Identification of frogs observed but not captured was enhanced by recording of calls. Frog calls are an important diagnostic character that assists greatly with species identification so whenever possible the advertisement calls of frogs were recorded with an Edirol R09 Solid-state Recorder and Rode directional microphone.

#### **3.3.3.5.2. Bioacoustic Recorders**

One or two automated bioacoustic recorder units (BARs, Frontier Labs) were deployed each night for eight nights during Survey 1 and for nine nights during Survey 2. These recorded sounds continuously throughout each 24-hour sampling period. To sample the widest area/array of habitats, BARs were left in position for one night before being moved to a new position (Plate 4). Recordings were collected for screening later.

Sound recordings were later screened for frog calls using Adobe Audition software. For each 24-hour recording period at each recording position, we analysed the five 1-hour sound files starting at (or closest to) 7: 00 pm to 11: 00 pm inclusive (recording time 7: 00 pm to 12: 00 am). The entire 60 minutes of each of the sound files was scanned visually in 30 s blocks noting the presence/absence of calls for each species. A total of 55 hours of audio recordings was analysed.

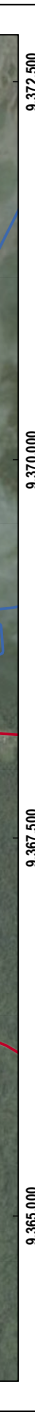
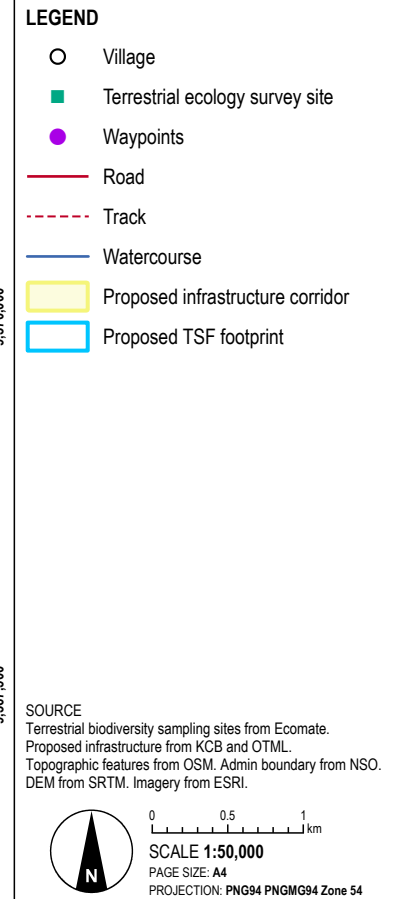


**FIGURE 6**  
Herpetofauna survey locations within the proposed TSF footprint





**Plate 4. Clifford Yae setting bioacoustic recorder units (BARs) to record frog calls.**  
Photograph by Enock Kale.

#### **3.3.3.5.3. Local Informant Interviews**

Direct observations were supplemented with data gathered during conversations with local informants who were assisting the biodiversity survey team. Although these supplemental data provided some useful information on the distribution and status of several conservation significant species not otherwise recorded during the surveys, it was apparent from responses by informants when asked to identify photographs of herpetofauna species from various localities in southern PNG that much of the information that they provided was unreliable. Results of these interviews are therefore not presented unless additional information was provided by informants to support their identifications.

#### **3.3.3.5.4. Voucher Material**

A small number of specimens was preserved as museum vouchers for subsequent examination to properly identify taxonomically difficult species. Specimens required for vouchers were euthanized using internationally recommended techniques; by submersion in chlorotone for frogs (McDiarmid 1994) or with lethal injection of chlorotone for reptiles (Barry 2012). Specimens were fixed in 10% formalin solution and then stored in 70% ethanol. Tissue samples for DNA analyses were also extracted from voucher specimens and stored in 95% ethanol. Voucher specimens will be exported under permit from the PNG Conservation and Environment Protection Authority (CEPA) to confirm identifications and will subsequently be deposited in the PNG National Museum and the South Australian Museum, Australia.

### 3.3.3.6. Odonata

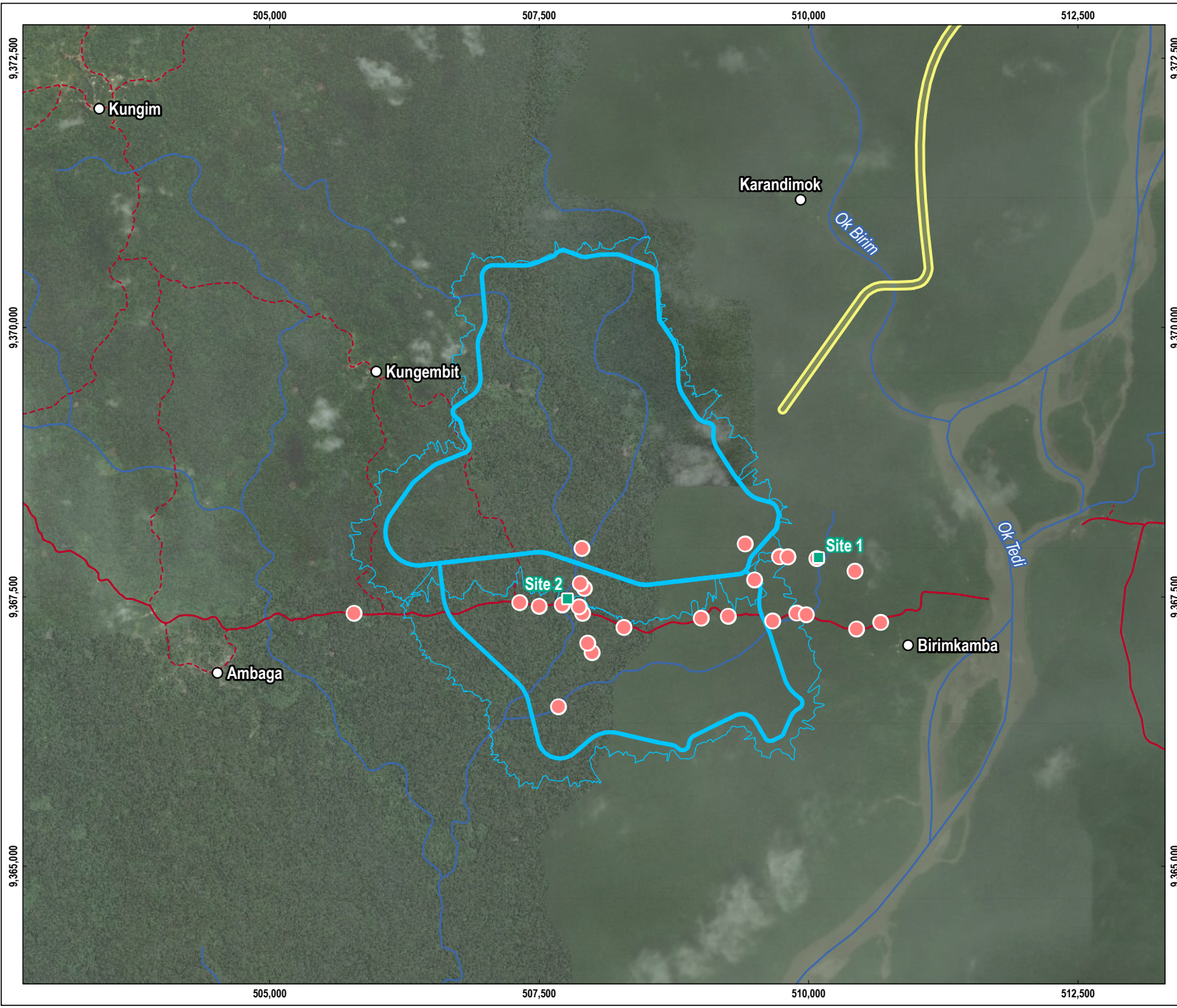
The Odonata of New Guinea remains poorly known and many groups of dragonflies and damselflies have recently undergone substantial taxonomic revisions. Particularly problematic groups include ‘flatwing’ damselflies of the family Argiolestidae (e.g. Kalkman et al. 2010; Kalkman & Richards 2023) and libellulid dragonflies of the genus *Diplacina* (Michalski 2012). In some cases, it is not possible to assign an established name to a species encountered during the surveys. The term ‘dragonfly’ is commonly used in two different ways in the literature: either to denote the entire order Odonata (including both dragonflies and damselflies), or to denote only the sub-order Anisoptera, or ‘True Dragonflies’, excluding the sub-order Zygoptera or ‘Damselflies’. The term ‘odonate’ is used throughout this report to indicate the entire order, including both dragonflies and damselflies. The term ‘dragonfly’ and ‘damselfly’ are used in the specific sense to indicate these respective subfamilies.

Odonate surveys were conducted for three full days (9<sup>th</sup> to 11<sup>th</sup> August 2025) at site 1, for seven days (13<sup>th</sup> to 19<sup>th</sup> August 2025) at site 2, for four days (27<sup>th</sup> to 30<sup>th</sup> November 2025) at Site 4 and for 5 days (05<sup>th</sup> to 09<sup>th</sup> December 2025) at Site 5. The primary breeding habitat of each species (when known) at Ok Birim was recorded, based on Michalski (2012), Kalkman & Orr (2013), Orr & Kalkman (2015) and field observations. Four breeding habitats were recognised: 1) ponds and ditches (permanent and temporary), 2) streams, 3) rivers and 4) tree hollows. Detailed descriptions of the habitats at all sites are provided in Section 4.1 (Figure 7).

#### 3.3.3.6.3. Active Searches

Active searches for adult Odonata were conducted from early morning to late afternoon, to encompass the range of flight times exhibited by different species. A team of 2–3 searchers conducted intensive searches for dragonflies and damselflies along small tracks through forest, in forest clearings and along larger access tracks (Figure 7). All available waterbodies including forest pools, small and larger streams, roadside ditches and swamps were surveyed (Plate 5a, b). Adults were captured with long-handled insect nets for closer examination. Representative voucher specimens were soaked in Acetone, dried, labelled and retained in glassine envelopes for subsequent examination and identification (Plate 5c).

Larval Odonata were not targeted during this study because the larvae of most New Guinean taxa remain unknown. Larvae are predaceous and providing sufficient prey to rear individuals to metamorphosis for identification in the field would have been labour intensive and based on studies of other tropical species, development rates of most species encountered would have been too slow to permit successful rearing in the field.



- LEGEND**
- Village
  - Terrestrial ecology survey site
  - Odonate survey point
  - Road
  - - - Track
  - Watercourse
  - Proposed infrastructure corridor
  - Proposed TSF footprint

**SOURCE**  
Terrestrial biodiversity sampling sites from Ecomate.  
Proposed infrastructure from KCB and OTML.  
Topographic features from OSM. Admin boundary from NSO.  
DEM from SRTM. Imagery from ESRI.

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**FIGURE 7**  
**Survey points for Odonates**



#### 3.3.3.6.4. Local Informant Interviews

There are no odonate species of cultural or dietary significance in PNG so local informants were unable to provide additional information about the local fauna.

#### 3.3.3.6.5. Voucher Material

To properly identify taxonomically difficult species, a subset of specimens was preserved as museum vouchers for subsequent examination. Specimens were fixed in acetone and stored in glassine envelopes in plastic boxes containing naphthalene to prevent mould and deterioration (Plate 5c). Voucher specimens were subsequently examined at the New Guinea Binatang Research Centre laboratory in Madang and some problematic taxa were exported to South Australian Museum for further examination under PNG Conservation and Environment Protection Authority (CEPA) Export Permit # 026098. Representative samples will be deposited in the South Australian Museum, Australia and in PNG at NGBRC.

### 3.4. Conventions Used

#### 3.4.1. Sources for Taxonomy and Nomenclature

Nomenclature follows the following sources:

- Flora—IUCN (2025).
- Mammals—IUCN (2025)
- Birds—The International Ornithological Congress (IOC) World Bird List version 15.1 (Gill et al. 2025).
- Herpetofauna—IUCN (2025), or latest relevant literature, including recent species descriptions, where Not Evaluated by the IUCN).

Where species have well established common (English) names, the scientific name appears with the common name on first mention in the text and only the common name is used thereafter. For species with no common name (e.g., most herpetofauna) the scientific name is used exclusively.

Unsettled taxonomies (common among New Guinean biota) or insufficient field data sometimes preclude the identification of taxa to species level. In this report:

- Where a species could not be identified, the genus name is followed by the abbreviation 'sp.' (or 'spp.' for plural); for example, '*Emoia* sp.'. Where multiple unidentified species are recorded in the same genus, they are distinguished by an alphabetical sequence identifier; for example, *Emoia* sp. A, *Emoia* sp. B.
- Where a species' identity is known but it is scientifically undescribed, the genus name is followed by 'sp. 1', 'sp. 2' etc.; for example, '*Oreophryne* sp. 1'.
- Where a taxon is known to be part of a 'species complex' whose component species remain obscure due to taxonomic uncertainty, the abbreviations 'sp. cf.' appear between the genus and (currently too broadly applied) species name; for example, '*Litoria* sp. cf. *arfakiana*'.

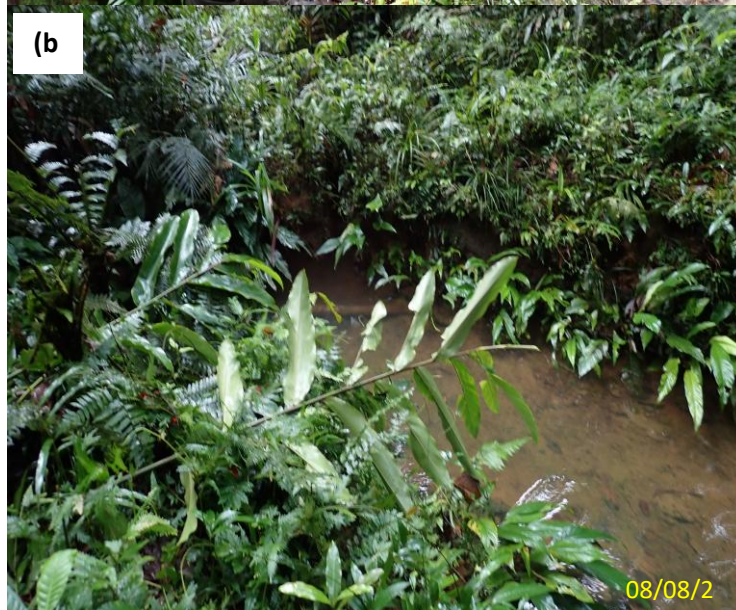


**Plate 5. Odonate sampling in the field. Fidelis Kimbeng and assistant searching for the odonates (a), stream habitat for poorly known damselfly at Site 1 and Fidelis preparing the odonates for museum voucher specimens (c). Photographs by Enock Kale.**

### **3.4.2. Species of Conservation Significance**

Species of conservation significance considered in this report include IUCN listed species in categories higher than Least Concern, nationally protected fauna and species new to science or undescribed species. IUCN listed and nationally protected species are collectively referred to as 'conservation listed' species.

### **3.4.3. IUCN Listed Species**

The conservation status of flora and fauna encountered during the baseline surveys was taken from the IUCN Red List of Threatened Species (IUCN 2025). Species defined as 'IUCN listed' in this report include all taxa evaluated under the IUCN Red List and assigned a conservation ranking above 'Least Concern' (LC). Their abbreviated codes mentioned subsequently in the text are, in descending order of threat/conservation priority:

- Threatened, including:
  - Critically Endangered (CR)
  - Endangered (EN)
  - Vulnerable (VU)
- Near Threatened (NT)

#### **3.4.3.1. Data Deficient (DD)**

Species encountered during the field surveys that have not been assessed by the IUCN are listed as 'Not Evaluated' (NE).

#### **3.4.3.2. Nationally Protected Species**

Species of national conservation significance include fauna listed as Protected (P) under the Papua New Guinea Fauna (Protection & Control) Act 1962. The list of nationally Protected species was obtained from Kula and George (1996). No flora species are protected under PNG law. The status of previously Protected species in PNG is ambiguous under the new PNG Protected Areas Act 2024, but we take the precautionary approach and consider these species to be Protected until this ambiguity is resolved.

#### **3.4.3.3. Undescribed (UN) or New to Science (NTS)**

Species that are potentially new to science and known but yet to be described species may have small local distributions and therefore be of conservation concern.

## **4. Results**

### **4.1. Vegetation**

The characterisation of vegetation and habitat condition of the proposed TSF footprint covers Site 1 and Site 2 (Figure 8). Site 3 was not characterised because it was not visited by the botany team, only camera traps were employed there when the survey team had

demobbed from the project area. Vegetation and habitat condition descriptions for Site 4 and Site 5 are also included for the proposed pipeline access road corridor.

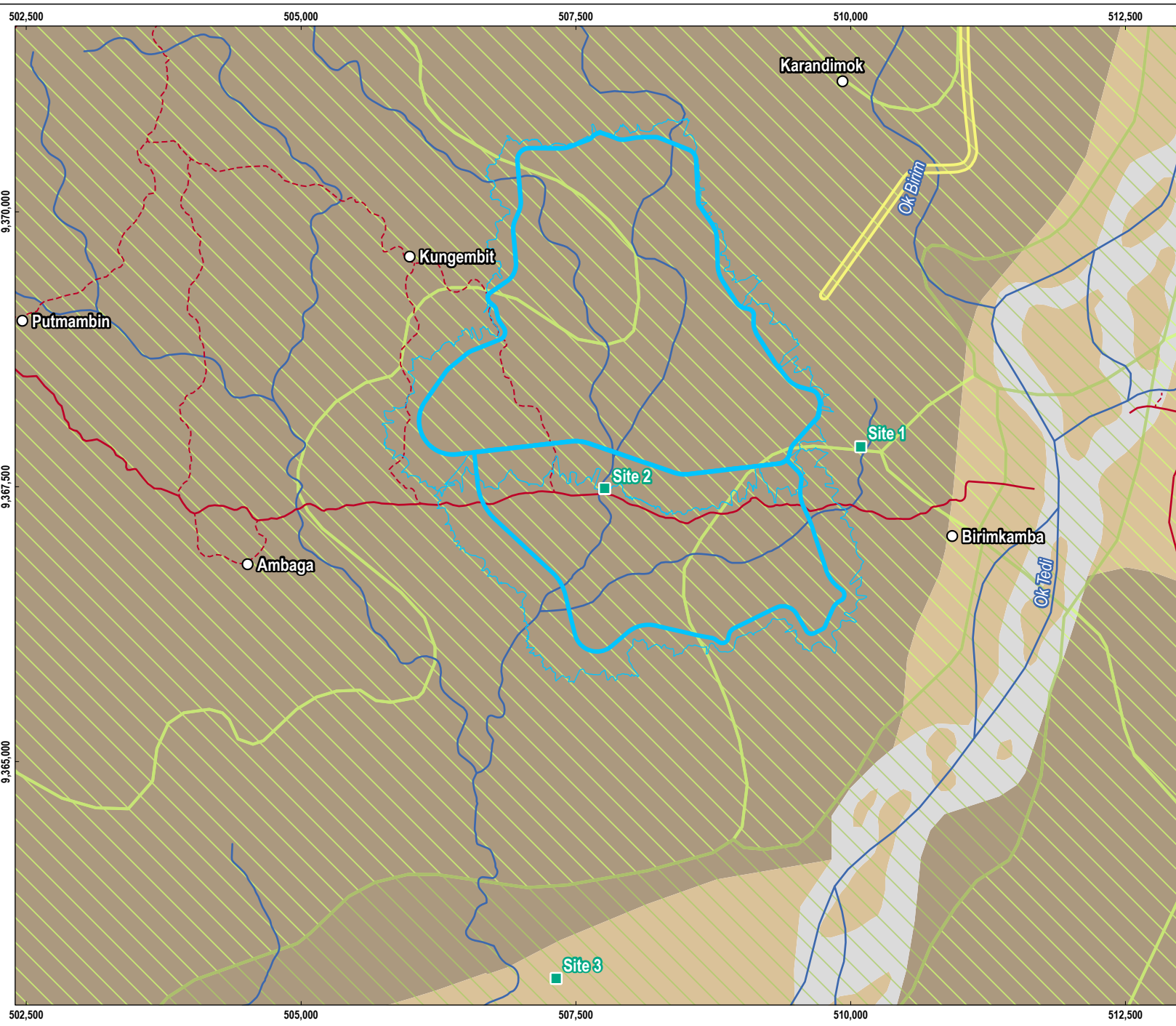
The TSF footprint consists of a FIMS complex of Medium Crowned Forest and Small Crowned Forest (Hm/Hs) that is intact for the most part but disturbed to an extent (Hm9/Hs9) in the central parts. The eastern margin of the proposed TSF footprint is gently sloping terrain, foothills and lower ridgelines with trees reaching heights of 25–30 m and with a moderately closed canopy (60–80% cover). The forest is structurally uniform with limited emergent development and a moderately developed understory supporting regenerating woody species and herbaceous plants. The canopy is dominated by *Vatica*, but the forest also supports a diverse assemblage of mixed species depending on microtopographic position. Along the plains and lower hills, common co-dominants include *Lithocarpus*, *Elaeocarpus*, *Cryptocarya* and *Syzygium*. These species are typically associated with deeper soils and more stable moisture regimes. On ridgelines and upper slopes, the forest shifts toward heavier representation of *Hopea* and *Anisoptera*, which dominate the canopy and often form emergents. These taxa are adapted to thinner soils, more exposed conditions and their presence reflects the edaphic and structural gradients within the Hm/Hs forest type.

The central and southern portions of the proposed TSF footprint are more variable and crown widths range from 4–15 m with canopy density fluctuating relating to disturbance, with patches of denser cover interspersed with more open areas. This area has a more diverse mix of taxa include *Elaeocarpus*, *Pometia*, *Sloanea*, *Lithocarpus* and *Eucaloptopsis*, which contribute to canopy layering, lateral crown spread and understory complexity. These species are well adapted to the foothill conditions and often co-occur with *Magnolia*, *Caldcluvia*, *Platea* and *Weinmannia*, further enhancing the floristic richness of this unit.

#### **4.1.1. Site 1—Vegetation Description**

##### **4.1.1.1. Vegetation Structure on Small Ridges and Undulating Slopes**

The topography of Site 1 is made up of small ridges and undulating slopes. A track connecting Kungembit to Birimkamba villages runs through the forest, which enabled systematic sampling along the small ridges and undulating slopes that extends from the eastern margin of the TSF footprint toward the west and to the north west. The forest at Site 1 is vertically stratified into four distinct layers; canopy, understory, shrub and ground layers.



#### LEGEND

- Village
- Terrestrial ecology survey site
- Road
- - - Track
- Watercourse
- Proposed infrastructure corridor
- Proposed TSF footprint

#### FIM vegetation group

- Low Altitude Forest on Uplands (below 1000m)
- Low Altitude Forest on Plains and Fans (below 1000m)

#### Geology

- Mixed or undifferentiated sedimentary
- Alluvial deposits
- Unclassified

**SOURCE**  
 Vegetation from FIMs. Geology from PNGRIS.  
 Proposed infrastructure from KCB and OTML.  
 Topographic features from OSM. Admin boundary from NSO.  
 DEM from SRTM. Imagery from ESRI.



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#### FIGURE 8

**Vegetation and geological units across the proposed TSF footprint**



DATE: 11.06.2024 PROJECT: 754-MELN374244 FILE: 374244C\_T006\_F008\_GIS

The canopy layer reaches heights of 25–30 m and is moderately closed. It is dominated by species such as *Vatica*, *Tristaniopsis*, *Lithocarpus*, *Elaeocarpus*, *Cryptocarya*, *Paratemon* and *Syzygium* across the plains and lower slopes. Emergents like *Hopea* and *Anisoptera* are prominent along ridgelines, reflecting adaptation to thinner soils and exposed conditions. Most canopy trees have diameters at breast height (DBH) below 50 cm, with occasional larger specimens contributing to vertical complexity (Plate 6). Beneath the canopy, is a rich assemblage of mid-storey trees and saplings. Key species include *Garcinia*, *Cryptocarya*, *Myristica*, *Alstonia*, *Aglaia*, *Flindersia*, *Melicope*, *Ganophyllum*, *Pimelodendron* and *Canarium*. The shrub layer comprises a diverse mixture of shade tolerant and gap adapted species such as *Horsfieldia*, *Randia*, *Ryparosa*, *Amaracarpus*, *Lasianthus*, *Symplocos*, *Syzygium* and *Pouteria*. These species occupy the lower vertical strata and are especially abundant along slope bases and transitional microhabitats. At ground level, the forest floor supports a rich herbaceous layer. Dominant taxa include *Elatostema*, *Curculigo*, *Selaginella*, *Cyperus*, *Cyrtosperma*, *Homalomena*, *Alpinia*, *Etlingera*, *Blechnum*, *Cyrtandra*, *Calanthe*, *Pandanus* and *Dianella*.



**Plate 6. Vegetation on small ridges and undulating slopes at Site 1.** Photograph by Penniel Lamei.

#### **4.1.1.2. Plains and Riverine Vegetation**

Within Site 1, a distinct habitat type occurs - low-lying plains and riverine corridors characterized by a moderately open canopy reaching heights of 15–20 m, with dominant tree species such as *Vatica* and *Elaeocarpus* forming the upper layer. The forest structure here is less vertically complex than adjacent ridged terrain, allowing light to penetrate the understorey.

Scattered throughout these plains are small, irregularly shaped patches of sago swamp, ranging in size from approximately 10 × 10 m–20 × 30 m (Plate 7a). These swamp pockets are ecologically rich and visually distinct, often occurring along drainage lines just below the ridge crests. They are fringed by water-tolerant species such as *Camposperma*, *Gmelina*, *Glochidion*, *Pongamia* and *Dillenia*, which dominate the canopy and mid-storey layers within these saturated zones. The swamp floor is carpeted with typical ferns and carnivorous plants, including *Stenochlaena* and *Nepenthes*, which thrive in the humid, nutrient-poor conditions. The adjacent riverine habitats are frequently flooded and are dominated by *Etlingera*, *Elatostema*, *Calamus*, *Aglaomena*, *Pandanus* and a newly recorded *Begonia* sp. (Plate 7b).



**Plate 7. Typical plain and riverine vegetation at Site 1. A small sago patch on a plain (a) and typical inundated forest floor along the riverine habitat with *Calamus*, *Aglaomena*, *Pandanus* and *Stenochlaena* (b). Photographs by Penniel Lamei.**

#### **4.1.2. Site 2—Vegetation Description**

##### **4.1.2.1. Riverine and Gullies**

The vegetation at Site 2 exhibits a mixed forest composition characterised by a dominant presence of *Vatica* species, forming a canopy that reaches heights of approximately 25–30

m. The forest is stratified into three distinct layers. The upper canopy layer is primarily composed of *Vatica*, *Campnosperma*, *Pouteria*, and *Tristania*, creating a dense and continuous overhead cover. Beneath this, the understorey layer features a rich assemblage of species including *Myristica*, *Lithocarpus*, *Canarium*, *Weinmannia*, *Elaeocarpus*, *Cryptocarya*, *Paratemon* and *Flindersia*.

The shrub layer in this unit is rich (Plate 8). Dominant shrub taxa include *Antidesma*, *Aporosa*, *Barringtonia*, *Garcinia*, *Horsfieldia*, *Myristica* and *Licuala* palms. These species are typically shade-tolerant and thrive under the filtered light conditions created by the moderately open canopy above. *Barringtonia* and *Licuala* are especially common in moist depressions and along drainage lines while *Antidesma* and *Aporosa* form thickets along gentle slopes and ridge flanks. *Garcinia*, *Horsfieldia* and *Myristica* contribute to both shrub and lower canopy layers, often bridging the vertical gap between understorey and emergent crowns.

Common herbaceous species include *Curculigo*, *Phrynium*, *Alsophila* (tree ferns), *Alpinia*, *Riedelia*, *Dianella* and a newly recorded species, *Begonia* sp. 2 nov. The *Begonia* sp. nov. appears to be locally restricted to shaded riparian zones and is especially common along riverine banks, which form a continuous ground cover in shaded, humid pockets. These herbs are particularly abundant in areas where the shrub layer moderates light and moisture.

The interaction between shrub and herb layers in Hm9/Hs9 reflects a classic FIMS defined forest dynamic where vertical layering and species mixing are shaped by topographic variation and canopy openness. At Site 1, this layering is especially pronounced along small ridges and transitional slopes, contributing to the site's overall ecological diversity and resilience.

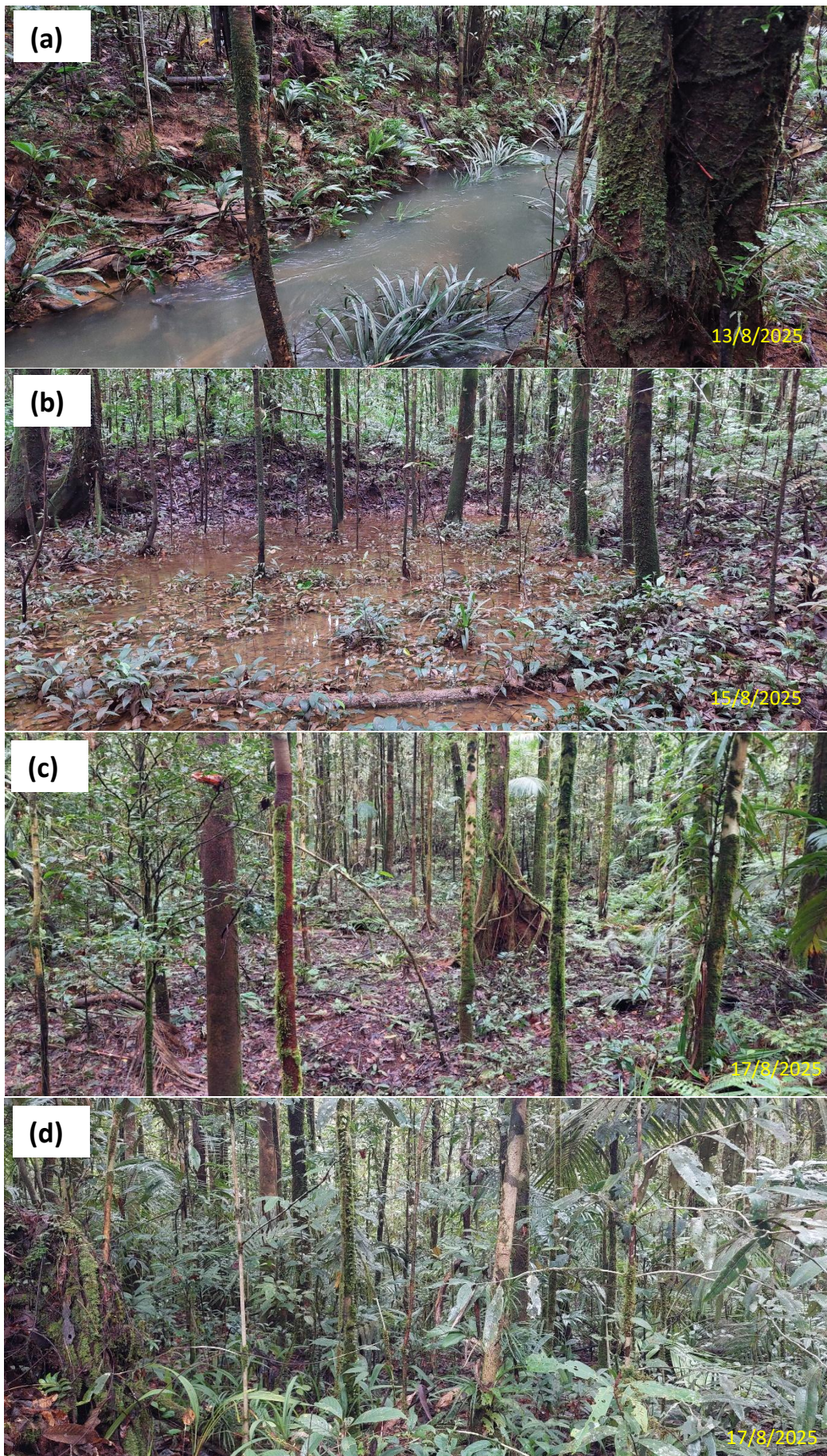


**Plate 8. Vegetation types at Site 2. Riverine vegetation along streams (a, b), vegetation along flooded riverine plain (c), dense vegetation of the shrub layer and herbaceous community (d). Photographs by Penniel Lamei.**

#### 4.1.3. Site 4—Vegetation Description

The forest at Site 4 is tall and well-developed covering an altitude of 120 to 200 m AMSL. The canopy height is about 25 m and emergent trees rise above 30 m. General observations confirm the presence of buttress trees, moss cover between 50 and 70 percent of tree bark. Large lianas such as *Uncaria lanosa* are absent, leaving the canopy uncluttered. The overall impression is of an old, undisturbed forest with strong vertical layering and intact structure.

The canopy is moderately closed and dominated by trees such as *Pometia pinnata*, *Aglaia*, *Endiandra*, *Cryptocarya*, *Helicia*, *Celtis philippensis*, *Glochidion*, and *Epicharis parasitica*. The emergents like *Octomeles sumatrana* and *Litsea*, clusters of *Vatica rassak* and *Hopea similis*, formed distinctive patches. The mid-canopy is dense and diverse, with species such as *Semecarpus magnificus*, *Myristica subalulata*, *Dysoxylum* spp, *Cryptocarya* spp, *Chisocheton* spp, *Dillenia papuana*, and *Canarium acutifolium*. The shrub layer is mixed, with *Calamus* spp, *Bambusa* sp, *Dracaena angustifolia*, *Garcinia* sp, *Ceodes longirostris*, *Osmoxylon* sp and *Orania lauterbachiana*. At ground level, the forest floor is shaded and moist, dominated by *Selaginella* sp, *Curculigo erecta* and numerous seedlings of larger trees.

#### 4.1.4. Site 5—Vegetation Description

The topography of Site 5 is characterized by small ridges with the forest vertically stratified into canopy, mid-storey, shrub, and ground layers. The survey covered four locations across an altitudinal range of 550 to 600 AMSL. The canopy reaches 30–35 m and is moderately closed, dominated by species of *Dysoxylum*, *Aglaia*, *Melicope*, *Planchonella* and *Lithocarpus* with fewer emergent such as *Syzygium* with DBH greater than one meter diameter. The mid-storey is dense with *Timonius*, *Pimelodendron amboinicum*, *Garcinia latissima*, *Camptosperma brevipetiolatum*, *Elaeocarpus* spp, *Aglaia sylvestris*, and *Myristica* spp, contributing to vertical complexity and dominance. The shrub layer is rich with *Polyalthia longirostris*, *Popowia pisocarpa*, *Osmoxylon novoguineense*, *Harpullia rhachipter*, *Tasmannia piperita*, etc. Among the shrubs is IUCN Data Deficient *Goniothalamus impricatus*, which was detected in all survey locations at Site 5 that highlights conservation importance of the site. Tree fern, *Cyathea contaminans* which are widespread and locally valued for food by the locals. The density of shrubs from secondary growth in some locations are dominated from species such as, *Averrhoa bilimbi*, *Pittosporum* sp., *Casearia* sp., and *Saurauia conferta* which are consistent with the mixed composition and varying type and condition often seen in Large/Medium Crowned Forests. The forest floor is shaded, moist and supports a dense herbaceous layer of *Selaginella*, *Curculigo recurvata*, *Pteris orientalis* and *Dianella ensifolia*. Moss cover is heavy on tree branches and epiphytic plants such as *Freycinetia* are common on canopy branches. Liana such as *Uncaria lanosa* are common and few have climbed into the crowns, adding further structural diversity.

#### 4.1.5. Infrastructure Tax Credit Scheme (ITCS) Road Vegetation

The ITCS extends from Alice Pit area, crosses the Ok Tedi and connects to the proposed TSF footprint, traversing a landscape originally dominated by Hm9/Hs9 forest vegetation. Current conditions reflect secondary disturbance with the ITCS road now gravelled and flanked by narrow strips of regenerating vegetation (Plate 9a). Disturbance is largely confined to the immediate road corridor with minor encroachment into adjacent primary forest stands, mostly by small food gardens maintained by the local communities.

The secondary vegetation along the road margins is dominated by fast-growing pioneer tree species such as *Macaranga*, *Mallotus*, *Trichospermum* and *Trema*, which form a loosely structured canopy reaching 10 to 15 m in height.

The dominant weed species along the ITCS road corridor is *Decalobanthus peltatus* (formerly *Merremia peltata*), a fast-growing vine commonly associated with secondary regrowth and disturbed forest margins (Plate 9b). *Decalobanthus peltatus* tends to colonize open, sunlit areas created by road maintenance where it climbs over pioneer trees and shrubs such as *Macaranga*, *Mallotus*, *Trichospermum* and *Trema*. While visually prominent, its presence is largely confined to the road edge and does not appear to be encroaching into intact forest patches. In some sections, *D. peltatus* forms dense mats over regenerating vegetation, suppressing vertical growth and delaying canopy closure. However, two isolated occurrences of high priority P1-listed weed; *Piper aduncum* were recorded along the road edges (Plate 9c). These occurrences did not show signs of active spread or infestation into adjacent forest stands. No other P1 weed species were observed and there is currently no visible evidence of *P. aduncum* forming dense thickets or displacing native vegetation within the corridor.

Despite these localized weed occurrences, the broader vegetation structure along the road corridor remains ecologically intact. The primary forest adjacent to the road continues to support layered canopy and understorey composition typical of Site 1 and 2.



**Plate 9. Gravelling of tax credit scheme road (a), invasive weeds, P1-listed *Piper aduncum* (b) and *Decalobanthus peltatus* (c) growing along the road. Photographs by Penniel Lamei.**

## **4.2. Flora**

### **4.2.1. Species Diversity**

Six hundred and thirty- eight plant species in 113 families were recorded (Appendix 1). Sites 1 and 2 had more species (314, 330 species respectively) than sites 4 and 5 (195, 138 species

respectively). One hundred and sixteen species were documented from Site 1 only, 103 species from Site 2 only, 78 species from Site 4 only and 59 species from Site 5 only. Vascular plant families were the most speciose with highest species diversity in Myrtaceae (46 species). Rubiaceae (45 species) and Lauraceae contributing 46, 45 and 31 species respectively. A single genus; *Syzygium* in Myrtaceae contributed the most species with 23 species; 18 species in Site 1, 11 species in Site 2, 14 species in Site 4 and 14 species in Site 5. The family Moraceae was not speciose in comparison; however, the genus *Ficus* contributed 26 species; eight species in Sites 1, nine species in Site 2, 14 species in Site 4 and 6 species in Site 5.

#### 4.2.2. Significant Habitat

Within the low-lying plains and drainage corridors of the proposed TSF footprint are small, irregularly shaped patches of sago palms (*Metroxylon sagu*) ranging in size from approximately 10 × 10 m–20 × 30 m (Plate 10). These swamp pockets are ecologically rich and visually distinct, often occurring just below ridge crests or along seasonal watercourses. While botanically notable for their hydrophilic flora, these sago stands hold deeper cultural significance. Many were intentionally planted by the grandparents of local communities and continue to be harvested as a staple food source. Their fronds are used for roofing and walling and their starch-rich trunks are processed for daily sustenance. The surrounding vegetation includes water-tolerant canopy and mid-storey species such as *Camposperma*, *Gmelina*, *Glochidion*, *Pongamia*, and *Dillenia* while the swamp floor supports ferns (*Stenochlaena*) and carnivorous plants (*Nepenthes*). No significant forest habitats were observed at Sites 4 and 5.



**Plate 10. Small patch of sago palms planted along drainage corridors and streams in Ok Birim proposed TSF. Sago is an important source of food and building materials for local communities. Photograph by Penniel Lamei.**

#### 4.3. Non-volant Mammals

##### 4.3.1. Survey Efforts

Survey effort at all sites is shown in Table 5.

**Table 5. Survey efforts for non-volant mammals.**

| Site         | Number of days | Elliott trap-nights | Snap trap nights | Camera trap-nights | Bandicoot trap nights | Local informants interviewed |
|--------------|----------------|---------------------|------------------|--------------------|-----------------------|------------------------------|
| 1            | 3              | 119                 | -                | 30                 | -                     | 2                            |
| 2            | 6              | 350                 | -                | 60                 | -                     | 2                            |
| 3            | 37             | -                   | -                | 333                | -                     | 0                            |
| 4            | 3              | -                   | 99               | 18                 | -                     | 2                            |
| 5            | 4              | -                   | 228              | 32                 | 12                    | 2                            |
| 5            | 52             | -                   | -                | 416                | -                     | -                            |
| <b>Total</b> | <b>55</b>      | <b>469</b>          | <b>327</b>       | <b>1,800</b>       | <b>12</b>             | <b>8</b>                     |

### 4.3.2. Species Diversity

Twenty-six native species and an additional four domestic, feral or exotic species were documented (Table 6). Most (67%) were recorded from local informant interviews alone. That is, all the 16 native species at Sites 1 and 2 and the 23 native species recorded at Sites 4 and 5 were from local informant interviews. Two common exotic rats (*Rattus rattus* and *Rattus exulans*) were also recorded from local informant interviews from Sites 3, 4 and 5. Elliot and snap traps were generally unsuccessful with no non-volant mammal species caught from Sites 1, 2, 3 and 4. Only two species of rodents (*Melomys rufescens*, *Paramelomys platyops*) were caught from Site 5. Despite very long hours of recording by the camera traps at Sites 3 and 5, only four and six native species were detected respectively. No non-volant mammal images were captured from Sites 1 and 4 (Table 8). Overall, no traps detected any non-volant mammal species at Site 4 although Feather-tailed possum (*Distoechurus pennatus*) was caught at night with a sling shot by one of the assistants (Plate 11a).

The largest number of native non-volant mammal species were recorded from Site 5 followed by Site 1, Site 2 then Site 4 and Site 3 (Table 6). Ten species were detected only at a single site while 16 species were shared among or amongst the sites. Species in Muridae and Paramelidae families were recorded from all the sites including the control site (Site 3). For example, *Uromys caudimaculatus* and *Echymipera kalubu* were recorded from all the sites and seemed to be most abundant as indicated by the high number of independent camera events (Plate 11b,c, Table 7). *Paramelomys* sp., which was found only at Site 5 had the most independent camera images (29).

Three non-volant mammal species of conservation significance (*Dasyurus albopunctatus*, *Dorcopsulus vanheurni* and *Zaglossus bartoni*) were recorded from both surveys 1 and 2. Although *Dorcopsis vanheurni* and *Z. bartoni* were recorded only from local informant interviews and their presence requires confirmation, *D. albopunctatus* was also detected by camera traps (Plate 11d). No other species of conservation significance were encountered. Species accounts for these three species are provided in section 5.1.1.2.2.

**Table 6. List of non-volant mammal species detected from Survey 1 and 2. No animals were captured in Elliot traps and no interviews were done at Site 3. i = interview; ct = camera trap; st = snap trap, c = capture.**

| Family      | Species                                    | Common Name                     | Local name<br>(Yongum language) | IUCN | Site 1 | Site 2 | Site 3 (TSF control) | Site 4 | Site 5 | Detection method |
|-------------|--------------------------------------------|---------------------------------|---------------------------------|------|--------|--------|----------------------|--------|--------|------------------|
| Muridae     | <i>Chiruromys vates</i>                    | Lesser Tree-mouse               | Baming                          | LC   | X      |        |                      |        |        | i                |
| Muridae     | <i>Hydromys chrysogaster</i>               | Common Water-rat                | Baktut                          | LC   | X      | X      |                      |        | X      | i                |
| Muridae     | <i>Melomys leucogaster</i>                 | White-bellied Melomys           | Bakodobik                       | LC   | X      | X      |                      | X      | X      | i                |
| Muridae     | <i>Melomys rufescens</i>                   | Black-tailed Melomys            | Baming                          | LC   | X      |        |                      |        | X      | i,st             |
| Muridae     | <i>Paramelomys platyops</i>                | Lowland Melomys                 | Bayawan                         | LC   | X      |        | X                    | X      | X      | i,ct,st          |
| Muridae     | <i>Paramelomys</i> sp. cf. <i>platyops</i> | Lowland Melomys                 | Bayawan                         | LC   |        |        | X                    |        |        | ct               |
| Muridae     | <i>Uromys caudimaculatus</i>               | Mottled-tailed Giant-rat        | Bowang                          | LC   | X      | X      | X                    | X      | X      | i,ct             |
| Muridae     | <i>Anisomys imitator</i>                   | Uneven-toothed Rat              | Wa'wa                           | LC   |        |        |                      | X      | X      | i                |
| Muridae     | <i>Pogonomys loriae</i>                    | Large Tree-mouse                | Awongwe                         | LC   |        |        |                      |        | X      | i                |
| Muridae     | <i>Xenuromys barbatus</i>                  | Rock-dwelling Giant-rat         | Atiniawong                      | LC   |        |        |                      |        | X      | i                |
| Dasyuridae  | <i>Dasyurus albopunctatus</i>              | New Guinea Quoll                |                                 | NT   |        |        |                      |        | X      | ct               |
| Dasyuridae  | <i>Myoictis wallacei</i>                   | Wallace's Three-striped Dasyure | Biakainon                       | LC   |        |        |                      |        | X      | i,ct             |
| Dasyuridae  | <i>Murexia melanurus</i>                   | Black-tailed Antechinus         |                                 | LC   |        |        |                      |        | X      | i                |
| Dasyuridae  | <i>Murexia longicaudata</i>                | Short-furred Dasyure            | Akokambet                       | LC   |        |        |                      |        | X      | i                |
| Paramelidae | <i>Echymipera kalubu</i>                   | Common Echymipera               | Batyawan                        | LC   | X      | X      | X                    | X      | X      | i,ct             |
| Paramelidae | <i>Echymipera rufescens</i>                | Long-nosed Echymipera           | Bagiat                          | LC   | X      | X      |                      |        | X      | i,ct             |

| Family                                   | Species                        | Common Name                 | Local name<br>(Yongum language) | IUCN | Site 1    | Site 2    | Site 3 (TSF control) | Site 4    | Site 5    | Detection method |
|------------------------------------------|--------------------------------|-----------------------------|---------------------------------|------|-----------|-----------|----------------------|-----------|-----------|------------------|
| Paramelidae                              | <i>Peroryctes raffrayana</i>   | Raffray's Bandicoot         | Lenkon                          | LC   |           |           |                      | X         |           | i                |
| Acrobatidae                              | <i>Distoechurus pennatus</i>   | Feather-tailed Possum       | Badakiap                        | LC   | X         | X         |                      | X         | X         | i,c              |
| Petauridae                               | <i>Dactylopsila trivirgata</i> | Striped Possum              | Badakiap                        | LC   | X         | X         |                      | X         | X         | i                |
| Petauridae                               | <i>Petaurus breviceps</i>      | Sugar Glider                | Baberauk                        | LC   | X         | X         |                      |           | X         | i                |
| Phalangeridae                            | <i>Phalanger gymnotis</i>      | Ground Cuscus               | Badot                           | LC   | X         | X         |                      | X         | X         | i                |
| Phalangeridae                            | <i>Phalanger mimicus</i>       | Southern common cuscus      | Bawun                           | LC   | X         | X         |                      |           |           | i                |
| Phalangeridae                            | <i>Spilocuscus maculatus</i>   | Common Spotted Cuscus       | Bambrim                         | LC   | X         | X         |                      | X         | X         | i                |
| Pseudocheiridae                          | <i>Pseudocheirus canescens</i> | Lowland Ringtail            | Kawunkong                       | LC   | X         |           |                      |           | X         | i                |
| Macropodidae                             | <i>Dorcopsulus vanheurni</i>   | Small Dorcopsis             | Awonuk                          | NT   |           |           |                      |           | X         | i                |
| Tachyglossidae                           | <i>Zaglossus bartoni</i>       | Eastern Long-beaked Echidna | Bambon                          | VU   | X         | X         |                      |           | X         | i                |
| <b>Total native species = 26</b>         |                                |                             |                                 |      | <b>16</b> | <b>12</b> | <b>4</b>             | <b>10</b> | <b>22</b> |                  |
|                                          |                                |                             |                                 |      |           |           |                      |           |           |                  |
| <b>Domesticated/feral/exotic species</b> |                                |                             |                                 |      |           |           |                      |           |           |                  |
| Canidae                                  | <i>Canis familiaris</i>        | Dog                         |                                 | NE   |           | X         |                      |           |           | ct               |
| Muridae                                  | <i>Rattus rattus</i>           | Black Rat                   | Bayawan                         | LC   |           | X         |                      |           | X         | i                |
| Muridae                                  | <i>Rattus exulans</i>          | Pacific Rat/Polynesian rat  |                                 | LC   |           |           |                      | X         | X         | i                |
| Suidae                                   | <i>Sus scrofa</i>              | Pig                         |                                 | LC   |           | X         | X                    |           |           | ct               |
| <b>Total species = 4</b>                 |                                |                             |                                 |      | <b>0</b>  | <b>3</b>  | <b>1</b>             | <b>1</b>  | <b>2</b>  |                  |

**Table 7. Non-volant mammals captured on the camera traps in Sites 1-5. Number in bracket indicates independent events by the camera traps.**

| Family                    | Species                                | Common name                     | Local name<br>(Yongum language) | IUCN | Site 1 (3 nights) | Site 2 (7 nights) | Site 3 (6 nights) | Site 4 (3 nights) | Site 5 (52 nights) |
|---------------------------|----------------------------------------|---------------------------------|---------------------------------|------|-------------------|-------------------|-------------------|-------------------|--------------------|
| Canidae                   | <i>Canis familiaris</i>                | Dog                             |                                 | NE   |                   | X (1)             |                   |                   | x (2)              |
| Muridae                   | <i>Paramelomys</i> cf. <i>platyops</i> | Lowland Mosaic-tailed Rat       | Bayawan                         | LC   |                   |                   | X (3)             |                   |                    |
| Muridae                   | <i>Paramelomys</i> sp(p).              |                                 | Bayawan                         |      |                   |                   |                   |                   | X (29)             |
| Muridae                   | <i>Uromys caudimaculatus</i>           | Giant White-Tailed Rat          | Bowang                          | LC   |                   | X (1)             | X (3)             |                   | X (21)             |
| Dasyuridae                | <i>Murexia</i> sp.                     |                                 |                                 | LC   |                   |                   |                   |                   | X (1)              |
| Dasyuridae                | <i>Myoictis wallacei</i>               | Wallace's Three-striped Dasyure |                                 | LC   |                   |                   |                   |                   | X (10)             |
| Dasyuridae                | <i>Dasyurus albopunctatus</i>          | New Guinea Quoll                |                                 | NT   |                   |                   |                   |                   | X (2)              |
| Paramelidae               | <i>Echymipera kalubu</i>               | Common Echymipera               | Batyawan                        | LC   |                   | X (7)             | X<br>(81)         |                   | X (16)             |
| Paramelidae               | <i>Echymipera rufescens</i>            | Long-nosed Echymipera           | Bagiat                          | LC   |                   |                   |                   |                   | X (1)              |
| Suidae                    | <i>Sus scrofa</i>                      | Pig                             |                                 | LC   |                   | X (2)             | X (6)             |                   | X (4)              |
| <b>Total species = 10</b> |                                        |                                 |                                 |      |                   | <b>4</b>          | <b>4</b>          |                   | <b>9</b>           |



Plate 11. The Feather-tailed possum (*Distoechurus pennatus*) caught by a local assistant at Site 4 (a), two of the four mammals caught on camera trap at Site 3; *Echimypera kalabu* (b) and *Uromys caudimaculatus* (c) and New Guinea Quoll (*Dasyurus albopunctatus*) detected by camera traps at Site 5.

#### 4.4. Bats

##### 4.4.1. Survey Effort

Table 8 shows the survey effort for bats (for calls, see under acoustic analysis section 1.1.4.5.2). One species (*Dobsonia moluccensis*) was captured by the locals with a “whip” made of bush material at Barawokwi cave at Site 5. Six species of bats in two families were captured by mist nets alone and 14 species in five families were identified from their calls (Plate 12). Three species were recorded from both mist net and calls.

Table 8. Mist-net survey hours.

| Site         | Number of days | Number of mist nets | Trapping hours | Mist-net hours |
|--------------|----------------|---------------------|----------------|----------------|
| 1            | 3              | 3                   | 5              | 45             |
| 2            | 6              | 3                   | 5              | 90             |
| 3            | -              | -                   | -              | -              |
| 4            | 3              | 2                   | 5              | 30             |
| 5            | 5              | 2                   | 5              | 50             |
| <b>Total</b> | <b>17</b>      | <b>10</b>           | <b>20</b>      | <b>215</b>     |

#### 4.5.1. Species Diversity

Twenty-four species of bats in six families were detected (Table 9). Many more species (21) were recorded from Site 5 than Sites 1, 2 and 4 (10, 11, 12 species respectively). Five species (*Emballonura diana*, *Emballonura furax*, *Emballonura raffrayana*, *Dobsonia moluccensis*, *Nyctimene albiventer*, *Nyctimene draconilla*) were detected from Site 5 only while one species, *Macroglossus minimus*, was recorded only from Site 4 and two species (*Hipposideros corynophyllus*, *Paranyctimene raptor*) were encountered at Sites 1 and 2 only. Five species (*Mosia nigrescens*, *Aselliscus tricuspidatus*, *Hipposideros diadema*, *Nyctimene albiventer*, *Syconycteris australis*) were encountered at all mist-net survey sites.

#### 4.5.2. Acoustic Analysis

At Sites 1 and 2, bat calls were recorded from 19 sites over 19 recording nights with 158,764 bat detector sound files. At Sites 4 and 5, bat calls were recorded from 16 sites over 16 recording nights with 122,440 bat detector sound files. These efforts detected eight species from Sites 1 and 2 and 14 species from Sites 4 and 5 (Table 9).

Representative echolocation call types are illustrated in Figure 1 of Appendix 2 and Figures 1A and 1B of Appendix 3. Most echolocation call types could be identified and associated with a bat species. The call type 88 mCF has been attributed to the Fly River Leaf-nosed Bat (*Doryrhina muscinus*), but Wollaston's Leaf-nosed Bat (*Hipposideros wollastoni*) is also a candidate.

The taxonomy of the Miniopteridae in PNG and indeed across Indo-Australasia is still to be resolved fully and the name applied here to the call type of a large species of Bent-winged Bat is based on the unpublished work of Wiantoro (2020).

The most likely candidate for the source of the 75 mCF call type, given the geographic location, is the Telefomin Leaf-nosed Bat (*H. corynophyllus*). However, capture is required to confirm this attribution.

#### 4.5.3. Significant Habitat

No caves or sinkholes were recorded within the proposed TSF footprint (BMT WBM 2015; this study). However, but Barawokwi cave, located approximately 200 m southeast of the camp at Site 5, is inhabited by bats.

**Table 9. Bat species detected from Sites 1, 2, 4 and 5. No species of conservation significance were detected.**

| Family                | Scientific name                                     | Common name                         | IUCN | Site 1 | Site 2 | Site 4 | Site 5 | Method of detection |
|-----------------------|-----------------------------------------------------|-------------------------------------|------|--------|--------|--------|--------|---------------------|
| <b>Emballonuridae</b> |                                                     | <b>Sheath-tailed bats</b>           |      |        |        |        |        |                     |
| Emballonuridae        | <i>Emballonura diana</i>                            | Large-eared Sheath-tailed Bat       | LC   |        |        |        | X      | Acoustic            |
| Emballonuridae        | <i>Emballonura furax</i>                            | New Guinea Sheath-tailed Bat        | LC   |        |        |        | X      | Acoustic            |
| Emballonuridae        | <i>Emballonura raffrayana</i>                       | Raffray's Sheath-tailed Bat         | LC   |        |        |        | X      | Acoustic            |
| Emballonuridae        | <i>Mosia nigrescens</i>                             | Lesser Sheath-tailed Bat            | LC   | X      | X      | X      | X      | Acoustic            |
| <b>Hipposideridae</b> |                                                     | <b>Leaf-nosed bats</b>              |      |        |        |        |        |                     |
| Hipposideridae        | <i>Aselliscus tricuspidatus</i>                     | Trident Leaf-nosed Bat              | LC   | X      | X      | X      | X      | Acoustic            |
| Hipposideridae        | <i>Hipposideros corynophyllus</i>                   | Telefomin Leaf-nosed Bat            | LC   | X      | X      |        |        | Acoustic            |
| Hipposideridae        | <i>Doryrhina muscinus</i>                           | Fly River Leaf-nosed Bat            | LC   | X      | X      |        | X      | Mist net & Acoustic |
| Hipposideridae        | <i>Hipposideros calcaratus</i>                      | Spurred Leaf-nosed Bat              | LC   |        |        |        | X      | Mist net            |
| Hipposideridae        | <i>Hipposideros cervinus</i>                        | Fawn Leaf-nosed Bat                 | LC   | X      | X      |        | X      | Acoustic            |
| Hipposideridae        | <i>Hipposideros diadema</i>                         | Diadem Leaf-nosed Bat               | LC   | X      | X      | X      | X      | Mist net & Acoustic |
| Hipposideridae        | <i>Hipposideros maggietaaylorae</i>                 | Maggie Taylor's Roundleaf Bat       | LC   |        |        | X      | X      | Mist net & Acoustic |
| <b>Miniopteridae</b>  |                                                     | <b>Bent-winged bats</b>             |      |        |        |        |        |                     |
| Miniopteridae         | <i>Miniopterus tristis grandis</i>                  | Great Bent-winged Bat               | LC   |        | X      |        | X      | Acoustic            |
| Miniopteridae         | <i>Miniopterus</i> sp. cf. <i>australis</i> "small" |                                     | NE   |        |        | X      | X      | Acoustic            |
| <b>Pteropodidae</b>   |                                                     | <b>Fruit Bats</b>                   |      |        |        |        |        |                     |
| Pteropodidae          | <i>Dobsonia moluccensis</i>                         | Bare-backed Fruit Bat               | LC   |        |        |        | X      | Capture             |
| Pteropodidae          | <i>Macroglossus minimus</i>                         | Dagger-toothed Long-nosed Fruit Bat | LC   |        |        | X      |        | Mist net            |

| Family                  | Scientific name                   | Common name                          | IUCN | Site 1    | Site 2    | Site 4    | Site 5    | Method of detection |
|-------------------------|-----------------------------------|--------------------------------------|------|-----------|-----------|-----------|-----------|---------------------|
| Pteropodidae            | <i>Nyctimene albiventer</i>       | Common Tube-nosed Fruit Bat          | LC   | X         | X         | X         | X         | Mist net            |
| Pteropodidae            | <i>Nyctimene draconilla</i>       | Lesser Tube-nosed Bat                | DD   |           |           |           | X         | Mist net            |
| Pteropodidae            | <i>Syconycteris australis</i>     | Common Blossom Bat                   | LC   | X         | X         | X         | X         | Mist net            |
| Pteropodidae            | <i>Paranyctimene raptor</i>       | Lesser Tube-nosed Bat                | LC   | X         | X         |           |           | Mist net            |
| <b>Rhinolophidae</b>    |                                   | <b>Horseshoe Bats</b>                |      |           |           |           |           |                     |
| Rhinolophidae           | <i>Rhinolophus euryotis</i>       | New Guinea Broad-eared Horseshoe Bat | LC   |           |           | X         | X         | Acoustic            |
| Rhinolophidae           | <i>Rhinolophus mcintyre</i>       | McIntyre's Horseshoe Bat             | DD   |           |           | X         | X         | Acoustic            |
| Rhinolophidae           | <i>Rhinolophus philippinensis</i> | Large-eared Horseshoe Bat            | LC   |           |           | X         | X         | Acoustic            |
| Rhinolophidae           | <i>Rhinolophus robertsi</i>       | Greater Large-eared Horseshoe Bat    | NE   |           |           | X         | X         | Acoustic            |
| <b>Vespertilionidae</b> |                                   | <b>Evening bats</b>                  |      |           |           |           |           |                     |
| Vespertilionidae        | <i>Pipistrellus papuanus</i>      | Papuan Pipistrelle Bat               | LC   | X         | X         |           | X         | Acoustic            |
| <b>Total</b>            | <b>24</b>                         |                                      |      | <b>10</b> | <b>11</b> | <b>12</b> | <b>21</b> |                     |

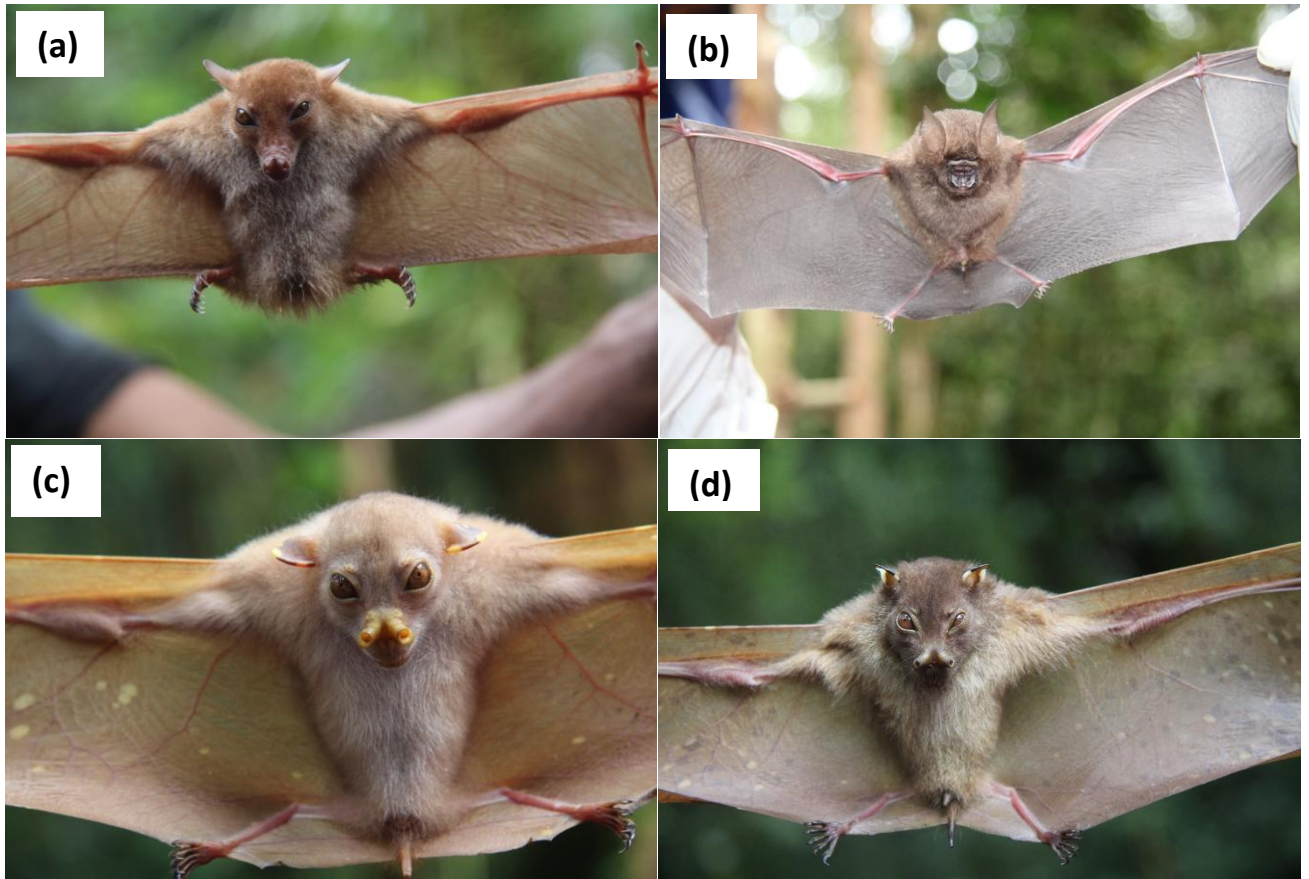


**Plate 12. Four species of bats caught from mist net from Sites 1 and 2, *Syconycteris australis* (a), *Hipposideros semoni* (b), *Nyctimene albiventer* (c) and *Paranyctimene raptor* (d). Photographs by Gendio Drumo.**

## **4.5. Birds**

### **4.5.1. Survey Efforts**

Survey effort in the proposed TSF footprint and the proposed pipeline access road corridor is summarized in Table 10. In both surveys, camera traps had the longest hours of effort that focused on understory birds.

**Table 10. Survey efforts per method used in enumerating the birds at Ok Birim proposed TSF footprint (Survey 1) and the proposed pipeline access road corridor (Survey 2).**

| Site         | Call record hours | General survey man hours | Point count man hours | Camera trap hours | Local informants interviewed |
|--------------|-------------------|--------------------------|-----------------------|-------------------|------------------------------|
| 1            | 42                | 45                       | 27                    | 720               | 2 informants                 |
| 2            | 70                | 90                       | 54                    | 1,440             | 2 informants                 |
| 3            | -                 | -                        | -                     | 7,992             | -                            |
| 4            | 192               | 16                       | 280                   | 768               | 2 informants                 |
| 5            | 240               | 20                       | 350                   | 10,914            | 2 informants                 |
| <b>Total</b> | <b>544</b>        | <b>171</b>               | <b>711</b>            | <b>21,834</b>     | <b>6</b>                     |

#### **4.5.2. Species Diversity**

One hundred and sixteen bird species were recorded (Table 11). More species were recorded from Site 1 (86) than Site 2 (66). Along the proposed pipeline access road corridor, more species were recorded at site 5 (65) than site 4 (53). Twenty-three species were recorded only from the proposed TSF footprint and seven species only from the two sites on the pipeline corridor. Forty-one species were identified from calls alone and another 36 by informant interviews alone. Seven species were identified from sighting alone, and 23 species from a combination of these methods. Eight species reported to be present by local informants were confirmed from calls, camera traps or sightings. For example, the locals indicated presence of Black-billed Brushturkey (*T. fuscirostris*) at sites 1 and 2. Camera trap confirmed its presence from Site 3 (Plate 13). Despite long hours of trapping at sites 3 and 5, camera traps captured images of only five species from each site including the *T. fuscirostris* from site 3 and Dwarf Cassowary (*C. bennetti*) and Wattled Brushturkey (*A. arfakianus*) from site 5. Common forest floor birds like the Sclateri's Crowned Pigeon whose calls were heard at sites 1, 2 and 5 were not captured on the camera traps.

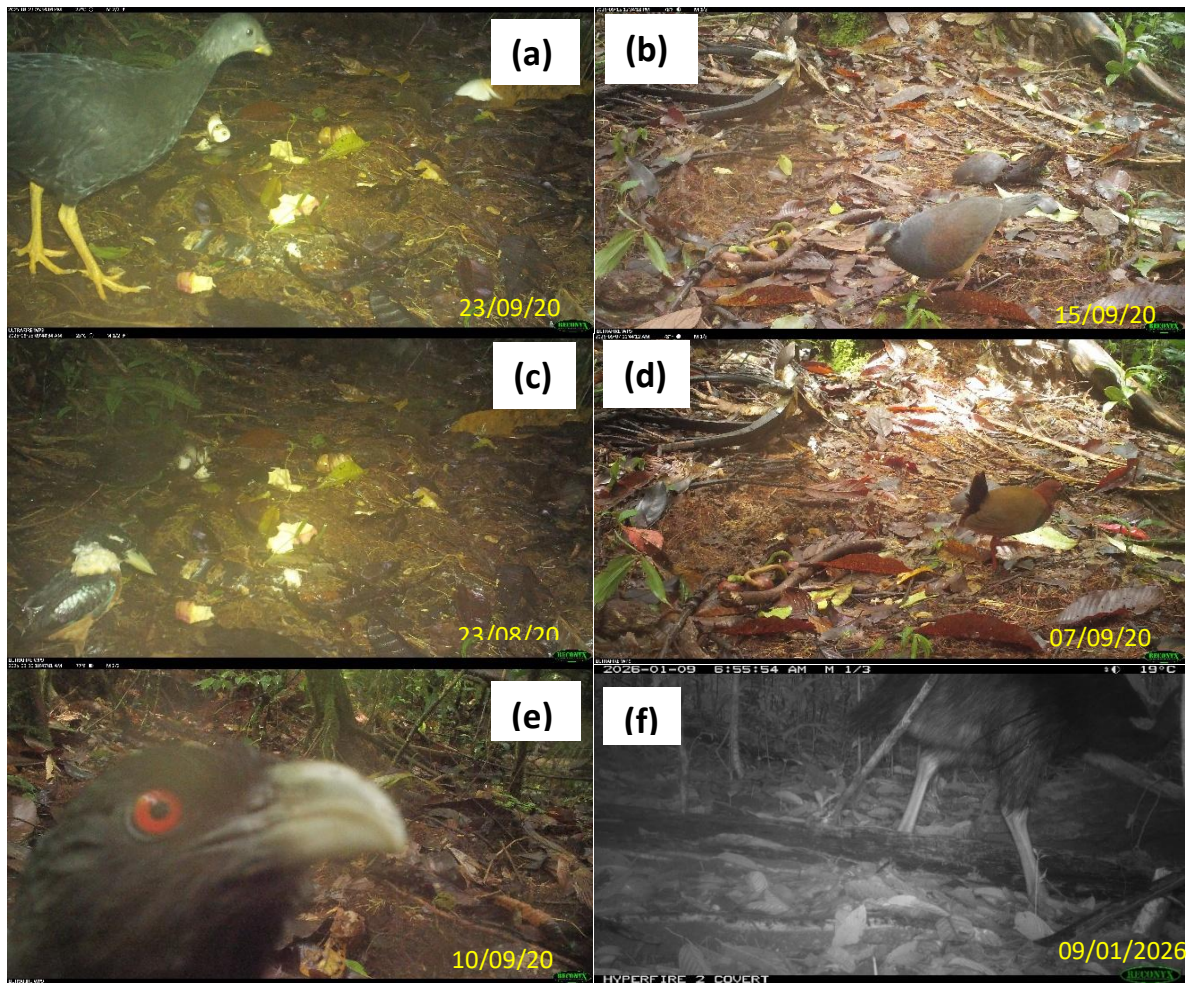


Plate 13. Birds caught on camera traps at Site 3; *Talegalla fuscirostris* (a), *Trugon terrestris*, (b), *Todoramphus sanctus* (c), *Gymnocrex plumbeiventris* (d), *Centropus menbeki* (e) and Site 5; *Cassuarius bennetti* (f).

**Table 11. Survey 1 and 2 bird species list. No restricted range species were documented. \*c = call, s = seen, i = interview, ct = camera trap.**

| No | Family        | Scientific name                   | Common name              | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|----|---------------|-----------------------------------|--------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 1  | Casuariidae   | <i>Casuarius casuarius</i>        | Southern Cassowary       | On Badiyape                  | X      | X      |        |        | X      | LC   |                          | i                 |
| 2  | Casuariidae   | <i>Casuarius bennetti</i>         | Dwarf Cassowary          |                              |        |        |        |        | X      | LC   |                          | ct                |
| 3  | Anatidae      | <i>Dendrocygna guttata</i>        | Spotted Whistling Duck   | On Dokayam                   | X      |        |        |        |        | LC   |                          | i                 |
| 4  | Megapodiidae  | <i>Aepypodius arfakianus</i>      | Wattled Brushturkey      |                              |        |        |        |        | X      | LC   |                          | ct                |
| 5  | Megapodiidae  | <i>Talegalla fuscirostris</i>     | Black-billed Brushturkey | On Horaworm                  | X      | X      | X      |        | X      | LC   |                          | i, ct             |
| 6  | Megapodiidae  | <i>Megapodius reinwardt</i>       | Orange-footed Scrubfowl  | On Wagagolock                | X      |        |        | X      |        | LC   |                          | i                 |
| 7  | Phasianidae   | <i>Synoicus ypsilophorus</i>      | Brown Quail              | On Dorack                    | X      |        |        |        |        | LC   |                          | i                 |
| 8  | Caprimulgidae | <i>Caprimulgus macrurus</i>       | Large-tailed Nightjar    | On Karakon                   | X      |        |        |        |        | LC   |                          | i                 |
| 9  | Podargidae    | <i>Podargus ocellatus</i>         | Marbled Frogmouth        | On Amim                      | X      |        |        |        |        | LC   |                          | i                 |
| 10 | Podargidae    | <i>Podargus papuensis</i>         | Papuan Frogmouth         | On Amim                      | X      | X      |        |        |        | LC   |                          | i                 |
| 11 | Apodidae      | <i>Aerodramus vanikorensis</i>    | Uniform Swiftlet         | On DiagROUT                  | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 12 | Cuculidae     | <i>Centropus menbeki</i>          | Ivory-billed Coucal      | On Kam                       | X      | X      | X      | X      | X      | LC   |                          | c,ct              |
| 13 | Cuculidae     | <i>Centropus phasianinus</i>      | Pheasant Coucal          | On Kumuk                     |        | X      |        |        |        | LC   |                          | i                 |
| 14 | Cuculidae     | <i>Microdynamis parva</i>         | Dwarf Koel               | On Brow                      |        | X      |        |        | X      | LC   |                          | c                 |
| 15 | Cuculidae     | <i>Cacomantis castaneiventris</i> | Chestnut-breasted Cuckoo | On Neagone                   | X      | X      |        |        |        | LC   |                          | c                 |
| 16 | Cuculidae     | <i>Cacomantis variolosus</i>      | Sahul Brush Cuckoo       | On Neagone                   | X      | X      |        |        |        | LC   |                          | c, i              |
| 17 | Columbidae    | <i>Macropygia amboinensis</i>     | Amboyna Cuckoo-Dove      | On Namkok                    | X      | X      |        | X      | X      | LC   |                          | i                 |

| No | Family       | Scientific name                 | Common name                   | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|----|--------------|---------------------------------|-------------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 18 | Columbidae   | <i>Reinwardtoena reinwardti</i> | Great Cuckoo-Dove             | On Dom                       | X      | X      |        | X      | X      | LC   |                          | c                 |
| 19 | Columbidae   | <i>Chalcophaps stephani</i>     | Stephan's Emerald Dove        | On Birum                     | X      | X      |        |        |        | LC   |                          | c                 |
| 20 | Columbidae   | <i>Trugon terrestris</i>        | Thick-billed Ground Pigeon    |                              |        |        | X      |        |        | LC   |                          | ct                |
| 21 | Columbidae   | <i>Gallicolumba rufigula</i>    | Cinnamon Ground Dove          |                              |        |        |        |        | X      | LC   |                          | ct                |
| 22 | Columbidae   | <i>Otidiphaps nobilis</i>       | Pheasant Pigeon               |                              |        |        |        |        | X      | LC   |                          | ct                |
| 23 | Columbidae   | <i>Goura sclaterii</i>          | Sclater's Crowned Pigeon      | On Gudim                     | X      | X      |        |        | X      | NT   |                          | c                 |
| 24 | Columbidae   | <i>Ptilinopus magnificus</i>    | Wompoo Fruit Dove             | On Bit                       | X      | X      |        |        |        | LC   |                          | c,i               |
| 25 | Columbidae   | <i>Ptilinopus perlatus</i>      | Pink-spotted Fruit Dove       | On Gike                      | X      | X      |        | X      | X      | LC   |                          | c                 |
| 26 | Columbidae   | <i>Ptilinopus superbus</i>      | Superb Fruit Dove             | On Bit                       | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 27 | Columbidae   | <i>Ptilinopus coronulatus</i>   | Coroneted Fruit Dove          | On Bit                       | X      | X      |        |        | X      | LC   |                          | c                 |
| 28 | Columbidae   | <i>Ptilinopus nainus</i>        | Dwarf Fruit Dove              |                              |        |        |        |        | X      | LC   |                          | c                 |
| 29 | Columbidae   | <i>Ducula rufigaster</i>        | Purple-tailed Imperial Pigeon | On Abim                      | X      |        |        |        | X      | LC   |                          | i                 |
| 30 | Columbidae   | <i>Ducula pinon</i>             | Pinon's Imperial Pigeon       | On Hape                      | X      | X      |        |        | X      | LC   |                          | i                 |
| 31 | Columbidae   | <i>Ducula mullerii</i>          | Collared Imperial Pigeon      | On-Semsem                    |        |        |        | X      |        | LC   |                          | s                 |
| 32 | Columbidae   | <i>Ducula zoeae</i>             | Zoe's Imperial Pigeon         | On Nap                       | X      | X      |        |        |        | LC   |                          | c                 |
| 33 | Columbidae   | <i>Gymnophaps albertisii</i>    | Papuan Mountain Pigeon        | On Yokovoke                  | X      | X      |        | X      | X      | LC   |                          | i                 |
| 34 | Rallidae     | <i>Gallinula tenebrosa</i>      | Dusky Moorhen                 |                              | X      |        |        |        |        | LC   |                          | i                 |
| 35 | Rallidae     | <i>Gymnocrex plumbeiventris</i> | Bare-eyed Rail                |                              |        |        | X      |        |        | LC   |                          | ct                |
| 36 | Charadriidae | <i>Charadrius dubius</i>        | Little Ringed Plover          | On Tranogol                  | X      |        |        |        |        | LC   |                          | i                 |

| No | Family       | Scientific name                | Common name                       | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|----|--------------|--------------------------------|-----------------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 37 | Ardeidae     | <i>Zonerodius heliosylus</i>   | Forest Bittern                    | On vimyop                    | X      |        |        |        |        | NT   |                          | i                 |
| 38 | Ardeidae     | <i>Ardea intermedia</i>        | Medium Egret                      | On Ockon                     | X      |        |        |        |        | LC   | P                        | i                 |
| 39 | Ardeidae     | <i>Ardea sumatrana</i>         | Great-billed Heron                |                              | X      |        |        |        |        | LC   |                          | i                 |
| 40 | Accipitridae | <i>Henicopernis longicauda</i> | Long-tailed Honey Buzzard         |                              | X      | X      |        |        |        | LC   |                          | i                 |
| 41 | Accipitridae | <i>Harpyopsis novaeguineae</i> | Papuan Eagle                      | On Dee                       | X      |        |        | X      | X      | VU   | P                        | i                 |
| 42 | Accipitridae | <i>Tachyspiza cirrocephala</i> | Collared Sparrowhawk              | On Kandam                    | X      |        |        |        |        | LC   |                          | i                 |
| 43 | Accipitridae | <i>Tachyspiza poliocephala</i> | Grey-headed Goshawk               | On Kandam                    | X      |        |        |        |        | LC   |                          | c                 |
| 44 | Accipitridae | <i>Tachyspiza hiogaster</i>    | Variable Goshawk                  | On Kandam                    | X      |        |        |        |        | LC   |                          | i                 |
| 45 | Accipitridae | <i>Haliastur indus</i>         | Brahminy Kite                     | On Avatkandom                | X      |        |        |        |        | LC   |                          | i                 |
| 46 | Accipitridae | <i>Haliastur sphenurus</i>     | Whistling Kite                    | On Decbakadam                | X      |        |        |        |        | LC   |                          | i                 |
| 47 | Strigidae    | <i>Ninox connivens</i>         | Barking Owl                       | On Krulkok                   | X      | X      |        |        |        | LC   |                          | c                 |
| 48 | Strigidae    | <i>Ninox theomacha</i>         | Papuan Boobook                    |                              |        |        |        | X      |        | LC   |                          | c                 |
| 49 | Bucerotidae  | <i>Rhyticeros plicatus</i>     | Blyth's Hornbill                  | On Neagavet                  | X      |        |        |        | X      | LC   | P                        | i                 |
| 50 | Coraciidae   | <i>Eurystomus orientalis</i>   | Oriental Dollarbird               | On Darkyarp                  | X      |        |        |        |        | LC   |                          | i                 |
| 51 | Alcedinidae  | <i>Melidora macrorrhina</i>    | Hook-billed Kingfisher            | On Burut                     | X      | X      |        |        | X      | LC   |                          | i                 |
| 52 | Alcedinidae  | <i>Tanysiptera galatea</i>     | Common Paradise Kingfisher        | On Badot                     |        | X      |        |        |        | LC   |                          | i                 |
| 53 | Alcedinidae  | <i>Tanysiptera sylvia</i>      | Buff-breasted Paradise Kingfisher | On Yubutrath                 | X      | X      |        |        |        | LC   |                          | c                 |
| 54 | Alcedinidae  | <i>Dacelo gaudichaud</i>       | Rufous-bellied Kookaburra         | On Karadone                  | X      | X      |        | X      | X      | LC   |                          | c                 |
| 55 | Alcedinidae  | <i>Todiramphus sanctus</i>     | Sacred Kingfisher                 | On Hanekope                  | X      |        | X      | X      | X      | LC   |                          | i,ct              |

| No | Family        | Scientific name                 | Common name                | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|----|---------------|---------------------------------|----------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 56 | Alcedinidae   | <i>Syma torotoro</i>            | Yellow-billed Kingfisher   | On Kokthroth                 | X      | X      |        |        | X      | LC   |                          | s,c               |
| 57 | Alcedinidae   | <i>Ceyx azureus</i>             | Azure Kingfisher           | On Din                       | X      | X      |        |        | X      | LC   |                          | c                 |
| 58 | Meropidae     | <i>Merops ornatus</i>           | Rainbow Bee-eater          | On Brun                      | X      |        |        |        |        | LC   |                          | i                 |
| 59 | Cacatuidae    | <i>Probosciger aterrimus</i>    | Palm Cockatoo              | On Yom                       | X      |        |        |        |        | NT   | P                        | i                 |
| 60 | Cacatuidae    | <i>Cacatua galerita</i>         | Sulphur-crested Cockatoo   | On Kava                      | X      | X      |        | X      | X      | LC   |                          | i                 |
| 61 | Psittaculidae | <i>Psitttrichas fulgidus</i>    | Pesquet's Parrot           | On Yuk                       | X      |        |        | X      | X      | VU   | P                        | i                 |
| 62 | Psittaculidae | <i>Micropsitta keiensis</i>     | Yellow-capped Pygmy Parrot | On Diugitemim                |        | X      |        | X      | X      | LC   |                          | c                 |
| 63 | Psittaculidae | <i>Eclectus polychloros</i>     | Papuan Eclectus            | On mugut                     | X      | X      |        | X      | X      | LC   |                          | i                 |
| 64 | Psittaculidae | <i>Geoffroyus geoffroyi</i>     | Red-cheeked Parrot         | On Kianle                    | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 65 | Psittaculidae | <i>Hypocharmosyna placentis</i> | Red-flanked Lorikeet       | On Dingitruim                | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 66 | Psittaculidae | <i>Lorius lory</i>              | Black-capped Lory          | On Vit                       | X      |        |        | X      | X      | LC   |                          | c                 |
| 67 | Psittaculidae | <i>Pseudeos fuscata</i>         | Dusky Lory                 | On Det                       | X      | X      |        | X      | X      | LC   |                          | c                 |
| 68 | Psittaculidae | <i>Chalcopsitta scintillata</i> | Yellow-streaked Lory       | On Deat                      | X      | X      |        |        |        | LC   |                          | c                 |
| 69 | Psittaculidae | <i>Trichoglossus haematodus</i> | Coconut Lorikeet           | On-vuvang                    |        |        |        | X      | X      | LC   |                          | s                 |
| 70 | Psittaculidae | <i>Cyclopsitta melanogenia</i>  | Dusky-cheeked Fig Parrot   | On Digetnim                  | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 71 | Pittidae      | <i>Pitta novaeguineae</i>       | Eastern Hooded Pitta       | On Barokbarok                | X      |        |        | X      |        | LC   |                          | c,i               |
| 72 | Meliphagidae  | <i>Melilestes megarhynchus</i>  | Long-billed Honeyeater     | On Dekop                     |        | X      |        | X      | X      | LC   |                          | c                 |
| 73 | Meliphagidae  | <i>Myzomela obscura</i>         | Dusky Myzomela             | On Evongip                   |        | X      |        |        |        | LC   |                          | s,c               |
| 74 | Meliphagidae  | <i>Philemon meyeri</i>          | Meyer's Friarbird          | On Aekok                     | X      | X      |        | X      |        | LC   |                          | c,i,s             |

| No | Family           | Scientific name                     | Common name                   | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|----|------------------|-------------------------------------|-------------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 75 | Meliphagidae     | <i>Philemon buceroides</i>          | Helmeted Friarbird            | On Aeiokok                   | X      | X      |        | X      | X      | LC   |                          | c                 |
| 76 | Meliphagidae     | <i>Xanthotis flaviventer</i>        | Tawny-breasted Honeyeater     | On Dagabat                   | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 77 | Meliphagidae     | <i>Meliphaga aruensis</i>           | Puff-backed Honeyeater        | On Gamgou                    | X      | X      |        |        |        | LC   |                          | s,c               |
| 78 | Meliphagidae     | <i>Microptilotis analogous</i>      | Mimic Honeyeater              | On Boeddet                   |        | X      |        | X      | X      | LC   |                          | c                 |
| 79 | Acanthizidae     | <i>Origma murina</i>                | Rusty Mouse-warbler           | On Morwart                   | X      |        |        | X      | X      | LC   |                          | c                 |
| 80 | Acanthizidae     | <i>Gerygone chrysogaster</i>        | Yellow-bellied Gerygone       | On Boodet                    | X      |        |        |        |        | LC   |                          | s,c               |
| 81 | Acanthizidae     | <i>Gerygone chloronota</i>          | Green-backed Gerygone         | On Vet                       |        | X      |        |        |        | LC   |                          | s                 |
| 82 | Acanthizidae     | <i>Gerygone magnirostris</i>        | Large-billed Gerygone         | On Boodet                    |        | X      |        | X      |        | LC   |                          | s                 |
| 83 | Pomatostomidae   | <i>Garritornis isidorei</i>         | Papuan Babbler                | On Warm                      | X      |        |        |        |        | LC   |                          | s,c               |
| 84 | Melanocharitidae | <i>Melanocharis arfakiana</i>       | Obscure Berrypecker           | On-Dakto                     |        |        |        | X      | X      | LC   |                          | c                 |
| 85 | Melanocharitidae | <i>Oedistoma iliolophus</i>         | Spectacled Longbill           | On Browot                    |        | X      |        |        |        | LC   |                          | s                 |
| 86 | Cinclosomatidae  | <i>Ptilorrhoa caerulescens</i>      | Blue Jewel-babbler            | On Dop-dandan                | X      | X      |        | X      | X      | LC   |                          | c                 |
| 87 | Cinclosomatidae  | <i>Ptilorrhoa castanonota</i>       | Chestnut-backed Jewel-babbler |                              |        |        |        |        | X      | LC   |                          | ct                |
| 88 | Acanthizidae     | <i>Machaerirhynchus flaviventer</i> | Yellow-breasted Boatbill      |                              |        |        |        | X      | X      | LC   |                          | s                 |
| 89 | Artamidae        | <i>Peltops blainvillii</i>          | Lowland Peltops               | On Dret                      | X      |        |        |        |        | LC   |                          | s                 |
| 90 | Artamidae        | <i>Melloria quoyi</i>               | Black Butcherbird             | On Bumgum                    | X      | X      |        | X      | X      | LC   |                          | i                 |
| 91 | Artamidae        | <i>Cracticus cassicus</i>           | Hooded Butcherbird            | On Gumie                     | X      | X      |        |        |        | LC   |                          | c                 |
| 92 | Campephagidae    | <i>Coracina lineata</i>             | Barred Cuckooshrike           | On Akam                      |        | X      |        | X      | X      | LC   |                          | c                 |
| 93 | Campephagidae    | <i>Coracina novaehollandiae</i>     | Black-faced Cuckooshrike      | On Gimicon                   | X      |        |        |        | X      | LC   |                          | i                 |

| No   | Family          | Scientific name                  | Common name                | Local name (Yongom language) | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | Detection Method* |
|------|-----------------|----------------------------------|----------------------------|------------------------------|--------|--------|--------|--------|--------|------|--------------------------|-------------------|
| 94   | Campephagidae   | <i>Coracina papuensis</i>        | White-bellied Cuckooshrike | On Waracee                   | X      |        |        | X      | X      | LC   |                          | i                 |
| 95   | Campephagidae   | <i>Edolisoma melas</i>           | Black Cicadabird           | On Browort                   | X      | X      |        |        | X      | LC   |                          | s,c               |
| 96   | Campephagidae   | <i>Lalage leucomela</i>          | Varied Triller             | On Kiktawot                  | X      | X      |        | X      | X      | LC   |                          | c                 |
| 97   | Pachycephalidae | <i>Pseudorectes ferrugineus</i>  | Rusty Pitohui              | On Kumjan                    |        | X      |        | X      | X      | LC   |                          | c                 |
| 98   | Pachycephalidae | <i>Colluricincla megarhyncha</i> | Arafura Shrikethrush       | On mowart                    | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 99   | Pachycephalidae | <i>Pitohui uropygialis</i>       | Southern Variable Pitohui  |                              |        |        |        | X      | X      | LC   |                          | c                 |
| 100  | Oriolidae       | <i>Oriolus szalayi</i>           | Brown Oriole               | On Maggrawok                 | X      |        |        |        |        | LC   |                          | c                 |
| 101  | Dicruridae      | <i>Dicrurus bracteatus</i>       | Spangled Drongo            | On Kaisecowak                | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 102  | Rhipiduridae    | <i>Rhipidura threnothorax</i>    | Sooty Thicket Fantail      | On Oktrekon                  |        | X      |        | X      |        | LC   |                          | s,c               |
| 103  | Monarchidae     | <i>Symposiachrus guttula</i>     | Spot-winged Monarch        | On Watwat                    | X      | X      |        | X      | X      | LC   |                          | s,c               |
| 104  | Monarchidae     | <i>Carterornis chrysomela</i>    | Golden Monarch             | On Watwat                    | X      | X      |        | X      | X      | LC   |                          | c,i               |
| 105  | Monarchidae     | <i>Arses telescopthalmus</i>     | Friilled Monarch           | On Watwat                    | X      | X      |        | X      | X      | LC   |                          | c                 |
| 106  | Corvidae        | <i>Corvus tristis</i>            | Grey Crow                  | On Daum                      | X      |        |        | X      |        | LC   |                          | c                 |
| 107  | Paradisaeidae   | <i>Manucodia ater</i>            | Glossy-mantled Manucode    | On Morike                    | X      | X      |        |        |        | LC   | P                        | c                 |
| c108 | Paradisaeidae   | <i>Cicinnurus regius</i>         | King Bird-of-paradise      | On Nawaroke                  | X      | X      |        | X      | X      | LC   | P                        | c                 |
| 109  | Paradisaeidae   | <i>Paradisaea raggiana</i>       | Raggiana Bird-of-paradise  | On Darop                     | X      | X      |        | X      | X      | LC   | P                        | s,c               |
| 110  | Petroicidae     | <i>Poecilodryas hypoleuca</i>    | Black-sided Robin          |                              | X      |        |        | X      | X      | LC   |                          | c,i               |
| 111  | Hirundinidae    | <i>Cecropis daurica</i>          | Eastern Red-rumped Swallow | On Bretagit                  | X      |        |        |        |        | LC   |                          | i                 |
| 112  | Sturnidae       | <i>Aplonis metallica</i>         | Metallic Starling          | On Drinee                    |        | X      |        |        | X      | LC   |                          | c                 |

| No  | Family               | Scientific name              | Common name             | Local name (Yongom language) | Site 1    | Site 2    | Site 3   | Site 4    | Site 5    | IUCN | Nationally Protected (P) | Detection Method* |
|-----|----------------------|------------------------------|-------------------------|------------------------------|-----------|-----------|----------|-----------|-----------|------|--------------------------|-------------------|
| 113 | Sturnidae            | <i>Aplonis cantoroides</i>   | Singing Starling        | On Drine                     | X         |           |          |           |           | LC   |                          | c                 |
| 114 | Sturnidae            | <i>Mino dumontii</i>         | Yellow-faced Myna       | On Watka                     | X         | X         |          | X         | X         | LC   |                          | c                 |
| 115 | Dicaeidae            | <i>Dicaeum geelvinkianum</i> | Red-capped Flowerpecker | On kiktawot                  |           | X         |          | X         | X         | LC   |                          | c                 |
| 116 | Nectariniidae        | <i>Leptocoma aspasia</i>     | Black Sunbird           | On Ewongip                   |           | X         |          | X         | X         | LC   |                          | c                 |
|     | <b>Total species</b> | <b>116</b>                   |                         |                              | <b>86</b> | <b>66</b> | <b>5</b> | <b>53</b> | <b>65</b> |      |                          |                   |

## 4.6. Herpetofauna

### 4.6.1. Survey Effort

Searches for frogs and reptiles were conducted by 2–3 persons during the day and at night. The highest search effort (man-hours) was spent at Site 2 (84 man-hours) (Table 12) while the most BAR recordings were obtained at Site 5 (80 hours), followed by Site 4 (45 hours), Site 2 (35 hours) and Site 1 (20 hours). Across the sites, more effort was expended at Site 2 (119 hours), followed by Site 5 (117 hours), then Site 1 (82 hours) and Site 4 (79 hours).

**Table 12. Summary of survey effort at the four sites surveyed during the Ok Birim herpetofauna surveys.**

|        | Number of days sampled (Total man-hours) | Number of nights sampled (Total man-hours) | Bar Recorders Number of unit/nights deployed (Total hours screened) |
|--------|------------------------------------------|--------------------------------------------|---------------------------------------------------------------------|
| Site 1 | 3 (42)                                   | 4 (20)                                     | 4 (20)                                                              |
| Site 2 | 7 (42)                                   | 7 (42)                                     | 7 (35)                                                              |
| Site 4 | 4 (19)                                   | 4 (15)                                     | 9 (45)                                                              |
| Site 5 | 5 (14)                                   | 5 (23)                                     | 16 (80)                                                             |

### 4.6.2. Species Diversity

Fifty-seven species of native herpetofauna were recorded during the surveys with 32 species of native frogs and 25 species of native reptiles (Table 13). The family Microhylidae (narrow-mouthed frogs) dominated the frog fauna with 18 (56%) out of the 32 species encountered. The Pelodyadidae (treefrogs) included ten (31% of the fauna) species, and the remaining four species belong to the family Ranidae (true frogs; 3 species, 9%) and Ceratobatrachidae (1 species, 3%). One exotic species, the Cane Toad, *Rhinella marina* was encountered at Site 1.

Diversity and abundance of the reptile fauna were moderately low, possibly reflecting in part the near-continuous overcast and wet conditions encountered during the survey. The reptile fauna was dominated by lizards of the family Scincidae (skinks) with eight (33 %) out of the 24 species documented and Gekkonidae (Geckos) with five species (21%). All other reptile groups contributed minor totals to the fauna with no more than three species in each group (Table 13). The reptile fauna is likely to be higher. For example, local informants reported an unknown *Varanus* species from the area that was not detected during the survey, and several additional lizards and snakes are expected to occur in the vicinity based on the distribution maps provided by IUCN (2025).

### 4.6.3. Frogs

The frog fauna is dominated by species with broad distributions across southern New Guinea; only one described species (*Amnihyala longicrus*) is listed in an IUCN category other

than Least Concern (Table 13). However, six species appear to be undescribed, and one may be new to science. These are described further in Section 1.1.5.4.53. The documentation of *Cornufer papuensis* at Site 4 was unexpected. This species is broadly distributed across the lowlands of northern New Guinea but only one population has previously been documented from southern New Guinea west of the Bird's Neck; from the vicinity of Timika, far to the west of Ok Birim (Richards et al. 2015). It is possible that this species has been introduced, but it has not been documented previously from Tabubil or Kiunga and Site 4 is the location surveyed that is most remote from large human settlements.

There are six broad ecological groups of frog species in the Ok Birim TSF footprint and proposed pipeline access road corridor with contrasting ecologies and life histories. The first consists of the 18 species of Microhylidae and *Cornufer papuensis* (Table 13) that have a life history in which frogs lay large, unpigmented eggs in terrestrial or arboreal nests. Developing embryos bypass the tadpole stage and hatch directly into fully formed froglets (Anstis et al. 2011). Because terrestrial/arboreal embryos require moist conditions to survive, microhylids are most diverse in permanently wet forest habitats.

The second group comprises the large, green, canopy-dwelling tree frog *Sandyrana pallidofemora* which probably breeds in tree holes high in the forest canopy (Richards 2025). *Sandyrana sanguinolenta* (Plate 14a) may also exhibit this reproductive strategy but this requires confirmation.

The third group comprises two species of Pelodryadidae (treefrogs), *Spicicalyx eucnemis* and *S. cf. genimaculata*, which occupy small, usually clear, slow-flowing streams and seepages in forested habitats where they lay eggs directly into the water. *Hylarana cf. grisea* probably also belongs in this group.

The fourth group comprises several small treefrogs (*Ischnohyla gracilis*, *Kallistobatrachus majikthise* and *Mahonabatrachus timidus*) that glue their eggs to leaves hanging over forest pools, seepages or small streams, where they develop into tadpoles that drop into the water below to complete their development.

The fifth group comprises two species of *Amnihyala* that lay their eggs in torrential forest streams where tadpoles with large suctorial mouthparts develop to metamorphosis.

The final group comprises the treefrog *Sandyrana infrafronata* and two true frogs (Ranidae), *Hylarana daemeli* and *H. novaeguineae*. These species are habitat generalists that breed in temporary and permanent ponds and ditches in a wide variety of habitats including tropical forest, swamps and savannas, including in highly modified environments.

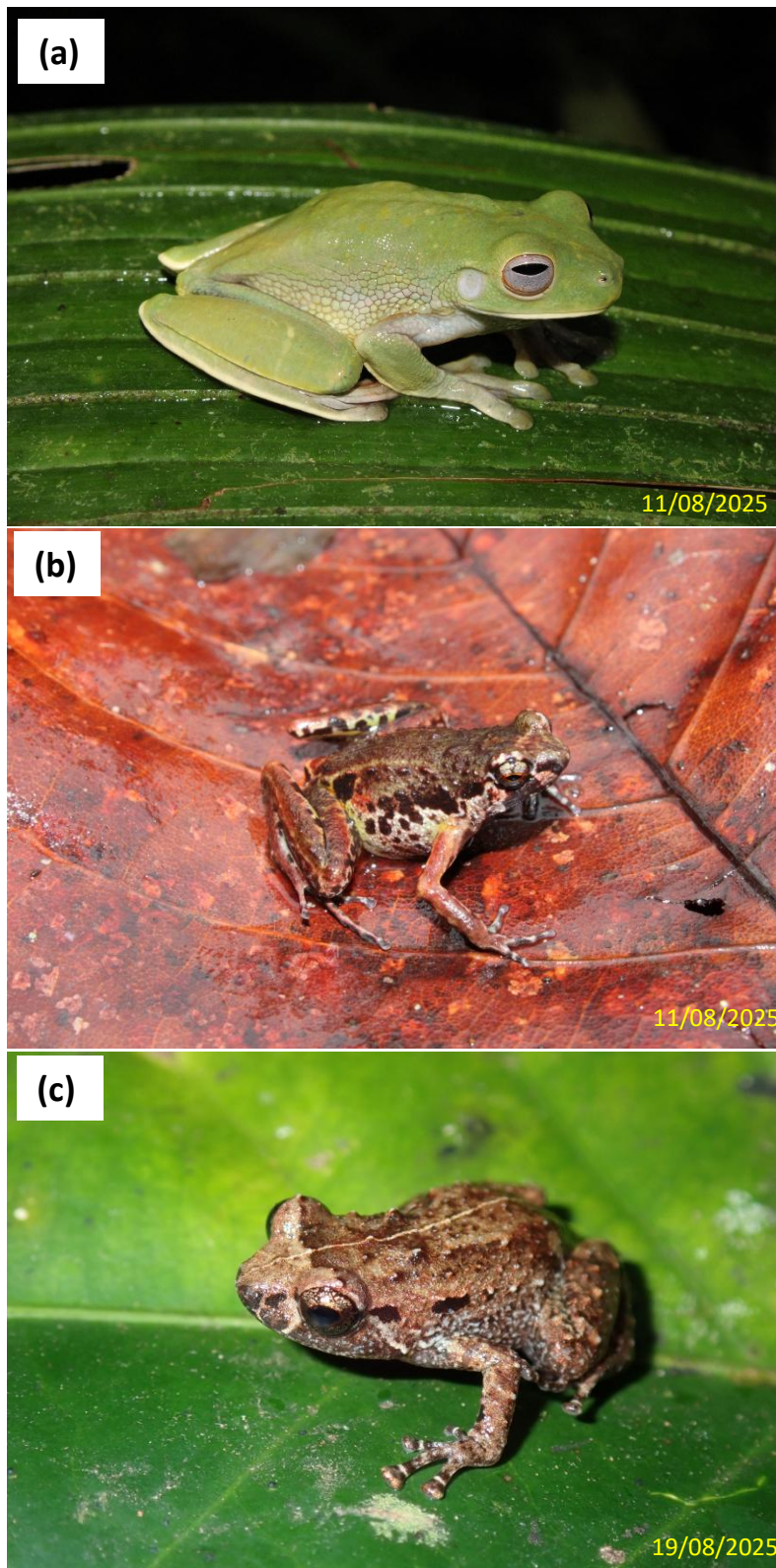


**Plate 14. Some frog species encountered in Ok Birim proposed TSF footprint during Survey 1. *Sandyrana sanguinolenta* (a), *Hylophorbus* sp. 1 (b) and *Oreophryne* sp. 1 (c). Photographs by Clifford Yae.**

#### 4.6.4. Reptiles

Like the frogs, the reptile fauna is dominated by common, widespread species; none of the reptiles are listed in an IUCN category other than Least Concern (Plate 15, Table 13). One species of skink (*Sphenomorphus* sp. 1) encountered at Site 5 does not appear to match any known species and may be new to science but only one specimen was captured, and further studies are required to confirm its taxonomic status.

Local informants reported that the two large River Turtles, the Pig-nosed Turtle (*Carettochelys insculpta*; IUCN Endangered) and Southern New Guinea Giant Softshell Turtle (*Pelochelys bibroni*; IUCN Vulnerable) and the Freshwater Crocodile (*Crocodylus novaeguineae*) occur in the Ok Birim and Ok Tedi, but are not known from the proposed TSF footprint. However, they reported that Freshwater Crocodiles are commonly encountered in waterbodies in the vicinity of Site 4 and that both *Pelochelys bibroni* and the small turtle *Emydura subglobosa* occur within the Ok Ma and adjacent streams. No direct evidence was obtained for the presence of *Pelochelys* but *Emydura subglobosa* probably occurs there. Further assessment of the likelihood of *Pelochelys* occurring in the vicinity may be required to confirm its presence and distribution.

Local informants at Sites 1 and 2 also reported the presence of a *Varanus* (goanna) species that differs from all photographs shown to them during interviews, so it is possible that an as-yet undiscovered goanna species occurs in the vicinity of the TSF footprint.

The documentation of *Carlia diguliensis* represents the third known record of this species from Papua New Guinea. This species is widespread in the Digul River drainage on the Indonesian side of the PNG-Indonesian border, and the previous two records for PNG were at the proposed Ok Birim and Bige TSF sites (BMT WBM 2015, 2016).

The reptile fauna at Ok Birim is not easily divided into well-defined ecological groupings. Rather, it is dominated by unspecialised species that have broad distributions across southern New Guinea. Table 13 lists the herpetofauna species recorded at Ok Birim proposed TSF footprint and tailings pipeline and their conservation status.

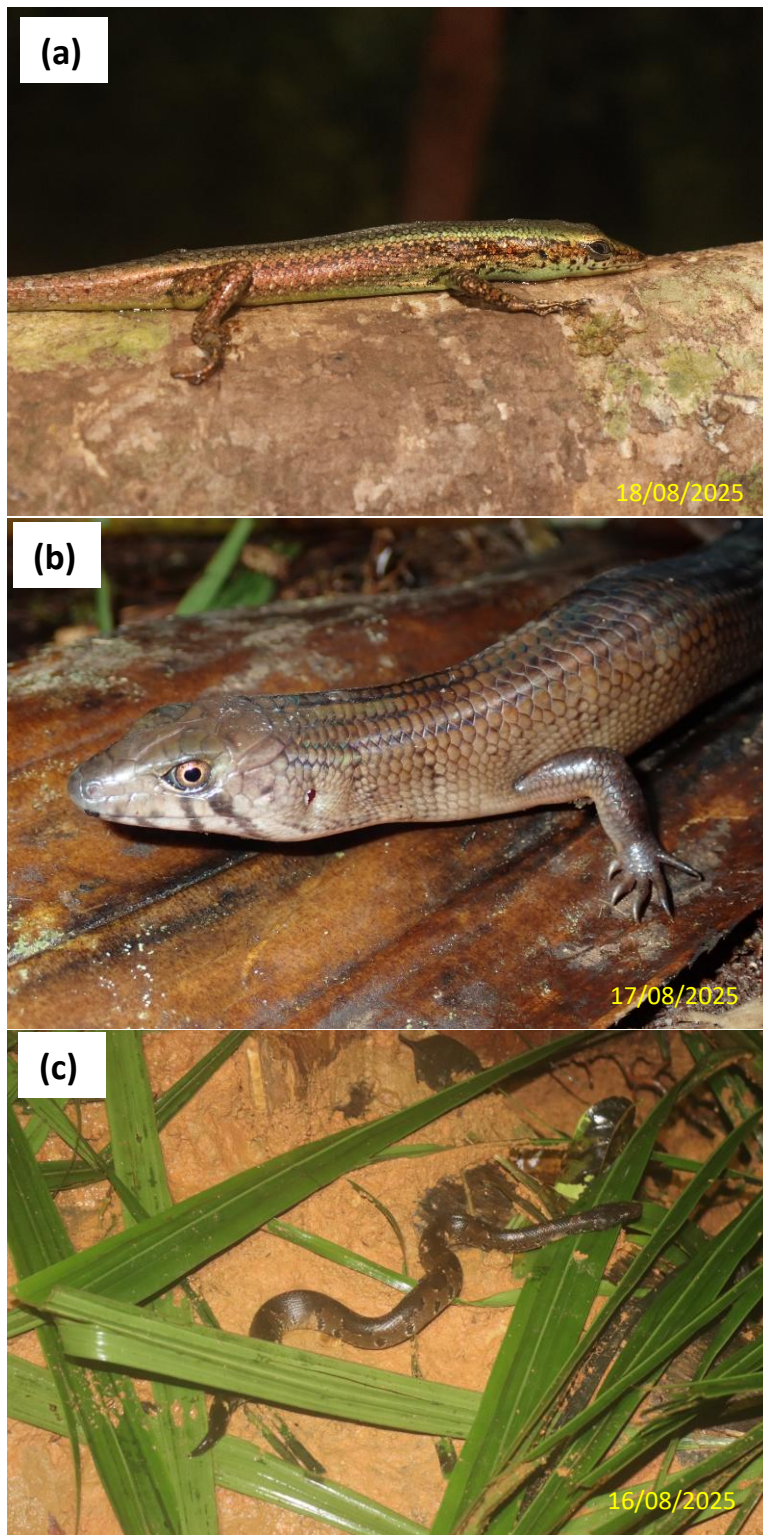


**Plate 15. Some reptiles encountered in the Ok Birim proposed TSF footprint during Survey 1, *Emoia kordoana* (a), *Eugonylus rufescens* (b) and Ground Boa, *Candoia aspera* (c). Photographs by Clifford Yaee.**

**Table 13. Ok Birim herpetofauna list from Survey 1 and 2.**

| Family            | Species                                             | Common name          | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | Undescribed (UN) or<br>New to Science (NTS) |
|-------------------|-----------------------------------------------------|----------------------|--------|--------|--------|--------|------|---------------------------------------------|
| <b>Frogs</b>      |                                                     |                      |        |        |        |        |      |                                             |
| Ceratobatrachidae | <i>Cornufer papuensis</i>                           |                      |        |        | X      |        | LC   |                                             |
| Microhylidae      | <i>Asterophrys slateri</i>                          |                      |        |        | X      | X      | LC   |                                             |
| Microhylidae      | <i>Asterophrys turpicola</i>                        | New Guinea Bush Frog |        |        | X      | X      | LC   |                                             |
| Microhylidae      | <i>Austrochaperina</i> sp. 1 (fast call)            |                      |        |        |        | X      | NE   |                                             |
| Microhylidae      | <i>Callulops</i> sp.                                |                      |        |        | X      | X      | NE   |                                             |
| Microhylidae      | <i>Choerophryne</i> sp. 1 cf. <i>gracilirostris</i> |                      | X      |        |        |        | NE   | NTS                                         |
| Microhylidae      | <i>Choerophryne</i> cf. <i>tuberculus</i>           |                      |        |        |        | X      | NE   |                                             |
| Microhylidae      | <i>Copiula derongo</i>                              |                      |        |        | X      | X      | LC   |                                             |
| Microhylidae      | <i>Copiula lennarti</i>                             |                      | X      | X      | X      | X      | LC   |                                             |
| Microhylidae      | <i>Hylophorbus</i> sp. 1 (fast call)                |                      | X      | X      | X      | X      | NE   | UN/NTS                                      |
| Microhylidae      | <i>Hylophorbus</i> sp. 2 (slow call)                |                      | X      |        | X      | X      | NE   | UN                                          |
| Microhylidae      | <i>Mantophryne lateralis</i>                        |                      |        |        | X      | X      | LC   |                                             |
| Microhylidae      | <i>Oreophryne oviprotector</i>                      |                      |        | X      |        | X      | LC   |                                             |
| Microhylidae      | <i>Oreophryne pseudunicolor</i>                     |                      | X      | X      |        | X      | LC   |                                             |
| Microhylidae      | <i>Oreophryne</i> sp. 1                             |                      | X      | X      | X      | X      | NE   | UN                                          |
| Microhylidae      | <i>Sphenophryne schlaginhaufeni</i>                 |                      |        |        | X      | X      | LC   |                                             |

| Family          | Species                                         | Common name            | Site 1    | Site 2    | Site 4    | Site 5    | IUCN | Undescribed (UN) or<br>New to Science (NTS) |
|-----------------|-------------------------------------------------|------------------------|-----------|-----------|-----------|-----------|------|---------------------------------------------|
| Microhylidae    | <i>Sphenophryne</i> cf. <i>cornuta</i>          |                        | X         | X         | X         | X         | NE   | UN                                          |
| Microhylidae    | <i>Xenorhina lacrimosa</i>                      |                        |           |           | X         |           | NE   |                                             |
| Microhylidae    | <i>Xenorhina</i> cf. <i>pohleorum</i>           |                        | X         |           |           |           | NE   | UN                                          |
| Pelodyadidae    | <i>Amnihyla longicrus</i>                       |                        |           |           |           | X         | DD   |                                             |
| Pelodyadidae    | <i>Amnihyla</i> cf. <i>arfakiana</i>            |                        |           |           |           | X         | NE   | UN                                          |
| Pelodyadidae    | <i>Ischnohyla gracilis</i>                      |                        |           |           |           | X         | NE   |                                             |
| Pelodyadidae    | <i>Kallistobatrachus majikthise</i>             |                        |           |           |           | X         | LC   |                                             |
| Pelodyadidae    | <i>Mahonabatrachus timidus</i>                  |                        |           |           |           | X         | LC   |                                             |
| Pelodyadidae    | <i>Sandyrana infrafronata</i>                   | White-lipped Treefrog  |           | X         |           |           | LC   |                                             |
| Pelodyadidae    | <i>Sandyrana pallidofemora</i>                  |                        | X         | X         | X         | X         | LC   |                                             |
| Pelodyadidae    | <i>Sandyrana sanguinolenta</i>                  | Sabang Treefrog        | X         | X         | X         | X         | LC   |                                             |
| Pelodyadidae    | <i>Spicicalyx eucnemis</i>                      | Fringed Treefrog       | X         |           |           | X         | LC   |                                             |
| Pelodyadidae    | <i>Spicicalyx</i> sp. 1 cf. <i>genimaculata</i> |                        | X         |           |           | X         | NE   | UN                                          |
| Ranidae         | <i>Hylarana daemeli</i>                         | Wood Frog              |           | X         |           | X         | LC   |                                             |
| Ranidae         | <i>Hylarana novaeguineae</i>                    |                        |           | X         |           |           | LC   |                                             |
| Ranidae         | <i>Hylarana</i> cf. <i>grisea</i>               |                        |           | X         | X         | X         | NE   |                                             |
|                 | <b>Total native species = 32</b>                |                        | <b>12</b> | <b>12</b> | <b>16</b> | <b>26</b> |      |                                             |
| Bufonidae       | <i>Rhinella marina</i>                          | Cane Toad <sup>1</sup> | X         |           |           |           | LC   |                                             |
| <b>Reptiles</b> |                                                 |                        |           |           |           |           |      |                                             |
| Agamidae        | <i>Hypsilurus magnus</i>                        |                        |           |           | X         |           | LC   |                                             |

| Family     | Species                            | Common name               | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | Undescribed (UN) or<br>New to Science (NTS) |
|------------|------------------------------------|---------------------------|--------|--------|--------|--------|------|---------------------------------------------|
| Agamidae   | <i>Hypsilurus modestus</i>         | Modest Forest Dragon      |        | X      |        | X      | LC   |                                             |
| Gekkonidae | <i>Cyrtodactylus capreoloides</i>  |                           |        |        |        | X      | LC   |                                             |
| Gekkonidae | <i>Cyrtodactylus papuensis</i>     |                           |        |        | X      |        | LC   |                                             |
| Gekkonidae | <i>Cyrtodactylus serratus</i>      |                           |        |        |        | X      | LC   |                                             |
| Gekkonidae | <i>Gehyra baliola</i>              | Short-tailed Dtella       |        | X      |        |        | LC   |                                             |
| Gekkonidae | <i>Nactus</i> sp.                  |                           |        |        | X      |        | NE   |                                             |
| Scincidae  | <i>Carlia diguliensis</i>          | Digul River Rainbow Skink | X      |        |        |        | LC   |                                             |
| Scincidae  | <i>Emoia caeruleocauda</i>         | Pacific Bluetail Skink    |        | X      |        |        | LC   |                                             |
| Scincidae  | <i>Emoia kordoana</i>              | Slender Tree Skink        |        | X      |        |        | LC   |                                             |
| Scincidae  | <i>Emoia longicauda</i>            |                           |        |        | X      |        | LC   |                                             |
| Scincidae  | <i>Emoia</i> sp. (strongly keeled) |                           |        |        |        | X      |      |                                             |
| Scincidae  | <i>Eugongylus rufescens</i>        | Unicolor Recluse Skink    |        | X      |        |        | LC   |                                             |
| Scincidae  | <i>Sphenomorphus meyeri</i>        |                           |        |        | X      |        | LC   |                                             |
| Scincidae  | <i>Sphenomorphus simus</i>         |                           |        |        | X      | X      | LC   |                                             |
| Scincidae  | <i>Sphenomorphus</i> sp. 1.        |                           |        |        |        | X      | NE   |                                             |
| Boidae     | <i>Candoia aspera</i>              | New Guinea Ground Boa     | X      | X      |        |        | LC   |                                             |
| Elapidae   | <i>Toxicocalamus</i> sp.           |                           |        |        |        | X      |      |                                             |
| Colubridae | <i>Boiga irregularis</i>           | Brown Tree Snake          | X      | X      | X      |        | LC   |                                             |
| Colubridae | <i>Stegonotus</i> sp.              | Ground Snake              |        | X      |        |        | NE   |                                             |
| Colubridae | <i>Tropidonophis</i> sp.           | Keelback Snake            |        |        |        | X      | NE   |                                             |

| Family       | Species                         | Common name                                   | Site 1   | Site 2   | Site 4    | Site 5   | IUCN | Undescribed (UN) or<br>New to Science (NTS) |
|--------------|---------------------------------|-----------------------------------------------|----------|----------|-----------|----------|------|---------------------------------------------|
| Pythonidae   | <i>Leiopython fredparkeri</i> * | White-lipped Python                           |          | X        |           |          | LC   |                                             |
| Trionychidae | <i>Pelochelys bibroni</i>       | Southern New Guinea Giant<br>Softshell Turtle |          |          | X         |          | VU   |                                             |
| Chelidae     | <i>Emydura subglobosa</i>       | Red-bellied Short-necked Turtle               |          |          | X         |          | LC   |                                             |
| Crocodylidae | <i>Crocodylus novaeguineae</i>  | New Guinea Freshwater Crocodile               |          |          | X         |          | LC   |                                             |
|              | <b>Total species = 25</b>       |                                               | <b>3</b> | <b>9</b> | <b>10</b> | <b>8</b> |      |                                             |

! Exotic

\*Although *Leiopython fredparkeri* is listed as Vulnerable by the IUCN the account is outdated and *L. fredparkeri* now incorporates the widespread, IUCN Least Concern *L. meridionalis* so it should be recognised as LC.

## 4.7. Odonata

### 4.7.1. Survey Effort

Odonates were sampled by 2–3 people for approximately 10 hours per day for three full days at Site 1 (30 hours), seven full days at Site 2 (70 hours), and for 22.5 hours over four days at Site 4 and 27 hours over five days at Site 5 for a total of 149 hours of sampling across the four survey sites. Survey activities started as early as 6 am (for crepuscular species) and usually finished at approximately 6.00 pm.

### 4.7.2. Species Diversity

Fifty-two species of odonates (dragonflies and damselflies) were recorded during the Ok Birim TSF footprint and proposed pipeline access road corridor surveys, including 25 species of damselflies and 27 species of dragonflies (Table 14). The families Coenagrionidae and Platycnemididae dominated the damselfly fauna with nine (36%) and eight (32%) species out of 25 respectively. The Argiolestidae contained four species (16%) and the remaining families (Calopterygidae, Chlorocyphidae, Isostictidae and Platystictidae) were each represented by just one species (4%). The family Libellulidae dominated the dragonfly fauna, representing 22 (88%) of the 27 species encountered. The four other families, Aeshnidae, Corduliidae, Macromiidae and Synthemistidae, were each represented by just 1–2 species (Table 14).

The damselflies (Zygoptera) and dragonflies (Anisoptera) at Ok Birim exhibited strikingly different patterns of reproductive habitat use. Nineteen of the 25 damselflies encountered (76%) breed in small, clear-flowing streams in forest environments, and two are known or expected to breed in arboreal water bodies (Table 14). Only two species of damselfly documented during the survey (*Agriocnemis femina* and *Argiocnemis rubescens*) are known to use standing water (pools, swamps and ditches) to breed (the breeding behaviour of *Teinobasis* species is poorly understood; some may breed in small pools). In contrast the dragonfly fauna is dominated by species that breed in standing waterbodies, with 18 of the 27 species encountered (67%) breeding in ponds and ditches; and another eight associated with large rivers (Table 14).

Odonate species reliant on small, clear-flowing forest streams for their reproduction and survival tend to have narrow habitat tolerances, higher levels of regional endemism and poor dispersal abilities. At Ok Birim several of the stream-dwelling damselfly species are poorly known (DD) and/or potentially undescribed (Table 14). In contrast, the dragonfly fauna is dominated by habitat generalists with broad distributions that are classified by the IUCN as Least Concern.

**Table 144. List of Odonata species encountered at Ok Birim survey Sites 1, 2, 4 and 5.**

|    | Odonata                                       |        |        |        |        | Primary reproductive habitat |         |        |           |             |                                          |
|----|-----------------------------------------------|--------|--------|--------|--------|------------------------------|---------|--------|-----------|-------------|------------------------------------------|
|    |                                               | Site 1 | Site 2 | Site 4 | Site 5 | Pools, swamps, ditches       | Streams | Rivers | Treeholes | IUCN Status | Undescribed (UN) or New to Science (NTS) |
|    | <b>Zygoptera</b>                              |        |        |        |        |                              |         |        |           |             |                                          |
|    | <b>Argiolestidae</b>                          |        |        |        |        |                              |         |        |           |             |                                          |
| 1  | <i>Argiolestes muller</i>                     | X      |        |        | X      |                              | X       |        |           | DD          |                                          |
| 2  | <i>Metagrion furcatum</i>                     |        |        | X      | X      |                              | X       |        |           | NE          |                                          |
| 3  | <i>Metagrion</i> cf. <i>pseudolamprostoma</i> |        |        |        | X      |                              | X       |        |           | NE          |                                          |
| 4  | <i>Podopteryx roseonotata</i>                 |        | X      |        | X      |                              |         |        | X         | DD          |                                          |
|    | <b>Calopterygidae</b>                         |        |        |        |        |                              |         |        |           |             |                                          |
| 5  | <i>Neurobasis australis</i>                   |        |        | X      |        |                              | X       | X      |           | LC          |                                          |
|    | <b>Chlorocyphidae</b>                         |        |        |        |        |                              |         |        |           |             |                                          |
| 6  | <i>Rhinocypha tincta</i>                      | X      | X      | X      | X      |                              | X       | X      |           | LC          |                                          |
|    | <b>Coenagrionidae</b>                         |        |        |        |        |                              |         |        |           |             |                                          |
| 7  | <i>Agriocnemis femina</i>                     |        | X      |        |        | X                            |         |        |           | LC          |                                          |
| 8  | <i>Agriocnemis rubescens</i>                  |        | X      |        |        | X                            |         |        |           | LC          |                                          |
| 9  | <i>Papuagrion magnanimum</i>                  | X      |        |        | X      |                              |         |        | X         | LC          |                                          |
| 10 | <i>Papuagrion occipitale</i>                  |        |        |        | X      |                              |         |        | X         | LC          |                                          |
| 11 | <i>Papuagrion</i> sp. (short legs)            |        |        |        | X      |                              |         |        | X         | NE          |                                          |
| 12 | <i>Pseudagrion ignifer</i>                    |        | X      |        |        |                              | X       |        |           | LC          |                                          |

|    | Odonata                                 |          |           |          |           | Primary reproductive habitat |           |          |           |             |                                          |
|----|-----------------------------------------|----------|-----------|----------|-----------|------------------------------|-----------|----------|-----------|-------------|------------------------------------------|
|    |                                         | Site 1   | Site 2    | Site 4   | Site 5    | Pools, swamps, ditches       | Streams   | Rivers   | Treeholes | IUCN Status | Undescribed (UN) or New to Science (NTS) |
| 13 | <i>Teinobasis scintillans</i>           | X        |           |          | X         |                              | ?         |          |           | LC          |                                          |
| 14 | <i>Teinobasis</i> sp. 1 (long, slender) | X        |           | X        | X         |                              | ?         |          |           | NE          | NTS                                      |
| 15 | <i>Teinobasis</i> sp. 2 (yellow)        |          |           | X        |           |                              | ?         |          |           | NE          | NTS                                      |
|    | <b>Isostictidae</b>                     |          |           |          |           |                              |           |          |           |             |                                          |
| 16 | <i>Selysioneura servicornu</i>          |          |           |          | X         |                              | X         |          |           | LC          |                                          |
|    | <b>Platycnemididae</b>                  |          |           |          |           |                              |           |          |           |             |                                          |
| 17 | <i>Idiocnemis</i> cf. <i>australis</i>  | X        | X         | X        | X         |                              | X         |          |           | NE          |                                          |
| 18 | <i>Idiocnemis</i> sp. 1                 | X        | X         |          | X         |                              | X         |          |           | NE          | UN                                       |
| 19 | <i>Nososticta nigrifrons</i>            |          |           | X        |           |                              | X         |          |           | LC          |                                          |
| 20 | <i>Nososticta ovimacula</i>             | X        | X         |          |           |                              | X         |          |           | DD          |                                          |
| 21 | <i>Nososticta rangifera</i>             | X        | X         | ?        |           |                              | X         |          |           | DD          |                                          |
| 22 | <i>Nososticta</i> sp. 1                 |          | X         |          |           |                              | X         |          |           | NE          | NTS                                      |
| 23 | <i>Palaiargia</i> sp. 1                 |          |           |          | X         |                              | X         |          |           | NE          | NTS                                      |
| 24 | <i>Papuargia</i> sp. 1                  |          |           |          | X         |                              | X         |          |           | NE          | NTS                                      |
|    | <b>Platystictidae</b>                   |          |           |          |           |                              |           |          |           |             |                                          |
| 25 | <i>Drepanosticta</i> sp.                |          |           | X        |           |                              | X         |          |           | NE          |                                          |
|    | <b>Total damselfly species = 25</b>     | <b>9</b> | <b>10</b> | <b>9</b> | <b>15</b> | <b>2</b>                     | <b>19</b> | <b>2</b> | <b>4</b>  |             |                                          |
|    | <b>Anisoptera</b>                       |          |           |          |           |                              |           |          |           |             |                                          |
|    | <b>Aeshnidae</b>                        |          |           |          |           |                              |           |          |           |             |                                          |
| 1  | <i>Agyrtacantha dirupta</i>             | X        | X         |          |           |                              | X         | X        |           | LC          |                                          |

|    | Odonata                            |        |        |        |        | Primary reproductive habitat |         |        |           |             |                                          |
|----|------------------------------------|--------|--------|--------|--------|------------------------------|---------|--------|-----------|-------------|------------------------------------------|
|    |                                    | Site 1 | Site 2 | Site 4 | Site 5 | Pools, swamps, ditches       | Streams | Rivers | Treeholes | IUCN Status | Undescribed (UN) or New to Science (NTS) |
|    | <b>Corduliidae</b>                 |        |        |        |        |                              |         |        |           |             |                                          |
| 2  | <i>Hemicordulia continentalis</i>  |        |        | X      | X      | X                            | X       | X      |           | LC          |                                          |
|    | <b>Libellulidae</b>                |        |        |        |        |                              |         |        |           |             |                                          |
| 3  | <i>Agrionoptera longitudinalis</i> |        | X      |        |        | X                            |         |        |           | LC          |                                          |
| 4  | <i>Diplacina anthaxia</i>          |        | X      |        |        |                              | X       |        |           | LC          |                                          |
| 5  | <i>Diplacina</i> sp.               |        |        |        | X      |                              | X       | X      |           | NE          |                                          |
| 6  | <i>Huonia epinephela</i>           |        |        |        | X      |                              | X       | X      |           | LC          |                                          |
| 7  | <i>Hydrobasileus brevistylus</i>   |        | X      | X      |        | X                            |         |        |           | LC          |                                          |
| 8  | <i>Lyriothemis hirundo</i>         |        |        |        | X      | X                            |         |        |           | LC          |                                          |
| 9  | <i>Lyriothemis meyeri</i>          | X      |        |        |        | X                            |         |        |           | LC          |                                          |
| 10 | <i>Nannophlebia amphicyllis</i>    |        |        |        | X      |                              | X       |        |           | LC          |                                          |
| 11 | <i>Nannophlebia</i> sp. 1          |        |        |        | X      |                              | X       |        |           | NE          |                                          |
| 12 | <i>Nannophya pygmaea</i>           |        | X      |        |        | X                            |         |        |           | LC          |                                          |
| 13 | <i>Nesoxenia mysis</i>             | X      | X      |        |        | X                            |         |        |           | LC          |                                          |
| 14 | <i>Neurothemis stigmatizans</i>    | X      | X      |        |        | X                            |         | X      |           | LC          |                                          |
| 15 | <i>Orthetrum glaucum</i>           |        |        |        | X      | X                            |         |        |           | LC          |                                          |
| 16 | <i>Orthetrum serapia</i>           | X      | X      |        |        | X                            |         | X      |           | LC          |                                          |
| 17 | <i>Orthetrum villosovittatum</i>   | X      | X      | X      | X      | X                            |         | X      |           | LC          |                                          |
| 18 | <i>Pantala flavescens</i>          | X      | X      |        |        | X                            |         | X      |           | LC          |                                          |
| 19 | <i>Protorthemis coronata</i>       | X      | X      |        |        | X                            |         |        |           | LC          |                                          |

|    | Odonata                         |           |           |           |           | Primary reproductive habitat |           |          |           |             |                                          |
|----|---------------------------------|-----------|-----------|-----------|-----------|------------------------------|-----------|----------|-----------|-------------|------------------------------------------|
|    |                                 | Site 1    | Site 2    | Site 4    | Site 5    | Pools, swamps, ditches       | Streams   | Rivers   | Treeholes | IUCN Status | Undescribed (UN) or New to Science (NTS) |
| 20 | <i>Rhyothemis princeps</i>      | X         | X         | X         | X         | X                            |           |          |           | LC          |                                          |
| 21 | <i>Rhyothemis resplendens</i>   |           | X         |           |           | X                            |           |          |           | LC          |                                          |
| 22 | <i>Tetrathemis irregularis</i>  |           | X         |           |           | X                            |           |          |           | LC          |                                          |
| 23 | <i>Tramea eurybia</i>           |           | X         |           | X         | X                            |           |          |           | LC          |                                          |
| 24 | <i>Zyxomma elgneri</i>          | X         | X         |           |           | X                            |           |          |           | LC          |                                          |
|    | <b>Macromiidae</b>              |           |           |           |           |                              |           |          |           |             |                                          |
| 25 | <i>Macromia melpomene</i>       |           |           |           | X         |                              | X         |          |           | LC          |                                          |
| 26 | <i>Macromia viridescens</i>     |           | X         |           |           |                              | X         |          |           | LC          |                                          |
|    | <b>Sythemistidae</b>            |           |           |           |           |                              |           |          |           |             |                                          |
| 27 | <i>Palaeosynthemis</i> sp.      |           |           | X         | X         |                              | X         |          |           | NE          |                                          |
|    | <b>Total species = 27</b>       | <b>10</b> | <b>17</b> | <b>5</b>  | <b>12</b> | <b>18</b>                    | <b>10</b> | <b>8</b> | <b>0</b>  |             |                                          |
|    | <b>Grand total species = 52</b> | <b>19</b> | <b>27</b> | <b>14</b> | <b>27</b> |                              |           |          |           |             |                                          |

#### 4.7.3. Significant habitats

Small clear-flowing streams and adjacent riparian forest in the proposed TSF footprint area and in the vicinity of Site 5 provide habitat for a distinct assemblage of stream-breeding odonates. Almost all of these are damselflies, and within this assemblage are all of the IUCN listed species and most of the potentially new-to-science species that were documented during these surveys. Exceptions may be *Teinobasis* sp. 1 and *Teinobasis* sp. 2; these species were detected in primary forest but their breeding habitats remain unknown. Clear-flowing aquatic and associated riparian habitats occur within the proposed TSF footprint. All IUCN-listed threatened and Undescribed/New to Science species except *Nososticta* sp. 1, have been documented outside of the proposed TSF footprint. The distribution of *Nososticta* sp. 1 is currently only confirmed within the proposed TSF footprint, and its presence in surrounding areas remains uncertain.

### 5. Species of Conservation Significance

Ninety one species of conservation significant flora and fauna were documented within the proposed TSF footprint during the 2025 surveys (Table 15). Sixty seven are IUCN listed species in the categories EN, VU, NT or DD of which three species are protected by PNG government. Most of the IUCN conservation significant species were recorded from Site 1 (50 Species), followed by Site 5 (20 species) then Site 4 (16 species) and Site 2 (10 species). Eight species of birds protected by PNG legislation were recorded from the project sites and 19 species new to science or undescribed species mostly of flora, frogs and odonates were recorded from the project sites.

**Table 155. Species of conservation significance at Ok Birim Proposed TSF (Survey 1) and proposed tailings pipeline road corridor (Survey 2).**

| Family           | Scientific name                | Common name             | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | UN or NTS |
|------------------|--------------------------------|-------------------------|--------|--------|--------|--------|--------|------|--------------------------|-----------|
| Lauraceae        | <i>Cryptocarya albifrons</i>   |                         |        |        |        | X      |        | EN   |                          |           |
| Lauraceae        | <i>Cryptocarya brevipes</i>    |                         | X      |        |        |        |        | EN   |                          |           |
| Lauraceae        | <i>Cryptocarya fluminensis</i> |                         | X      |        |        |        |        | EN   |                          |           |
| Lauraceae        | <i>Cryptocarya sulcata</i>     |                         | X      | X      |        |        |        | EN   |                          |           |
| Lauraceae        | <i>Endiandra engleriana</i>    |                         | X      |        |        |        |        | EN   |                          |           |
| Sapotaceae       | <i>Palaquium morobense</i>     |                         |        |        |        | X      | X      | EN   |                          |           |
| Rubiaceae        | <i>Timonius argenteus</i>      |                         |        |        |        |        | X      | EN   |                          |           |
| Psittaculidae    | <i>Psittrichas fulgidus</i>    | Pesquet's Parrot Parrot | X      |        |        | X      | X      | VU   | P                        |           |
| Dipterocarpaceae | <i>Anisoptera thurifera</i>    |                         | X      | X      |        |        |        | VU   |                          |           |
| Clusiaceae       | <i>Calophyllum suberosum</i>   |                         | X      |        |        |        |        | VU   |                          |           |
| Phyllanthaceae   | <i>Cleistanthus insignis</i>   |                         | X      |        |        |        |        | VU   |                          |           |
| Lauraceae        | <i>Cryptocarya caloneura</i>   |                         | X      |        |        |        |        | VU   |                          |           |
| Elaeocarpaceae   | <i>Elaeocarpus murukkai</i>    | Quandong                |        | X      |        |        |        | VU   |                          |           |
| Euphorbiaceae    | <i>Endospermum medullosum</i>  | PNG Basswood            |        |        |        | X      |        | VU   |                          |           |
| Lamiaceae        | <i>Gmelina sessilis</i>        |                         | X      |        |        |        |        | VU   |                          |           |
| Accipitridae     | <i>Harpyopsis novaeguineae</i> | Papuan Eagle            | X      |        |        | X      | X      | VU   | P                        |           |
| Fagaceae         | <i>Lithocarpus vinkii</i>      |                         | X      |        |        |        | X      | VU   |                          |           |

| Family         | Scientific name                 | Common name                 | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | UN or NTS |
|----------------|---------------------------------|-----------------------------|--------|--------|--------|--------|--------|------|--------------------------|-----------|
| Lauraceae      | <i>Litsea collina</i>           |                             |        | X      |        |        |        | VU   |                          |           |
| Lauraceae      | <i>Litsea globosa</i>           |                             | X      |        |        |        |        | VU   |                          |           |
| Sapotaceae     | <i>Palaquium supfianum</i>      |                             |        | X      |        |        |        | VU   |                          |           |
| Rubiaceae      | <i>Psychotria ramuensis</i>     |                             |        |        |        | X      |        | VU   |                          |           |
| Malvaceae      | <i>Pterocymbium beccarii</i>    | Amberoi                     |        |        |        |        | X      | VU   |                          |           |
| Myrtaceae      | <i>Syzygium leptoneurum</i>     |                             | X      |        |        |        |        | VU   |                          |           |
| Tachyglossidae | <i>Zaglossus bartoni</i>        | Eastern long-beaked echidna | X      | X      |        |        | X      | VU   |                          |           |
| Elaeocarpaceae | <i>Aceratium parvifolium</i>    |                             | X      | X      |        |        |        | NT   |                          |           |
| Rubiaceae      | <i>Acronychia pullei</i>        |                             |        |        |        |        | X      | NT   |                          |           |
| Meliaceae      | <i>Aglaia lepiorrhachis</i>     |                             | X      |        |        |        |        | NT   |                          |           |
| Cyatheaceae    | <i>Alsophila vandeusenii</i>    |                             | X      |        |        |        |        | NT   |                          |           |
| Phyllanthaceae | <i>Aporosa ledermanniana</i>    |                             |        | X      |        |        |        | NT   |                          |           |
| Fabaceae       | <i>Archidendron ptenopum</i>    |                             |        |        |        | X      |        | NT   |                          |           |
| Phyllanthaceae | <i>Bridelia macrocarpa</i>      |                             |        | X      |        |        |        | NT   |                          |           |
| Clusiaceae     | <i>Calophyllum laticostatum</i> |                             |        | X      |        |        |        | NT   |                          |           |
| Lauraceae      | <i>Cryptocarya massoy</i>       | Massoy                      | X      |        |        |        |        | NT   |                          |           |
| Dasyuridae     | <i>Dasyurus albopunctatus</i>   | New Guinea Quoll            |        |        |        |        | X      | NT   |                          |           |
| Primulaceae    | <i>Discocalyx latepetiolata</i> |                             | X      | X      |        |        |        | NT   |                          |           |

| Family         | Scientific name                | Common name              | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | UN or NTS |
|----------------|--------------------------------|--------------------------|--------|--------|--------|--------|--------|------|--------------------------|-----------|
| Macropodidae   | <i>Dorcopsulus vanheurni</i>   | Small Dorcopsis          |        |        |        |        | X      | NT   |                          |           |
| Elaeocarpaceae | <i>Elaeocarpus multisectus</i> |                          |        | X      |        |        |        | NT   |                          |           |
| Gentianaceae   | <i>Fagraea gracilipes</i>      |                          | X      | X      |        |        |        | NT   |                          |           |
| Annonaceae     | <i>Goniothalamus aruensis</i>  |                          | X      | X      |        |        |        | NT   |                          |           |
| Columbidae     | <i>Goura sclaterii</i>         | Sclater's Crowned Pigeon | X      | X      |        |        | X      | NT   |                          |           |
| Proteaceae     | <i>Helicia latifolia</i>       |                          | x      | X      |        |        |        | NT   |                          |           |
| Arecaceae      | <i>Licuala bakeri</i>          |                          | X      | X      |        |        |        | NT   |                          |           |
| Arecaceae      | <i>Licuala bellatula</i>       |                          | X      | X      |        |        |        | NT   |                          |           |
| Arecaceae      | <i>Licuala brevicalyx</i>      |                          |        | X      |        |        |        | NT   |                          |           |
| Sapotaceae     | <i>Madhuca leucodermis</i>     |                          |        | X      |        |        |        | NT   |                          |           |
| Clusiaceae     | <i>Mammea novoguineensis</i>   |                          | X      |        |        |        |        | NT   |                          |           |
| Myristicaceae  | <i>Myristica hooglandii</i>    | Nutmag                   |        |        |        |        | X      | NT   |                          |           |
| Sapotaceae     | <i>Palaquium warburgianum</i>  | Pencil Cedar             | X      |        |        |        |        | NT   |                          |           |
| Sapotaceae     | <i>Planchonella thyrsoidea</i> |                          |        | X      |        |        |        | NT   |                          |           |
| Annonaceae     | <i>Polyalthia longirostris</i> |                          |        |        |        | X      |        | NT   |                          |           |
| Cacatuidae     | <i>Probosciger aterrimus</i>   | Palm Cockatoo            | X      |        |        |        |        | NT   | P                        |           |
| Myrtaceae      | <i>Syzygium coalitum</i>       | Laulau                   | X      |        |        |        |        | NT   |                          |           |
| Combretaceae   | <i>Terminalia impediens</i>    | Okari                    | X      | X      |        |        |        | NT   |                          |           |
| Ardeidae       | <i>Zonerodius heliosylus</i>   | Forest Bittern           | X      |        |        |        |        | NT   |                          |           |

| Family          | Scientific name                 | Common name               | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | IUCN | Nationally Protected (P) | UN or NTS |
|-----------------|---------------------------------|---------------------------|--------|--------|--------|--------|--------|------|--------------------------|-----------|
| Meliaceae       | <i>Aglia cucullata</i>          | Amoora                    | X      |        |        |        |        | DD   |                          |           |
| Pelodryadidae   | <i>Amnihyla longicrus</i>       |                           |        |        |        |        | X      | DD   |                          |           |
| Fabaceae        | <i>Archidendron megaphyllum</i> |                           | X      |        |        |        |        | DD   |                          |           |
| Argiolestidae   | <i>Argiolestes muller</i>       |                           | X      |        |        |        |        | DD   |                          |           |
| Moraceae        | <i>Ficus aurantiacifolia</i>    |                           |        |        |        | X      | X      | DD   |                          |           |
| Clusiaceae      | <i>Garcinia mangostifera</i>    | Mangosteen                | X      | X      |        |        |        | DD   |                          |           |
| Annonaceae      | <i>Goniothalamus imbricatus</i> |                           | X      | X      |        |        | X      | DD   |                          |           |
| Magnoliaceae    | <i>Magnolia tsiampacca</i>      | Wau Beech                 |        | X      |        |        |        | DD   |                          |           |
| Platycnemididae | <i>Nososticta ovimacula</i>     |                           | X      | X      |        |        |        | DD   |                          |           |
| Platycnemididae | <i>Nososticta rangifera</i>     |                           | X      | X      |        |        |        | DD   |                          |           |
| Argiolestidae   | <i>Podopteryx roseonotata</i>   |                           |        | X      |        | X      |        | DD   |                          |           |
| Myrtaceae       | <i>Syzygium fibrosum</i>        |                           | X      |        |        |        |        | DD   |                          |           |
| Rhinolophidae   | <i>Rhinolophus mcintyreii</i>   | McIntyre's Horseshoe Bat  |        |        |        | X      | X      | DD   |                          |           |
| Ardeidae        | <i>Ardea intermedia</i>         | Medium Egret              | X      |        |        |        |        | LC   | P                        |           |
| Paradisaeidae   | <i>Cicinnurus regius</i>        | King Bird of Paradise     | X      | X      |        | X      | X      | LC   | P                        |           |
| Paradisaeidae   | <i>Manucodia ater</i>           | Glossy Manucode           | X      | X      |        |        |        | LC   | P                        |           |
| Paradisaeidae   | <i>Paradisaea raggiana</i>      | Raggiana Bird of Paradise | X      | X      |        | X      | X      | LC   | P                        |           |
| Bucerotidae     | <i>Rhyticeros plicatus</i>      | Blyth's Hornbill          | X      |        |        |        | X      | LC   | P                        |           |
| Meliaceae       | <i>Aglia</i> sp. 1              |                           |        |        |        | X      |        | NE   |                          | NTS       |

| Family          | Scientific name                               | Common name | Site 1    | Site 2    | Site 3   | Site 4    | Site 5    | IUCN      | Nationally Protected (P) | UN or NTS |
|-----------------|-----------------------------------------------|-------------|-----------|-----------|----------|-----------|-----------|-----------|--------------------------|-----------|
| Begoniaceae     | <i>Begonia</i> sp. 1                          |             | X         |           |          |           | X         | NE        |                          | NTS       |
| Begoniaceae     | <i>Begonia</i> sp. 2                          |             |           | X         |          |           |           | NE        |                          | NTS       |
| Clusiaceae      | <i>Calophyllum</i> sp. 1                      | Kalo        |           | X         |          | X         | X         | NE        |                          | NTS       |
| Dilleniaceae    | <i>Dillenia</i> sp. 1                         |             | X         | X         |          |           |           | NE        |                          | NTS       |
| Meliaceae       | <i>Dysoxylum</i> sp. 1                        |             |           |           |          | X         |           | NE        |                          | NTS       |
| Clusiaceae      | <i>Garcinia</i> sp. 1                         | Kandis      |           |           |          | X         |           | NE        |                          | NTS       |
| Phyllanthaceae  | <i>Glochidion</i> sp. 1                       |             | X         |           |          |           |           | NE        |                          | NTS       |
| Platycnemididae | <i>Idiocnemis</i> sp. 1                       |             | X         | X         |          |           |           | NE        |                          | UN?       |
| Microhylidae    | <i>Choerophryne</i> cf. <i>gracilirostris</i> |             | X         |           |          |           |           | NE        |                          | NTS       |
| Microhylidae    | <i>Hylophorbus</i> sp. 1 (fast call)          |             | X         | X         |          |           |           | NE        |                          | UN/NTS    |
| Microhylidae    | <i>Oreophryne</i> sp. 1                       |             | X         | X         |          |           |           | NE        |                          | UN        |
| Platycnemididae | <i>Palaiargia</i> sp. 1                       |             |           |           |          |           | X         | NE        |                          | NTS       |
| Platycnemididae | <i>Papuargia</i> sp. 1                        |             |           |           |          |           | X         | NE        |                          | NTS       |
| Microhylidae    | <i>Sphenophryne</i> cf. <i>cornuta</i>        |             | X         | X         |          |           |           | NE        |                          | UN        |
| Pelodryadidae   | <i>Spicicalyx</i> cf. <i>genimaculata</i>     |             | X         |           |          |           |           | NE        |                          | UN        |
| Coenagrionidae  | <i>Teinobasis</i> sp. 1 (long, slender)       |             | X         |           |          | X         | X         | NE        |                          | NTS       |
| Coenagrionidae  | <i>Teinobasis</i> sp. 2 (yellow)              |             |           |           |          | X         |           | NE        |                          | NTS       |
| Microhylidae    | <i>Xenorhina</i> cf. <i>pohleorum</i>         |             | X         |           |          |           |           | NE        |                          | UN        |
| <b>Total</b>    | <b>91</b>                                     |             | <b>54</b> | <b>10</b> | <b>0</b> | <b>16</b> | <b>20</b> | <b>67</b> | <b>8</b>                 | <b>19</b> |

## 5.1. IUCN Species documented in 2025

Species accounts for all IUCN threatened, Near Threatened and Data Deficient species are presented below, except for plants where all species are listed but detailed accounts are only provided for threatened species (Endangered, Vulnerable) given the large number of taxa involved.

### 5.1.1. Endangered Species

#### 5.1.1.1. Flora

##### ***Cryptocarya albifrons***

This species was assessed as Endangered by the IUCN when it was known from only two collections with an extremely small area of occupancy and extent of occurrence (8 km<sup>2</sup>). It is now known to occur more widely, with new locations confirmed in Central, Eastern Highlands and Morobe Provinces. This is based on Lae National Herbarium (LAE) records (<https://www.pngplants.org/PNGdatabase.html>). Its habitat is lowland rainforest which is under constant threat from deforestation and agriculture. The record from Site 4 is a major range extension and the first record for Western Province.

##### ***Cryptocarya brevipes***

This large tree was until recently known from three localities between about 100 and 1,830 m AMSL in PNG, between the Huon Peninsula in the northeast and the Rumginae road near Kiunga in the southwest. The record from this study is from Site 1 within the TSF footprint. This species has recently been recorded from another location in Eastern Highlands Province. Deforestation and agricultural expansion are main threats. The species was not detected in 2014 study.

##### ***Cryptocarya fluminensis***

This is a small tree that was previously known from four localities in PNG's lowland forests (70–200 m altitude) including several locations near Port Moresby (Laloki and Brown rivers). It has subsequently been documented from Tonolei and Buin on Autonomous Region of Bougainville, and from one location in Western Province. It is assessed as Endangered due to its small distribution and threat from deforestation and land conversion to agriculture. The record from this study was at Site 1 within the TSF footprint. It was not detected in the 2014 study.

##### ***Cryptocarya sulcata***

This montane forest tree was previously known from just three localities in Morobe Province, PNG, where it grows at altitudes between 750–1,550 m AMSL altitude. It is listed as Endangered due to its very small distribution and threats from logging and agricultural expansion. This species was found at Sites 1 and 2 in the TSF footprint. These records represent a major range extension and substantially extend the species' known altitudinal range. A reassessment of its IUCN status may be warranted. It was not detected in the 2014 study.

### ***Endiandra engleriana***

This tree is known from five localities scattered across northern mainland New Guinea, where it grows at an altitude of about 1,000 m asl. It is assessed as Endangered because deforestation and conversion to agriculture are major threats. It is not found in protected areas or ex situ collections. The record from Site 1 is within the TSF footprint and is the first record from Western Province and the first from south of the central cordillera. It was not detected in the 2014 study.

### ***Timonius argenteus***

This species is endemic to PNG where it has previously been reported from four locations in the lowland forests of West Sepik, East Sepik, and Madang Provinces. Logging and mining projects are serious threats to its habitat while locals used it for house construction. The record from Site 5 is the first from Western Province and the first from south of the central cordillera.

## **5.1.2. Vulnerable Species**

### **5.1.2.1. Flora**

#### ***Mersawa (Anisoptera thurifera)***

Known locally as PNG Mersawa is a large dipterocarp tree native to PNG, eastern Indonesia and Philippines. It is heavily exploited for timber and faces ongoing threats from logging, agricultural expansion, and settlement development. Although it has a wide distribution, its population is predicted to decline by 30–45% over the next century (Barstow, M. & Jimbo, T. 2017). Based on Lae Herbarium records, it occurs in protected areas in Kamiali Wildlife Management area (<https://www.pngplants.org/search.htm>) and cultivated at Lae Botanical Garden. This species was detected at Sites 1 and 2 in the proposed TSF footprint although it was not detected in the 2014 study.

#### ***Gmelina sessilis***

This species is endemic to New Guinea and is widespread in eastern mainland PNG and on New Britain island. Based on Lae Herbarium and IUCN records (IUCN 2026), there is also a record from the Snow Mountains in Indonesian New Guinea. It was known from nine locations and major threats include deforestation and conversion of forests to agriculture and plantations. It does not occur in protected areas or ex situ collections. The record from Sites 1 and 4 represents a major range extension and the first record for Western Province. However, it was not detected in the 2014 study.

#### ***Cryptocarya caloneura***

This species was previously known from nine localities spread broadly across southern and northern mainland PNG, one of them in the upper Fly River catchment (de Kok, R. 2020). It is a species that grows in lowland forests and is considered Vulnerable due to deforestation and habitat destruction. Based on Lae Herbarium records this species also occurs from Mupi in Indonesian New Guinea. The species was recorded from Site 1 within the proposed TSF footprint. However, it was not detected in the 2014 study.

***Litsea collina***

This tree is widespread in eastern and northern PNG and also occurs on Manus Island and the Solomon Islands. Deforestation and conversion to agriculture are the main threats. Its timber is used commercially, but no conservation actions are in place. Based on Lae Herbarium records, this species was collected near Ingembit and along Bingge river, Western Province. At Ok Birim it was encountered at Site 2 within the TSF footprint. It was not detected in the 2014 study.

***Litsea globosa***

This tree species has a very wide distribution between Sabah (Malaysia), Papua (Indonesia) and PNG, growing in montane forests up to 2,200 m AMSL. Deforestation and agricultural expansion are major threats. It occurs in some protected areas but is not conserved ex situ. This species was encountered at Site 1 within the TSF footprint. It was not detected in 2014 study.

***Syzygium leptoneurum***

This small tree is endemic to PNG where it grows in lowland to hill forests between 30–500 m AMSL. Based on herbarium collections, this species occurs in Morobe, Central, West Sepik, Madang and Gulf Provinces. It was documented at Site 1 within the TSF footprint. This represents a substantial range extension and the first record for Western Province. Logging concessions and plantations threaten its habitat. No conservation actions are currently recorded. It was not detected in the 2014 study.

***Calophyllum suberosum***

This tree is found in swamp forests and riversides in southern New Guinea and Sulawesi. It is assessed as Vulnerable due to deforestation and logging pressures. Its timber may be exploited under the general *Calophyllum* trade. The species is mainly found in the northern regions, Milne Bay and the New Guinea Islands (PNGTreeKeys website). It was recorded from Site 1, but it was not detected in the 2014 study.

***Cleistanthus insignis***

This tree species has a broad distribution in disturbed rainforests and along creek banks across the lowlands and foothills of mainland Papua New Guinea and on several islands in Milne Bay Province. It is classified as Vulnerable because it is predicted to undergo a population decline of up to 30% over three generations [Lalo, R. 2019]. The species is used locally for fencing and house construction but has no commercial export value. Habitat loss from subsistence gardening and timber use is a major threat. The record from Site 4 is the third record for Western Province.

***Elaeocarpus murukakai***

Known locally as Quandong, this is a canopy tree endemic to Papua New Guinea, where it is found in montane forests between 1,800 and 2,350 m AMSL. It has a moderately restricted distribution with fewer than ten known locations, all of them on the Papuan Peninsula in eastern PNG. It is assessed as Vulnerable because its population is declining due to logging, mining and habitat loss. It is also considered at risk from climate change. The record from Site 2 in the Ok Birim TSF footprint is the first for Western Province and

represents a major range extension and a substantially lower known altitudinal occurrence. It was not detected in the 2014 study.

#### ***Lithocarpus vinkii***

This is a tropical hardwood tree found across the entire length of mainland New Guinea, where it grows in lowland and montane rainforests at altitudes between near sea level and 1,800 m asl. It is widely used for timber, making it one of PNG's major export species. Logging and agricultural expansion are driving a predicted 40–45% population decline over the next 100 years. Research is needed to guide effective protection. This species was encountered at Site 1; however, it was not detected in the 2014 study.

#### ***Palaquium supfianum***

This species has a broad distribution in northern and eastern PNG. It may also occur as far west as Borneo. Logging and land-use change are major threats. Research is needed to clarify its distribution and conservation needs. There is one collection record for the Palmer River in Western Province. This species was documented at Site 2 within the proposed TSF footprint. It was not detected in the 2014 study.

#### ***Amberoi (Pterocymbium beccarii)***

Known locally as Amberoi is a large emergent tree has a broad distribution across mainland New Guinea and some nearby islands. It grows mainly in lowland rainforests, sometimes extending to lower montane forests up to 1,000 m, and is widely harvested for timber, particularly for veneer and plywood. Due to logging and forest conversion, its population has declined by at least 30% over the last three generations, leading to its assessment as Vulnerable. This species was encountered at Site 5 and based on Lae Herbarium, this is the second record apart from occurring at Wawoi. Locally known as Ahawom and the wood is used for building materials mainly for house and considered for canoe. It was not detected in the 2014 study.

### **5.1.2.2. Non-volant mammals**

#### **Eastern Long-beaked Echidna (*Zaglossus bartoni*) – Also Nationally Protected**

A large, long nosed, slow-moving mammal of the forest floor, up to 75 cm long and weighing 5 to 10 kg. It is endemic to New Guinea and has been recorded up to the highest mountains in a variety of habitats including hill forest, montane forest and sub-alpine grassland and scrub. Although there are reports of this species from near sea level (e.g., Leary et al. 2016a), these appear to refer to records of the Western Long-beaked Echidna (*Z. bruijnii*) from the Vogelkop Peninsula in Indonesia, which was previously treated as conspecific with Eastern Long-beaked Echidna (Flannery 1995; Nicol 2015); there are no confirmed records of the Eastern Long-beaked Echidna from below 600 m AMSL.

Eastern Long-beaked Echidnas are tolerant of some habitat disturbance, but are particularly susceptible to overhunting, especially where dogs are used. They can be fairly common in areas inaccessible to humans, but are now rare or locally extinct in many areas; many surviving populations are now restricted to isolated patches of montane forest (Flannery 1995; Nicol 2015).

This Vulnerable species was formerly reported to be widespread in forest above about 1,000 m AMSL (Hyndman and Menzies 1990). Although it was not recorded on camera trap, a higher sampling effort is often required to detect the species even when it is present (e.g., Woxvold et al. 2025), and it was recognised by local informants interviewed at low elevation Sites 1 and 2 and at higher elevations at Site 5. However, several lines of evidence indicate that this species is likely to be absent or very scarce and in a limited area, within the study area. This is because:

- There are no prior records from hill forest below 1,000 m AMSL reported for the Ok Tedi area (Hyndman and Menzies 1990).
- There are no confirmed records below 600 m AMSL anywhere across the species' range.
- During the present surveys, local informants mis-identified several mammal species from photographic materials.
- As a distinctive and favoured hunting quarry, encounters with echidnas are long remembered, potentially resulting in spurious affirmative responses even when correctly identified; for example, no evidence has been provided about the locations at which local residents may have encountered echidnas.

Considering all available evidence, this species is expected to be absent from low elevation sites, and probably also in hill forest at higher elevations in the study area (500–550 m); if it is present in hill forest within the study area, then it is probably locally scarce, with the main body of the local population centred on forest at higher elevations.

#### 5.1.2.3. Birds

##### **Papuan Eagle (*Harpyopsis novaeguineae*) – Also Nationally Protected**

The Papuan Eagle is the island's largest bird of prey that is endemic to New Guinea where it is widespread in forested habitats from sea-level to over 3,000 m AMSL (Coates 1985; Beehler and Pratt 2016). It occurs at low population densities with breeding pairs occupying extensive territories (estimated at  $13.0 \pm 3.9$  km<sup>2</sup> at Crater Mountain WMA: Watson and Asoyama 2001). While most records are from undisturbed forest, it also persists in logged forest (I. Woxvold, unpublished data), presumably where suitable prey remains. Not a soaring raptor, it hunts mammals and birds on the ground, in trees or from tree hollows by flying through or low over the canopy (Coates 1985; Watson and Asoyama 2001). Visually inconspicuous, it is most readily detected by its distinctive call.

Habitat loss and hunting present the major threats. In many areas it is actively targeted by hunters for its plumes which are used for ceremonial purposes (Coates 1985; Watson and Asoyama 2001; BirdLife International 2026). As a result, it is now rare or extirpated from areas near human settlement where hunting persists.

Papuan Eagle was recorded at Sites 4 and 5 based on local informants interviewed. Suitable forest habitat is present throughout much of the study area and the species may be locally widespread though scarce, particularly in areas frequently visited by humans. Gregory (1995) reported it to be locally scarce in the Ok Tedi area with only three records in four years of survey.

### **Pesquet's Parrot (*Psitttrichas fulgidus*) – Also Nationally Protected**

This unusual large parrot is endemic to New Guinea where it inhabits hill and lower montane forest up to 1,600 m AMSL, occasionally higher (Coates 1985; Beehler and Pratt 2016). A nomadic and specialist frugivore, it feeds almost exclusively on a select variety of figs (*Ficus* spp.) (Mack and Wright 1998). Pesquet's Parrots nest in tree hollows, which they excavate in tall dead trees (Igag et al. 2019).

Hunting is the major threat (BirdLife International 2026). Plumes of Pesquet's Parrot are commonly used for ceremony and trade, and hunting has resulted in its decline or loss from the vicinity of many settled areas (Coates 1985; Kocher Schmid 1993; Mack and Wright 1998). As a result, Pesquet's Parrot has been listed as one of PNG's rarest birds (Beehler 1993). However, recent surveys indicate the species remains secure in large areas of suitable habitat in central and western mainland PNG, much of which occurs on rugged terrain in areas with a low human population density (Woxvold et al. 2019; BirdLife International 2026). Other threats include habitat loss and loss of food trees (*Ficus* spp.) and nest trees. Logging appears not to present a major threat as this species has been observed in 10-year regrowth in heavily logged areas (I. Woxvold, unpublished data), though the birds may rely on more mature forest for nest sites.

Pesquet's Parrot was recorded at Sites 1, 4 and 5 based on local informants. Suitable forest habitat is locally and regionally widespread and it may occur in small numbers anywhere in the study area. In the 1990s it was locally "[s]till not uncommon away from habitation but becoming rare as hunting persists" Gregory (1995, p.17). It is infrequently reported on bird tours in the region between Kiunga and Tabubil (eBird 2026), and the lack of direct encounters of this generally conspicuous species suggests that it was scarce or absent at the sites surveyed.

#### **5.1.2.4. Herpetofauna**

##### **Southern New Guinea Giant Softshell Turtle (*Pelochelys bibroni*)**

The Southern New Guinea Giant Softshell Turtle occurs in most large waterways draining south-central mainland New Guinea. It occupies large waterbodies and at Site 4 local informants stated that this species occurs in the Ok Ma and in tributaries of the Ok Tedi. This species' occurrence in streams in the proposed TSF footprint at Site 1 and 2 is highly unlikely, despite the conclusion of the 2014 study (BMT WBM 2015) which was also based on local testimony.

#### **5.1.3. Near Threatened Species**

##### **5.1.3.1. Non-volant mammals**

##### **New Guinea Quoll (*Dasyurus albopunctatus*)**

A medium sized marsupial carnivore (up to 0.5 kg), brown in colour with white spots (Plate 11d). Endemic to New Guinea where it occurs throughout from sea level to above 3,500 m AMSL, less commonly in lowlands and foothills (Flannery 1995; Baker 2015). It can be found

in a variety of habitats including primary and secondary forest and nearby gardens and subalpine heath. As a top-order predator it is nowhere very common.

This Near Threatened species is susceptible to forest loss and habitat degradation (Woolley et al. 2016) and poisoning by cane toads. It is too small and uncommon to be a specific hunting target, though it is taken opportunistically with snares and the use of dogs.

The New Guinea Quoll was photographed in hill forest on two camera traps at Site 5. It is locally widespread in the Ok Tedi hill forests (Hyndman and Menzies 1990) where it may be common above about 400 m AMSL. It may be locally scarce or absent at lower elevations.

#### **Small *Dorcopsis* (*Dorcopsulus vanheurni*)**

A small forest wallaby weighing up to 2 to 3 kg, dark brown on the back and usually paler below. Endemic to New Guinea where it is found throughout the central ranges, usually above 800 m AMSL (Eldridge and Coulson 2015) and occasionally lower (Hyndman and Menzies 1990; I. Woxvold, unpublished data).

*Dorcopsulus* wallabies are threatened mainly by subsistence hunting and to some degree by habitat modification, with clear declines and localised extinctions recorded in some lower montane areas where human population densities are highest (Leary et al. 2016b; Eldridge and Coulson 2015). However, the Small *Dorcopsis* is widespread and secure in suitable habitat across much of its range – it is routinely the most frequently camera trapped animal (mammal or bird) in a long-term monitoring study undertaken in the Hegigio-Kikori River basin in Hela and Southern Highlands Provinces (Woxvold et al. 2025), and it is often recorded at suitable sites in other Provinces (I. Woxvold, unpublished data).

Hyndman and Menzies (1990) reported the Small *Dorcopsis* to be common in forest above 500 m AMSL in the Ok Tedi area, and during this study it was recognised by local residents interviewed at Site 5. The only other non-arboreal macropod (i.e., not a tree kangaroo) within range is the New Guinea Pademelon (*Thylogale browni*), an IUCN Vulnerable species that is generally much rarer than the Small *Dorcopsis* at sites where both species are present (Woxvold et al. 2025). Small *Dorcopsis* may occur locally in study area hill forest, probably mostly or entirely above 400 m AMSL. More work would be required to estimate local abundance, but any local animals will form part of a larger population that is likely to occur at higher densities above the study area.

#### **5.1.3.2. Birds**

##### **Palm Cockatoo (*Probosciger aterrimus*), Also Nationally Protected**

The Palm Cockatoo is widespread throughout New Guinea in the lowlands and hills, occasionally to 1,350 m AMSL, in primary and secondary forest and savanna (Beehler and Pratt 2016). It occurs more widely from the West Papuan Islands east to Cape York Peninsula, Australia. However, it is nowhere common and typically occurs at lower densities than other sympatric cockatoos and large parrot species (Igag et al. 2019). Habitat loss and hunting are major threats. Palm Cockatoos are also susceptible to the loss of trees with suitable nest hollows (Igag et al. 2019).

Palm Cockatoo was recorded at Site 1 based on local informants. Suitable forest habitat is locally and regionally widespread and it may occur in small numbers anywhere in the study area. However, Gregory (1995) noted that it is generally uncommon in the region, and the lack of direct encounters of this generally conspicuous species suggests that it was scarce or absent at the Ok Birim study sites during the survey.

### **Sclater's Crowned Pigeon (*Goura sclaterii*)**

The world's largest pigeons, crowned pigeons (*Goura* spp.) are terrestrial-foraging species endemic to the lowlands (below c. 500 AMSL) of New Guinea. They occur in groups of up to 30 birds (usually less than seven) in closed-canopy evergreen forest, preferring areas of gentle terrain including seasonally flooded habitats (Coates 1985; Gibbs et al. 2001). Until recently, the distribution of *Goura* pigeons in southern mainland PNG was poorly known. Recent data indicate that Sclater's Crowned Pigeon (*Goura sclaterii*) occurs from the Mimika River (Indonesia) east into PNG at least as far as the lower Kikori River in Gulf Province (Woxvold 2018) and there are numerous records indicating that it is the only crowned pigeon resident in the Fly-Strickland Rivers basin (eBird 2026; I. Woxvold, unpublished data). Reports of this species from east of the Kikori River (e.g., BirdLife International 2026) are in error.

Habitat loss and degradation, including through logging, and hunting present the major threats to crowned pigeons. All *Goura* species are susceptible to hunting, being easily captured and highly prized for their meat and plumes (Coates 1985; King and Nijboer 1994; BirdLife International 2026). Other threats include habitat fragmentation, dogs and collisions with traffic in areas with roads.

Sclater's Crowned Pigeon was detected aurally at Sites 1, 2 and 5. Suitable forest habitat is present throughout much of the study area and the species is likely to be locally widespread, though it is probably scarce or absent in areas frequently visited by humans. Gregory (1995) reported local observations by H. Bell up to about 400 AMSL, but indicated that it had been extirpated from forest at lower elevations around Ningerum, indicating its susceptibility to local hunting practices.

### **Forest Bittern (*Zonerodius heliosylus*)**

The Forest Bittern is endemic to New Guinea where it is widely though sparsely distributed, predominantly in the lowlands (below 500 AMSL) but occasionally up to 1,650 m AMSL (Sam and Koane 2014, Beehler and Pratt 2016). It is a reclusive and rarely seen inhabitant of forest swamps, streams and pools (Coates 1985).

Habitat loss, degradation and physical and chemical contamination of watercourses and riparian and wetland habitats present the major threats. It is not specifically targeted by hunters, but as with most New Guinean birds, individuals would be taken should the opportunity arise.

Forest Bittern was recorded at Site 1 based on local informants. Suitable forest habitat is locally and regionally widespread, and it may occur in small numbers anywhere in the study area. However, no records of this species was included in Gregory's (1995) summary of bird records from the Ok Tedi region.

#### 5.1.4. Data Deficient Species

##### 5.1.4.1 Bats

###### **Lesser Tube-nosed Bat (*Nyctimene draconilla*)**

The Lesser Tube-nosed Bat is a poorly known fruit bat from lowland regions of New Guinea, typically associated with freshwater swamps, rivers, and tropical forests. It is currently classified as Data Deficient due to major uncertainties in its distribution, population size, and even reliable identification, as it is difficult to distinguish from similar species. Available records suggest it occurs mainly south of New Guinea's central cordillera from sea level to about 100 AMSL, but its full range remains unclear. There are no major known threats or evidence of hunting, but further research into its taxonomy, ecology, and population status is considered essential for effective conservation (Armstrong 2021).

###### **McIntyre's Horseshoe Bat (*Rhinolophus mcintyre*)**

McIntyre's Horseshoe Bat currently does not have a common name and is a poorly known horseshoe bat from Papua New Guinea. Currently listed as Data Deficient due to limited information on its distribution, population size, and threats. It was originally described as a subspecies of *Rhinolophus arcuatus*, but genetic evidence supports its elevation to full species status. It is relatively common south of the cordillera (K.N. Armstrong unpublished data) and roosts in limestone caves and forages in forest habitats, suggesting ecological dependence on both intact forest and cave systems. Although specific threats are not well documented, habitat loss and cave disturbance are likely risks (Patrick & Ruedas 2017).

##### 5.1.4.2. Herpetofauna

###### ***Amnihilia longicrus***

A small (body length to about 30 mm) green treefrog with a broad distribution across the southern lowlands and foothills of mainland New Guinea between the Vogelkop Peninsula in the west and the Purari River basin in the east (Richards 2025). It is found along small, clear-flowing rocky streams in forest and at Ok Birim, a single animal was encountered at Site 5.

This species is listed as Data Deficient by the IUCN (2020) "in view of continuing uncertainties as to its taxonomic status, extent of occurrence, population status and ecological requirements." However, it is now known to be a widespread species (Richards 2025) so it may warrant reassessment as Least Concern.

##### 5.1.4.3. Odonata

###### ***Argiolestes muller***

This is a moderately robust "flatwing" damselfly that perches with its wings held horizontally. It was previously known from two localities at elevations of 328–515 m AMSL in and near the Muller Range (Kalkman et al. 2010), approximately 120 km east of Ok Birim. At Ok Birim it was encountered along clear-flowing streams at Sites 1, 2 and 5. It is assessed as

Data Deficient because “the species' range is poorly documented and its habitat requirements and population status are poorly understood” (Richards 2019a)

#### ***Podopteryx roseonotata***

A large, robust “flatwing” damselfly that is known from scattered localities across mainland New Guinea and the Aru Islands from southwestern Papua Province in the southwest to the Huon Peninsula in PNG in the northeast. The records, from Sites 2 and 5, fill a large gap in the known distribution of the species. *Podopteryx roseonotata* is probably a phytotelmata (treehole) breeder and it was assessed as Data Deficient because its “habitat requirements are poorly known and, if it is a phytotelmata breeder it may be particularly sensitive to forest disturbance” (Richards 2019b).

#### ***Nososticta ovimacula***

A small, slender, black damselfly with black appendages and a large (in males) or small (in females) blue spot on the thorax (Plate 15a). This stream-dwelling species was previously known from two locations to the east of Ok Birim, one in the upper Fly and Strickland river basins and the other in the Kikori River basin, both on the southern fringe of Papua New Guinea's central cordillera (Theischinger & Richards 2016). It was assessed as Data Deficient by the IUCN (2025) due to the lack of knowledge about its distribution, habitat requirements and population status. This species was moderately common at Sites 1 and 2 at Ok Birim, and these records extend this species' known range approximately 88 km to the west.

#### ***Nososticta rangifera***

A small, slender black damselfly with white appendages and an elongate orange spot on the thorax. This stream-dwelling species was previously known only from southeastern South Papua Province of Indonesian New Guinea (Kaize & Kalkman 2011). It was assessed as Data Deficient by the IUCN because it “is known from three locations in the southeast of Indonesian New Guinea. Nothing definite is known about the habitat requirements of the species and it is therefore assessed as Data Deficient until more data are available” (Dow, 2020). The Ok Birim record extends the known distribution of this species approximately 230 km to the northeast and appears to be the first from Papua New Guinea.

## **5.2. Nationally Protected Species**

Seven bird species protected under *Fauna (Protection and Control) Act 1966* were documented (*Harpyopsis novaeguineae*, *Probosciger aterrimus*, *Cicinnurus regius*, *Manucodia ater*, *Paradisaea raggiana*, *Psitttrichas fulgidus*, *Rhyticeros placatus*). No protected fauna in other taxa were found. However, chapter 154 of *Fauna (Protection and Control) Act 1966* that gives legal authority to protect PNG fauna was repealed by the recent *Protected Area Act 2024*. Until such legal framework and policy become clearer, species listed here (Table 14) are as a precautionary measure.

## **5.3. New to Science, Undescribed Species and Range Restricted Species**

Nineteen new to science or undescribed species were recorded.

### 5.3.1. Flora

#### ***Begonia* sp. 1**

This newly identified *Begonia* species was first recorded within the proposed TSF footprint approximately 300 m east of Site 1 at 85 AMSL. The specimen was found along Mohed Creek within riverine primary forest and was not observed again during subsequent surveys at sites 1 and 2. Morphologically, *Begonia* sp.1 presents as a sprawling to erect herbaceous plant, reaching 20-30 cm in height. Its leaves are green with deeply serrated margins and an oblique base (Plate 16a). The stem is distinctly hairy. Male flowers exhibit greenish tepals that range from orbicular to ovate, accompanied by conspicuously bright yellow stamens. Female flowers were not observed during the survey. Notably, the leaf morphology bears a superficial resemblance to members of the genus *Elatostema* (Urticaceae). However, taxonomic comparison confirms that *Begonia* sp.1 does not correspond to any specimens currently held in the Lae National Herbarium reference collections.

#### ***Begonia* sp. 2**

This species of *Begonia* is newly recognized and has not been formally described in existing botanical references at Lae National Herbarium reference collections. It is the first record from Site 2. It occurs predominantly along creeks and main streams within riverine forest zones, where it favours consistently moist conditions. The species was subsequently observed and recorded at three additional locations in the proposed TSF footprint, with most sightings concentrated in humid riverine habitats. Morphologically, *Begonia* sp.2 is a sprawling to erect herbaceous plant reaching 30-40 cm in height. The leaves are oblanceolate with serrated margins, an oblique base and are distinguished by prominent white spots on the adaxial surface (Plate 16b). Stems as well as secondary and tertiary leaf veins, are densely hairy. Male flowers possess two white tepals and bright yellow stamens. Female flowers have five white tepals with a yellow style. The fruit capsules are winged, hairy and range from green to white in color. This species bears resemblance to *Begonia brevirimosa* subsp. *brevirimosa*, but differs notably in its dense indumentum, particularly the hairy stems and leaf veins as well as the more pubescent nature of its flowers and fruit capsules, which are not glabrous.

#### ***Dillenia* sp. 1**

This suspected new species of *Dillenia* shows no morphological resemblance to any specimens currently held in the Lae National Herbarium. It can grow to an estimated height of three to four meters and was observed growing among small patches of sago palms, favouring the moist and saturated habitat characteristics of the proposed TSF footprint biome. The species is notably common within the proposed TSF footprint and was recorded at both Site 1 and Site 2, particularly along valley drainage lines and in sago swamp areas. Although the collected specimens are sterile, their vegetative features are distinct from known *Dillenia* taxa. Juvenile plants can be tentatively identified by the presence of white spots along the margin of the adaxial leaf surface, an identifying trait that disappears in mature individuals (Plate 16c). To confirm its taxonomic status, it is recommended that fertile material, especially floral parts must be collected for further examination.

### ***Glochidion* sp. 1**

This suspected new species of *Glochidion* is a shrub reaching 50 cm to one m in height. It was first observed along ridge slopes and subsequently recorded on the ridge in the vicinity of the site 1. It favours closed-canopy forest environments and thrives on well-drained soils. It is considered a potential new taxon, as it does not resemble any existing *Glochidion* specimens held in the Lae National Herbarium. Taxonomically, the leaves are lanceolate and glaucous on the abaxial surface. The fruits are cauliflorous, red, sessile and distinctly pumpkin-like in appearance (Plate 16d). Although no flowers were observed during the survey, it is recommended that fertile material particularly floral structures be collected to confirm the species' identity.

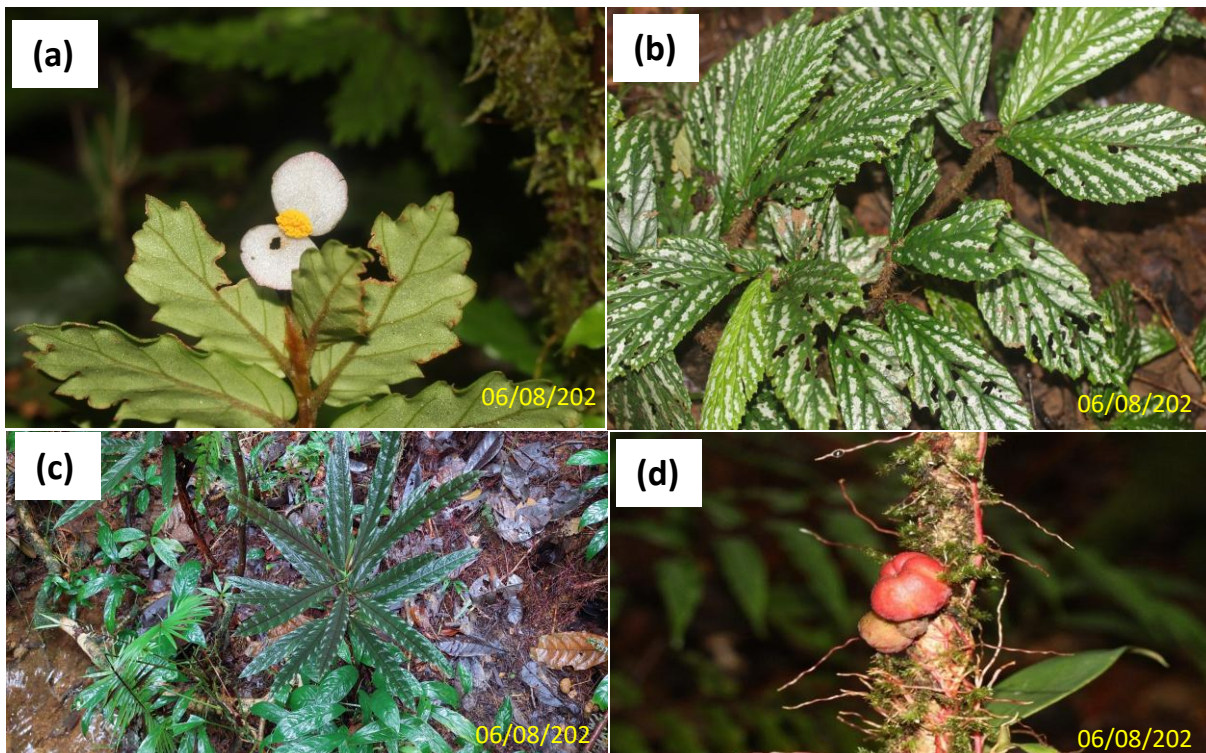


**Plate 16. Plant species likely new to science at Ok Birim proposed TSF footprint. *Begonia* sp.1 with deeply serrated margin, white to greenish orbicular tepals and brightly yellow stamens (a), *Begonia* sp.2 with leaves having white blotches on adaxial surfaces and serrate margin (b), juvenile *Dillenia* sp.1, that favours wet and saturated macrohabitat (c) and *Glochidion* sp.1, with cauliflorous fruits that looks like small pumpkin at Site 1 (d).**

Photographs by Penniel Lamei.

### **5.3.2. Bats**

#### **Greater Large-eared Horseshoe Bat (*Rhinolophus robertsi*) Species Complex**

This taxon is part of the *Rhinolophus* '*philippinensis*' complex that has so far been difficult to resolve taxonomically. In Australia, the Greater Large-eared Horseshoe Bat is currently recognised as *Rhinolophus robertsi* by the authoritative species list maintained by the Australasian bat Society (Milne et al. 2023; <https://www.ausbats.org.au/batmap.html>). Work in progress (K.N. Armstrong et al. unpublished data), which includes information on genetics, skull morphology and echolocation calls from forms across Australasia and Island Southeast Asia confirms the separation of the Australian form from the species in the type

locality in the Philippines. In Australia, its echolocation call is distinct from that of a second smaller sympatric undescribed form that is also part of the same species complex (known as the 'Intermediate'). Both these same echolocation call types have been recorded in various localities in Papua New Guinea (K.N. Armstrong unpublished data) and the lowest frequency call type is routinely allocated to *Rhinolophus robertsi*. However, a capture of the form that produces this call type has never been made, which has prevented confirmation of its similarity to the Australian form.

### **5.3.3. Herpetofauna**

#### **5.3.3.1. Microhylidae**

##### ***Choerophryne* cf. *gracilirostris* (New to Science)**

A series of recordings captured on an acoustic recorder at Site 1 cannot be associated with any known frog species but most closely resemble the calls of *Choerophryne gracilirostris*, a small, long-snouted species known from the Muller Range and Southern Highlands Province (Richards 2025). Voucher specimens are required to confirm the identity of this species, but it is likely to be new-to-science and likely has a small range.

##### ***Hylophorbus* sp. 1 (fast call) (Undescribed)**

Forest floor dwelling frog with long limbs and a call comprising a rapidly repeated series of rather melodious honking notes (Plate 14b). *Hylophorbus* is a taxonomically difficult genus, but it is likely that this species is undescribed. Whether it has previously been documented elsewhere in southern PNG or is new-to-science and known only from the Ok Birim area will require detailed comparisons with other populations, including genetic studies. Despite these uncertainties this species is considered likely to qualify as restricted range and it is possibly a local endemic. Voucher specimens and tissues were collected.

##### ***Hylophorbus* sp. 2 (slow call) (Undescribed)**

Identification of this frog is based on the call only, which closely resembles that of an undescribed *Hylophorbus* species known to occur widely in southern Papua New Guinea to the east of Ok Birim. This species could also be “true” *H. rufescens*. Collection of voucher material at Ok Birim will be required to confirm whether they are the same species.

##### ***Oreophryne* sp. 1 (Undescribed)**

A small (males ~17-18 mm body length) arboreal frog with short limbs and a call comprising a series of high-pitched peeping notes (Plate 14c). This species is undescribed but was previously known from the outskirts of Tabubil town (Richards, unpublished data). Specimens from Tabubil were erroneously included in the type series of *O. notata* by Zweifel (2003), but it actually represents an undescribed species. It qualifies as restricted range and may have a small local range. Voucher specimens and tissues were collected.

##### ***Sphenophryne* cf. *cornuta* (Undescribed)**

A medium size (body length to about 40 mm) scansorial (shrub-dwelling) frog with an angular, pointed snout and a distinct spike above each eye. Previously included within the widespread species *S. cornuta*. However, recent genetic studies have revealed that populations in southern Papua New Guinea are genetically divergent; they also have a

different call. Although undescribed, the species at Ok Birim is widespread and abundant and does not qualify as restricted range.

***Xenorhina* cf. *pohleorum* (Undescribed)**

A single call captured on an acoustic recorder at Site 1 resembles that of *X. pohleorum*, a small terrestrial/fossorial frog known from several locations between the Rentoul River in Western Province and the Gulf Province lowlands in south-central Papua New Guinea. However, there are subtle differences between the calls, and it is possible that the recording represents an undescribed species. Voucher material is required to confirm the status of this frog species.

**5.3.3.2. Pelodryadidae**

***Spicicalyx* cf. *genimaculata* (Undescribed)**

A medium-sized (males to ~40 mm body length) treefrog with large eyes, small lappets of skin along the limbs and a small spike on the heel. Although this species is undescribed it was first collected more than 30 years ago in the vicinity of Ok Ma (S. Richards, unpublished data). Extensive surveys across southern PNG in the past 20 years have failed to detect additional populations of this species and it may have a distribution restricted to the southern fringes of the Star Mountains.

**5.3.4. Odonata**

***Teinobasis* sp. 1 (New to Science)**

An exceptionally long (abdomen ~55 mm) and slender damselfly in the genus *Teinobasis* represents a species new to science. This distinctive species is unlike any other member of the genus. It was encountered on low vegetation in primary forest at Sites 1, 4 and 5.

***Teinobasis* sp. 2 (New to Science)**

A small, slender, yellow-faced damselfly of the coenagrionid genus *Teinobasis* is new to science. It is known from a single specimen collected on a hillslope far from water in primary forest at Site 4.

***Idiocnemis* sp. 1 (undescribed)**

A small, slender, stream-dwelling damselfly with pale rings on the abdomen and a blue tail tip (Plate 17b). This species was common along small streams at sites 1, 2 and 5 and in nearby forest. It is a member of the *Idiocnemis bidentata* group, and two species of this group are known from the upper Fly River catchment: *Idiocnemis mertoni* and *I. schorri*. However, the thorax pattern of the specimens from Ok Birim differs consistently from both of these species (Gassmann 2000; Gassmann et al. 2016). Although unlikely, it is possible that the species at Ok Birim is one of the above two species or (more likely) it is the undescribed “*Idiocnemis* near *mertoni*” reported from approximately 230 km to the southwest of Ok Birim in southeastern Papua Province (Indonesian New Guinea) by Kaize & Kalkman (2011).

***Nososticta* sp. 1 (New to Science)**

A small, black damselfly with yellow markings on the thorax was collected from a small stream at Site 2. Its colour pattern and terminalia are unique in the genus and it is new to science.

***Palaiargia* sp. 1 (New to Science)**

A single male of a small but moderately robust damselfly belonging to the genus *Palaiargia* appears to be new to science. Two unidentified females may also belong to this species. All were collected near clear-flowing forest streams at Site 5.

***Papuargia* sp. 1 (New to Science)**

A robust, black-and-green damselfly in the genus *Papuargia* is sufficiently different from the sole representative of this species in southern PNG that it likely represents a species new-to-science. Like other members of the genus, it was found along clear-flowing rocky streams in forest. This species was found only at Site 5.

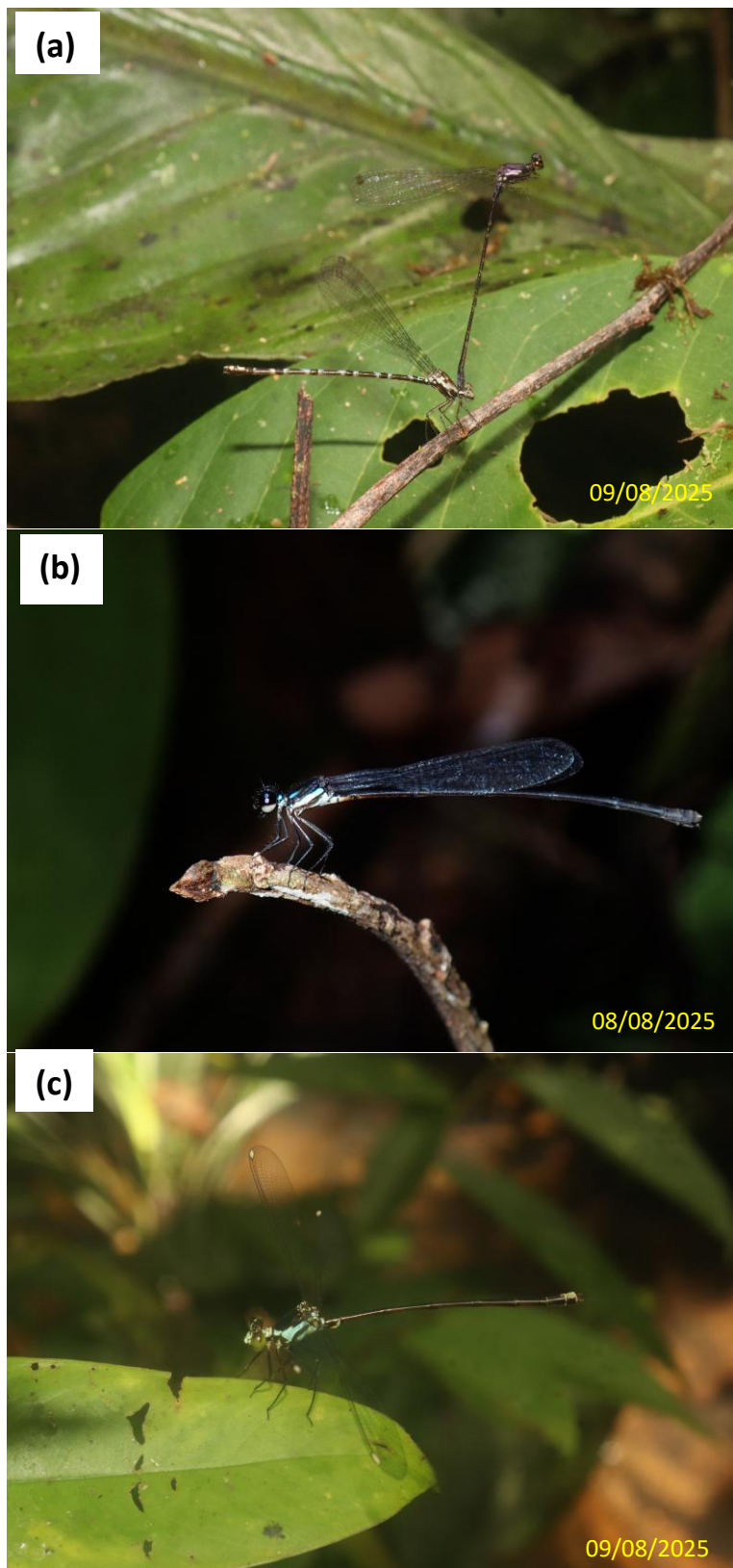


**Plate 17. Some odonate species encountered in the TSF footprint from near streams at Site 1. Female *Nososticta ovimacula* (a), *Idiocnemis* cf *schorri* (b) and *Metagrion* cf. *annehueberae* (c). Photographs by Enock Kale.**

## **5.4. Other Conservation Significant Species from Literature Review**

Other species of conservation significance based on literature review that are likely to occur within the Ok Birim proposed TSF footprint, along the proposed pipeline or nearby based on their known distributions and habitat requirements are listed in Table 16.

Four species of conservation significance that were not recorded in this study were documented by previous studies in the proposed TSF (BMT WBM 2015) and/or during another study at Bige (BMT WBM 2016), about 20 km south of the proposed Ok Birim TSF footprint. No similar study along the proposed pipeline corridor was/were done that we are aware of; therefore, no comparison is made.

Brief accounts of each species are provided.

**Table 166. Other species of conservation significance under IUCN, PNG government or with restricted range based on literature review.**

| Family                    | Scientific name                 | Common name               | BMT WBM study | IUCN | Nationally Protected (P) | Restricted-range (RR) (<50,000 km <sup>2</sup> ) |
|---------------------------|---------------------------------|---------------------------|---------------|------|--------------------------|--------------------------------------------------|
| <b>Flora</b>              |                                 |                           |               |      |                          |                                                  |
| Annonaceae                | <i>Polyalthia longirostris</i>  |                           |               | NT   |                          |                                                  |
| Clusiaceae                | <i>Calophyllum collinum</i>     | Collin's Calophyllum      |               | EN   |                          |                                                  |
| Euphorbiaceae             | <i>Endospermum medullosum</i>   | New Guinea basswood       |               | VU   |                          |                                                  |
| Fabaceae                  | <i>Intsia bijuga</i>            | Kwila                     |               | NT   |                          |                                                  |
| Fabaceae                  | <i>Pterocarpus indicus</i>      | Papua New Guinea Rosewood |               | EN   |                          |                                                  |
| Myrtaceae                 | <i>Syzygium pergamaceum</i>     |                           |               | VU   |                          |                                                  |
| Pandanaceae               | <i>Pandanus iwen</i>            | Woromo                    |               | DD   |                          |                                                  |
| <b>Non-volant mammals</b> |                                 |                           |               |      |                          |                                                  |
| Macropodidae              | <i>Dendrolagus spadix</i>       | Lowlands Tree-kangaroo    |               | VU   | P                        | RR                                               |
| Macropodidae              | <i>Dorcopsis luctuosa</i>       | Grey Dorcopsis            | 2015, 2016    | VU   |                          |                                                  |
| Peroryctidae              | <i>Echymipera kalabu oriomo</i> | Oriomo Echymipera         |               | NE   |                          | RR                                               |
| Peroryctidae              | <i>Echymipera echinista</i>     | Menzies' Echymipera       |               | DD   |                          |                                                  |
| <b>Bats</b>               |                                 |                           |               |      |                          |                                                  |
| Pteropodidae              | <i>Aproteles bulmerae</i>       | Bulmer's Fruit Bat        |               | CR   |                          |                                                  |
| Pteropodidae              | <i>Nyctimene draconilla</i>     | Lesser Tube-nosed Bat     | 2015          | DD   |                          |                                                  |
| <b>Birds</b>              |                                 |                           |               |      |                          |                                                  |
| Estrildidae               | <i>Lonchura stygia</i>          | Black Mannikin            |               | LC   |                          | RR                                               |

| Family               | Scientific name                    | Common name                  | BMT WBM study | IUCN | Nationally Protected (P) | Restricted-range (RR) (<50,000 km <sup>2</sup> ) |
|----------------------|------------------------------------|------------------------------|---------------|------|--------------------------|--------------------------------------------------|
| Maluridae            | <i>Chenorhamphus campbelli</i>     | Campbell's Fairywren         |               | NE   |                          | RR                                               |
| <i>Paradisaeidae</i> | <i>Ptiloris magnificus</i>         | Magnificent Riflebird        | 2016          | LC   | P                        |                                                  |
| <b>Herpetofauna</b>  |                                    |                              |               |      |                          |                                                  |
| Carettochelyidae     | <i>Carrettochelys insculpta</i>    | Pig-nosed Turtle             |               | EN   |                          |                                                  |
| Microhylidae         | <i>Callulops marmoratus</i>        |                              | 2015          | DD   |                          | RR                                               |
| Microhylidae         | <i>Xenorhina tillacki</i>          |                              |               | LC   |                          |                                                  |
| Chelidae             | <i>Chelodina parkeri</i>           | Parker's Snake-necked Turtle |               | NT   |                          |                                                  |
| Chelidae             | <i>Chelodina reimanni</i>          | Reimann's Snakeneck Turtle   |               | NT   |                          |                                                  |
| Gekkonidae           | <i>Cyrtodactylus derongo</i>       | Derongo Bow-fingered Gecko   |               | DD   |                          |                                                  |
| <b>Odonata</b>       |                                    |                              |               |      |                          |                                                  |
| Coenagrionidae       | <i>Pseudagrion parafarinicolle</i> |                              |               | DD   |                          |                                                  |
| Coenagrionidae       | <i>Teinobasis cuneata</i>          |                              |               | DD   |                          | RR                                               |
| Coenagrionidae       | <i>Teinobasis flavolineata</i>     |                              |               | DD   |                          | RR                                               |
| Platycnemididae      | <i>Idiocnemis schorri</i>          |                              |               | DD   |                          | RR                                               |
| Platycnemididae      | <i>Nososticta paraconifera</i>     |                              |               | DD   |                          | RR                                               |
| Platycnemididae      | <i>Nososticta marina</i>           |                              |               | DD   |                          |                                                  |
| Platycnemididae      | <i>Papuargia brevistigma</i>       |                              |               | DD   |                          | RR                                               |
| Libellulidae         | <i>Diplacina cyrene</i>            |                              |               | DD   |                          |                                                  |
| Libellulidae         | <i>Rhyothemis hurleyi</i>          |                              |               | DD   |                          |                                                  |
| Macromiidae          | <i>Macromia eurynome</i>           |                              |               | DD   |                          |                                                  |

### 5.4.1. Flora

#### ***Polyalthia longirostris***

Formerly known as *Haplostichanthus longirostris* (Xue et al. 2012). It is known from less than 10 locations from PNG and Solomon Islands and occurs from sea level to 100 AMSL. There is only one record from Western Province below Kiunga around 23 AMSL (IUCN website). Not much is known about its distribution and ecology. However, given that the proposed TSF footprint lies within known elevational range, it is likely to occur there.

#### ***Calophyllum collinum***

The species is endemic to New Guinea and is known from Snow Mountains of Irian Jaya, Western and Morobe Provinces with elevational range from 25 to 500 AMSL (IUCN website). Known locations in Western Province are Kiunga and Ningerum (Conn, 1995). Despite the proposed TSF footprint being within *C. collinum* elevational range and close proximity to known localities, it was not documented in the 2014 study and in this survey.

#### ***Endospermum medullosum***

The New Guinea Basswood is widely distributed in New Guinea, Solomon Islands and Vanuatu. The species has been recorded from near Kiunga (IUCN website). However, it was not documented in the 2014 study and by this survey in the proposed TSF footprint.

#### ***Intsia bijuga***

The Kwila has wide distribution including New Guinea, South East Asia, Solomon Islands, Vanuatu and Australia. In Papua New Guinea, Kwila seems to be mostly found on the northern region. There are few records from southern region from Gulf Province and Lower Fly in Western Province. There are no records from Middle and North Fly regions, which could mean Kwila is probably not present in proposed TSF footprint.

#### ***Pandanus iwen***

This pandanus is likely found only in Papua New Guinea as it has been recorded from Kiunga only (IUCN website). It is likely to occur in the proposed TSF footprint, but 2014 study and this survey did not document it.

#### ***Pterocarpus indicus***

This species has wide distribution from Southeast Asia to new Guinea. However, in Western Province, it is recorded from Daru Island and lower parts of Lower Fly (Conn, 1995). In Gulf, Morobe and Central Provinces, it seems to occur from sea level to 1300 m (Conn 1995, IUCN website). However, there are no records from Middle and North Fly areas including the Lower Ok Tedi where the proposed TSF is located. While the 2014 study and this survey did not find the species, the chances of finding it in the future cannot be ruled out.

#### ***Syzygium pergamaceum***

The species is endemic to PNG, inhabit swampy areas and is found from sea level up to 1,150 m AMSL (IUCN website). In Western Province, it is recorded from Stuart Island and above Fly River and Elevala River junction in Kiunga area (Conn 1995). Given that the proposed TSF footprint is in riverine forest and within its elevational range, *S. pergamaceum* likely occurs there.

#### 5.4.2. Non-volant Mammals

##### **Oriomo Echymipera (*Echymipera kalabu oriomo*) – Subspecies**

The Oriomo Echymipera (*E. k. oriomo*) is not evaluated by IUCN because it is likely subspecies of *E. Kalubu* (verbal comm., Daniel S. Okena, Ian Woxvold). It is also not recognized by Handbook of Mammals of the World (Baker 2015) as a separate species although it was treated as a full species in Papua LNG work in Gulf Province (Aplin et al, 2017). The Oriomo Echymipera could not be easily identified based on field morphological characters by either the experts or the locals. Therefore, all the bandicoot images from the camera traps and catches from other traps in this study were treated as *E. kalubu*. Specimens are required for morphological and molecular confirmation.

##### **Menzie's Echymipera (*Echymipera echinista*) – Data Deficient**

Menzie's Echymipera is very rare and only known from two locations: Fly River and Strickland River drainages from 40-80 m AMSL (Flannery 1995). There are also unconfirmed records from Mt Menawi in Papua, Indonesia which would extend its range to 1000 m AMSL (IUCN website).

##### **Tree Kangaroos (*Dendrolagus* spp.) – Endangered, Vulnerable**

Local people indicated that tree kangaroos occur at higher elevations from the proposed TSF footprint. *Dendrolagus notatus* and *D. goodfellowi* are found at higher elevations while the poorly known *D. spadix* also occurs up to 800 AMSL (Flannery 1995). *Dendrolagus spadix* is known only from the south western part of the Papuan Plateau on limestone. However, the nearest part of its known range is 150 km east from the proposed TSF footprint. The 2014 study states that it is unlikely to be found in the proposed TSF area based on habitat requirement (BMT WBM 2015). However, given that the proposed TSF is in the *D. spadix* elevation range with limestone areas further north and with a low human population density, the chance of *D. spadix* occurring in North Fly area cannot be ruled out completely.

##### **Grey Dorcopsis (*Dorcopsis luctuosa*) - Vulnerable**

The Grey Dorcopsis is known from sea level to 400 m AMSL in southern Trans-Fly to south-eastern parts of PNG; Gulf, Central and Milne Bay provinces. It occurs in primary forest and disturbed habitats like abandoned gardens (IUCN website). Ok Birim location and forest type seems suitable for *D. luctuosa* to occur. Local informants indicated its presence in 2014 study (BMT WBM 2015); however, in this study they indicated that the species occurs at higher elevations and not within the proposed TSF footprint.

#### 5.4.3. Bats

##### **Bulmer's Fruit (*Aproteles bulmerae*) – Critically Endangered**

Bulmer's Fruit Bat (*A. bulmerae*) roosts in caves at higher elevation in the Hindenburg Wall, Simbu and Eastern Highlands Provinces (Flannery & Seri 1993). It is unlikely to be found in

lower elevations like Ok Birim or the lower Ok Tedi area. If *A. bulmerae* is found at low elevation, it is most likely due to foraging rather than roosting.

#### **Lesser Tube-nosed Bat (*Nyctimene draconilla*) – Data Deficient**

The Lesser Tube-nosed Bat occur mostly in the southern region between Mt. Bosavi and Asmat regency in the Papua, Indonesia. Bonaccorso (1998) recorded the species from the central highlands in PNG. It has been recorded from sea level up to 100 m AMSL. All the records of this species are from freshwater swamps and rivers (IUCN website). Lesser Tube-nosed is likely to occur in the proposed TSF footprint area given the riverine landscape of the of the proposed TSF project areas. However, further work is required to determine actual range of the species and remains a DD species under IUCN.

### **5.4.4. Birds**

#### **Magnificent Riflebird (*Ptiloris magnificus*) – Nationally Protected**

The Magnificent Riflebird is widely distributed in PNG, Papua (Indonesia) and occurs on the northern tip of Australia and is LC according to IUCN website. However, it is one of the birds of Paradisea species protected by PNG government whose legal status and many other protected species in PNG is uncertain (see section 5.2).

#### **Black Mannikin (*Lonchura stygia*) - Restricted Range**

The Black Mannikin is a grassland and riverine inhabitant (Beehler et al. 1986, Coates 1990, Gregory 1995) known from a restricted area of the southern Trans-Fly region. It may have extended its range northwards with wetland and grassland development in the upper and middle Fly brought about by hydrological changes due to mining activities but the habitat at the proposed TSF footprint is not suitable for this species.

#### **Campbell's Fairywren (*Chenorhamphus campbelli*) - Restricted Range**

Campbell's Fairywren was formerly placed in *C. grayi*. However, recent molecular study has split it into separate species *C. grayi* and *C. campbelli* (Driskell et al 2011). Campbell's Fairywren is known from Mt Bosavi on the east and spread towards Lake Murray and Kiunga on the west (Rowley et al 2021, Pratt and Beehler 2015). However, the species is rarely observed and its ecology and biology are almost unknown.

### **5.4.5. Herpetofauna**

A further six conservation significant species may occur within the proposed TSF footprint and pipeline corridor based on a desktop study of relevant literature and on the results of the 2015 Bige TSF footprint study (Table 16).

#### **Pig-nosed Turtle (*Carrettochelys insculpta*) – Endangered**

This is a large (to > 55 cm carapace length and 22 kg) freshwater turtle known only from the southern lowlands of New Guinea and several drainages in the Northern Territory of Australia. In New Guinea it appears to occupy most of the major drainages south of the central cordillera and it is widespread in the Fly River drainage (Georges et al. 2006). The Pig-nosed Turtle inhabits a wide variety of water bodies including rivers, swamps and lagoons, and estuarine reaches of the river deltas. During the Ok Birim surveys local informants

reported that this species occurs in the Ok Birim but it almost certainly does not occur within the TSF footprint and the species was not encountered at any of the four sites surveyed. Adults are omnivorous, and in the Gulf Province lowlands feed primarily on the unripe fruit, leaves and stems of the mangrove *Sonneratia* spp. (Rose et al. 1982), on other mangrove fruits and vegetation, and on various molluscs and crustaceans (Georges et al. 2008a,b). The Pig-nosed Turtle nests in sandy banks along river channels (Pernetta & Burgin 1980), and it is also known to nest adjacent to water in the mouths of major rivers, on islands in river deltas, and even on coastal beaches. In New Guinea nesting occurs at night between September and February. Adults and eggs of this species are widely consumed by local communities and other sources of mortality include predation by varanid lizards and inundation of nests during river flooding. Georges et al. (2008b) considered the harvest of *Carettochelys* for local consumption in PNG to be unsustainable, and a significant threat to the survival of these populations. Eisemberg et al. (2015) described current harvesting practices in the Kikori basin and presented a series of recommendations to reduce impacts on this species.

***Callulops marmoratus* – Data Deficient**

A poorly-known species that appears to be widespread between the Purari River basin and the upper Fly River area but probably qualifies as restricted range. Documented at Bige during the 2015 TSF footprint survey (BMT WBM 2016).

***Xenorhina tillacki***

A small fossorial frog previously known from the Muller Range. Documented at Bige during the 2015 TSF footprint survey which is a large extension of range.

***Chelodina parkeri* – Near Threatened**

This species is known from the floodplains and swamps of the Merauke River drainage in southeastern Indonesian Papua and the inland swamps of the Bensbach, Morehead, Fly, and Aramia-Bamu River drainages of the Western Province of southwestern Papua New Guinea.

***Chelodina reimanni* - Near Threatened**

This species is known from Merauke area in adjacent Papua Province of Indonesia-not yet confirmed from PNG but could occur in waterways of the proposed TSF footprint.

***Cyrtodactylus derongo* – Data Deficient**

This species is known only from the type locality, the former Site of Derongo Village (late 1960s) in Western Province, Papua New Guinea. Surveys in lowland areas around Tabubil have failed to collect this species (P. Oliver. pers. comm. 2014), but there is nothing obviously unusual about its known habitat and it may occur more widely in this region.

## **5.4.6. Odonates**

Based on their known distributions and habitat requirements, an additional 10 odonate species of conservation significance may occur within the proposed TSF footprint and the

proposed pipeline road corridor (Table 16). All of these are assessed as Data Deficient by the IUCN.

***Pseudagrion parafarinicolle* – Data Deficient**

Known from the type locality at Lake Kutubu in Southern Highlands Province, Papua New Guinea and from a small number of sites in Papua New Guinea's Gulf Province lowlands. May occur south of Tabubil (as *P. farinicolle*; Richards & Theischinger 2015). A species of small, low-gradient, clear-flowing streams that may occur in the Ok Birim area.

***Teinobasis cuneata* – Data Deficient and Range Restricted**

Known from a single location, on a stream draining the southern slopes of the Hindenburg Range in Western Province, Papua New Guinea at an altitude of 365 m AMSL. (Theischinger & Richards 2015); a species of lowland rainforest that may occur in the vicinity of Site 5 based on the suitable stream habitat there.

***Teinobasis flavolineata* – Data Deficient and Range Restricted**

Known from a single location, a stream draining the southern slopes of the Hindenburg Range near Tabubil town in Western Province, Papua New Guinea at an altitude of 282 m AMSL (Theischinger & Richards 2015). Similar habitat occurs at Site 5 and the species may occur in that area.

***Idiocnemis schorri* – Data Deficient and Range Restricted**

Known from altitudes between 360 and 520 m AMSL along the southern fringe of Papua New Guinea's central cordillera between Tabubil in the west and the Kikori River basin in the east (Gassmann et al. 2016). The species requires clear-flowing streams so the elevation and habitat at Site 5 may be suitable for this species.

***Nososticta paraconifera* – Data Deficient and Range Restricted**

Known from two locations in south-central Papua New Guinea, one in the upper Fly River basin of Western Province (Theischinger & Richards 2016) and another in the Purari River Basin of Gulf Province (S.J. Richards, unpublished data). Occurred patchily along small, clear streams flowing over rocky and sandy substrates in lowland rainforest.

***Nososticta marina* – Data Deficient**

Distribution poorly known but occurs in Aru Islands and Western and Gulf Provinces in PNG - likely to be forest-dependent and probably requires running water. The habitat at Ok Birim appears to be suitable.

***Papuargia brevistigma* – Data Deficient and Range Restricted**

Known from a single location in the upper Strickland River Basin (Orr & Richards 2017), and from one other site in the Purari river basin (S.J. Richards, unpublished data), both in southern Papua New Guinea. On clear rocky streams and small waterfalls so habitat at Ok Birim may not be suitable. A specimen of *Papuargia* was encountered at Site 5 but it does not appear to belong to this species; it appears to be new to science.

***Diplacina cyrene* – Data Deficient**

Appears to have a broad distribution in southern and western New Guinea. Requires clear-flowing streams (sometimes rocky; Richards, unpublished data) so occurrence at Site 5 and surrounding areas is possible given the availability of suitable habitat there.

***Rhyothemis hurleyi* – Data Deficient**

Known from six locations in Indonesian New Guinea (Lieftinck 1949) and two in the southwest of Papua New Guinea (Tillyard 1926). Presumably near ponds and rivers, so suitable habitat within study area so may occur.

***Macromia eurynome* – Data Deficient**

Known from two locations in the south of New Guinea, one on the Lorentz River in Indonesian New Guinea (Lieftinck 1952, 1971) and one in Papua New Guinea (Richards et al. 1998). The known locations are separated by approximately 940 km. Occurs at streams and is almost certainly forest dependent so suitable habitat occurs within the study area, particularly in the vicinity of Site 5.

## 6. Invasive Alien Flora and Fauna

Six exotic invasive species were documented from the study area; plants (5), mammals (4) and frogs (1). Brief species accounts are provided, but for plants only two species accounts are provided.

### 6.1. Flora

**Mile-a-minute (*Decalobanthus peltatus*)**

This was the dominant weed along the ITCS road. It is a fast-growing vine commonly associated with secondary regrowth and disturbed forest margins. It colonizes open, sunlit areas and climbs over pioneer trees and shrubs. In some sections of the road, it formed dense mats over regenerating vegetation that suppressed vertical growth and canopy closure. It is largely confined to the road edge and does not appear to encroach the primary forest. However, clearing the forest for the TSF construction will enable *D. peltatus* to invade regenerating vegetation on the forest edges.

**Spiked Piper (*Piper aduncum*)**

*Piper aduncum* is one of the most invasive plants in PNG. They are often found in clearings and rarely invade primary forests. This is why *P. aduncum* was found along the ITCS road only. When the forest is cleared for the TSF construction, *P. aduncum* is very likely to invade the cleared areas.

### 6.2. Non-volant Mammals

**Dog (*Canis familiaris*)**

Dogs are almost always associated with humans. The dogs observed during the survey are most likely pets or feral. Dogs can have significant impact on the local fauna when used in

hunting by the owner or hunting by itself. For example, small mammal species composition and abundance tend to decline in habitats associated with feral dogs (Zapata-Ríos & Branch 2016).

#### **Black Rat (*Rattus rattus*)**

The invasive Black Rat (*R. rattus*) often occurs around human and was reported by the locals from Sites 2 and 5. It is most likely present around human households in the villages as it was not observed in the primary forests or captured in the traps. The population in Ok Birim is likely to increase propagule pressure to invade TSF footprint and the pipeline corridor once constructed.

#### **Pacific Rat/Polynesian rat (*Rattus exulans*)**

The Pacific rat is another invasive rat often occurs in variety of habits often in disturbed habitats like agricultural and around human households like the Black Rat. It was also reported by the locals from Sites 4 and 5. It is most likely present around human households in the villages as it was not observed in the primary forests or captured in the traps. The population in Ok Birim is likely to increase propagule pressure to invade TSF footprint and the pipeline corridor once constructed.

#### **Pig (*Sus scrofa*)**

Pigs found during the survey were either domesticated or feral. The pigs are exotic and seem to be widespread in the project area as observed by their diggings. They are likely to have a major impact on animal densities in the forest floor (May and Norton 1996). For example, they compete with echidnas and bandicoots for soil invertebrates like earthworms and grubs. They also disturb roots by digging up soil which potentially disturb burrowing sites for small mammals such as *Paramelomys* spp. that frequently nests in the ground tunnels. However, both domestic and feral pigs form important protein source for the local communities.

### **6.3. Herpetofauna**

#### **Cane toad (*Rhinella marina*)**

The Cane Toad, *Rhinella marina* was the only exotic frog encountered at Site 1 in TSF footprint. The toad was introduced to the Port Moresby area in 1948 (and possibly as early as 1938; Lever 2001) and now occurs widely across the country. It is abundant at Tabubil and this species will colonise disturbed habitats connected by road to existing *Rhinella* populations.

## **7. Discussion**

### **7.1. Flora**

#### **7.1.1. Floristic Composition and Community Structure**

The survey recorded 638 species from 113 families with Myrtaceae (26 species) and Lauraceae (25 species) as dominant families. These families are characteristic components of

tropical rainforest vegetation and contribute substantially to canopy structure and floristic composition. Species of *Syzygium* and *Cryptocarya* were well represented across the study area while *Ficus* species, although less species rich, are recognised as important food resources for frugivorous fauna in tropical rainforest ecosystems.

Angiosperms dominate the flora with 454 species (71.1 % of total recorded flora). Ferns (16 species, 2.5 %), lycophytes (five species, 0.8 %) and gymnosperms (two species, 0.7 %) comparatively contributed fewer species, but remain important components of forest understory and habitat diversity.

The high proportion of single species families (40.38%) reflects high floristic diversity within the study area. Habitat heterogeneity from ridge forests to sago swamps likely enhances species turnover, contributing to the observed floristic mosaic. Similar patterns of floristic heterogeneity and localised species turnover are characteristic of tropical rainforest systems (Hubbell, 2001).

### **7.1.2. Species of Conservation Significance**

While progress has been made on New Guinea flora, taxonomic and population status of many new floral species remains unknown. New species are continuously being discovered, for example, four new species are recorded in this survey. Even then materials may not be readily available for rapid assessments for taxonomic verification. For example, about half of the plant species (113 species) of 2014 study were not identified to species level because of lack of suitable plant material being available from the North Fly area (BMT WBM 2015). Similarly, many plant species are not evaluated by international conventions like the IUCN due to lack of data. For example, almost 50% of the species recorded in this study and 47% species in 2014 study were not assessed by IUCN (NE) (Table 15). Depending on the availability of data, conservation status of a species can be updated. For example, *Myristica buchneriana* was treated as VU in 2014 study, but 2019 assessment has categorised it as LC (Barstow 2019). Prior to the 2015 *M. buchneriana* was only known from northern region (BMT WBM 2015). Like *M. buchneriana*, geographical distribution of many plant species in New Guinea are poorly known, which affects their conservation status. For example, another species; *E. engleriana* was known previously from north of the central cordillera. This study is likely the first record in southwest region. This indicates that species considered as having restricted geographical range are likely not so. The TSF surveys in the lower Ok Tedi area provide further extensions of these two species to the southwest region. It requires more surveys to establish extent of their distribution and many other plant species. Similarly, DD species such as *Magnolia tsiampacca* points to knowledge gaps in PNG's floristic assessments. Other IUCN Red list species like *Anisoptera thurifera* and *Lithocarpus vinkii* are indicative of taxa with declining populations due to logging and commercial agriculture.

### **7.1.3. Novel Taxa and Endemism**

The discovery of eight presumed species new to science including two *Begonia*, one *Dillenia*, and one *Glochidion* is not unusual in botanical surveys in New Guinea. The flora is not well collected and new species would be expected in surveys of new areas. These taxa occupy specialised ecological niches: *Begonia* species in riparian microhabitats, *Dillenia* in saturated

sago swamps and *Glochidion* on ridge slopes. Their morphological distinctiveness suggests diversification driven by ecological specialisation within localised ecological gradients, consistent with island biogeography principles where isolation and habitat heterogeneity drive speciation (MacArthur & Wilson 1967).

*Dillenia* sp. nov, was commonly recorded in swamp corridor habitats and may represent a taxon adapted to hydric soil conditions with juvenile leaf traits potentially useful for identification. *Glochidion* sp. nov, characterised by cauliflorous pumpkin-like fruits, displays specialised reproductive morphology that may influence dispersal syndromes. These findings reinforce the global significance of PNG as a biodiversity hotspot where endemism and taxonomic novelty remain under documented (Cámara-Leret et al. 2020).

#### **7.1.4. Significant Habitat**

The sago palm patches identified within the proposed TSF footprint represent ecologically sensitive habitats with dual ecological and cultural functions. Ecologically, they serve as swamp forest macrohabitats supporting hydrophilic flora such as *Nepenthes* and *Stenochlaena* that contributes to habitat heterogeneity and microtopographic complexity.

### **7.2. Non-volant Mammals**

Trap success for small mammals was low, which is consistent with results commonly reported from tropical lowland forests. Continuous rain before nightfall may have affected movement of the mammals in Survey 1. Sites 1 and 2 were close to the ITCS road and during the survey heavy machinery and vehicle movements were observed along the corridor, which may have disturbed the mammals. Roads are also known to increased hunting pressure that leads to negative impacts on species diversity and abundance (Laurance et al, 2008, Brodie et al 2014). Hunting activity by Ok Birim villagers using air guns was also observed in the study area (Plate 18). Similar factors may also apply for Site 5, which is closer to Tabubil. However, this does not explain the nil trap success rate at Site 4, which is more remote than other survey sites.

Survey 1 recorded slightly more native non-volant mammal species than the 2014 study (17 vs 15 species respectively) from the proposed TSF footprint while Survey 2 from Site 5 at a higher elevation in the foothills near Tabubil documented more species than the 2014 study (22 vs 15 species). However, trapping success was low in both 2025 surveys and most of the species (67%) recorded were based solely on information provided by local informants.

Three IUCN conservation significant species: *Zaglossus bartoni* (VU) and *Dorcopsis luctuosa* (VU) and *Dorcopsulus vanheurni* were recorded from local interviews in 2015 and this study. The New Guinea Quoll (*D. albopunctatus*: NT) was the only IUCN threatened mammal species that was recorded by a method other than interviews; it was detected on camera traps at Site 5. Generally, the results of the 2015 and 2025 surveys suggest that the proposed TSF footprint at Ok Birim and the proposed pipeline access road corridor harbour mostly common, widespread mammals like bandicoots such as *E. klaubu* and murids such as *U. caudimaculatus* and *Paramelomys* sp. Population densities of the local mammal species appeared to be low, with several notable exceptions including *E. kalubu* that was captured

on 81 camera trap images at Site 3. The apparently low density of most species based on nil to low capture rates by the Elliott and snap traps at all the sites and low camera trap detection rates (except at Site 5) may be due to a combination of factors. These may include hunting pressure, habitat disturbance, predation by feral animals such as pigs and dogs, and seasonal variation in resource availability, including fruiting cycles for some species.



**Plate 18.** A man from Ok Birim demonstrating how to use an airgun. Photograph by Daniel Solomon Okena.

## 7.3. Bats

### 7.3.1. Survey Effort and Bat Diversity

The number of bat species did not vary greatly between Site 1 (10 species) and Site 2 (11 species). This is expected, since both sites were in similar habitats (see section 4.1) and the distance between the sites was only about 2 km. At higher elevation, more species were detected from Site 5 (21 species) than Site 4 (12 species) with five species exclusively recorded from Site 5 and one species from Site 4 only (Table 9). Six species were recorded from all the sites while 12 species were recorded from more than one site. This study detected slightly more species (24) than the 2014 study (20) but it also covered a larger area and a broader elevational band than the 2014 study which was restricted to around 100 m AMSL.

The area surveyed from Sites 1 and 2 overlaps with the north part of the 2014 study (BMT WBM 2015); therefore, there should be high degree of species overlap. This study found 11 bat species at Sites 1 and 2 compared to the 20 species documented during the 2014 study. Furthermore, only four species (*A. tricuspidatus*, *M. nigrescens*, *P. raptor*, *S. australis*) were found during both the 2015 and 2025 studies. The comparatively low diversity documented during the 2025 survey of the TSF footprint probably reflects to a large extent the much lower survey effort compared to 2015. This study at Sites 1 and 2 had nine nights of call recordings and 135 mist net hours compared to the 2014 study with 35 nights and 15,552 mist net hours. The relatively low species overlap between the two studies (2014 vs 2025) is more difficult to interpret; although heavy rain for most of the nights is likely to have affected the bats nocturnal activities in 2025 as most bats avoid rain due to the increased energy costs and potential interference with their echolocation (Goerlitz 2018).

More species were recorded from calls than from the mist nets (14 vs 6.), which is similar to results of the 2014 study (14 vs 4 respectively). While the call records detect a greater number of species than mist nets, identification of some species requires capture to confirm their call type and therefore to confirm their presence in the project area. For example, the most likely candidate for 75 mCF call type is Telefomin Leaf-nosed Bat (*H. corynophyllus*) given the geographical location.

The Telefomin Leaf-nosed Bat was recorded from its calls. Based on collection records in museums, *H. corynophyllus* was collected from the Telefomin valley, in a montane area of North Fly in Western Province (Bonaccorso 1998) and the Tembagapura area of Papua Province, Indonesia (Helgen 2007). The species was not recorded in the 2014 study and was listed as unlikely to occur in the Ok Birim proposed TSF footprint. While a specimen is needed to confirm its presence, its presence in Ok Birim by this study indicates that the species may have a wide elevational range from the lowlands (and perhaps sea level) to montane forests. It roosts in deep limestone caves and forages in the forest (Bonaccorso, 1998). No caves and sinkholes were observed at Sites 1 and 2 while Site 5 was in the Lukwi cave system (James et al. 1989). However, the species was not detected from Site 5 or Site 4. More effort is needed to detect its presence at the higher elevation because the detection of *H. corynophyllus* from Site 1 and 2 indicates the species is present in the project areas.

### 7.3.2. Significant Habitat

Site 5 is an area where the Lukwi caves are known to occur (James 1989). According to James (1989), there are 25 caves in an area of 5 km<sup>2</sup>. The Barawokwi sinkhole that was visited is likely one of the Lukwi caves. According to local assistants, several caves occur in the broader area surrounding Site 5; however, these are located at a considerable distance from the camp area, requiring several hours of travel to access, and were not inspected as part of this survey. These caves may house significant populations of different bat species. For example, it was observed that bats are actively roosting in the Barawokwi sinkhole where a single individual of *Dobsonia moluccensis* was caught by the local assistants while flying out in the evening.

## 7.4. Birds

### 7.4.1. Survey Efforts

Survey 1 (Sites 1–3) was conducted slightly south of the 2014 study (BMT WBM 2015), but the studies are in very similar habitat types. Therefore, birds and other fauna as well as plants were expected to have high degree of overlap. Fourteen of the 28 bird species found in the 2014 study were documented in this study. However, this study did not record one species, the Magnificent Riflebird (*Ptiloris magnificus*) that was documented in the 2015 study from Bige (BMT WBM 2016) (Table 16), 20 km south of Ok Birim TSF footprint while eight species were unresolved morphospecies in 2014 study. Overall, this study recorded 90 species that were not recorded in 2014 study.

Thus, Survey 1 recorded four times more species (104) than the 2014 study (28) at the Ok Birim proposed TSF footprint. This significant difference between the results from the two surveys is almost certainly due to the different methodologies of the two studies; the 2014 study was a rapid survey using helicopter rides with drop off and pick up occurring each day so peak times for bird detection were missed, and helicopter noise may have also impacted bird activity levels. During the 2025 surveys, Site 5 was conducted at higher elevations on the foothills north of Ok Birim where it added 12 more species for a total of 116 species for the 2025 surveys. Species detected from Survey 2 that were not encountered in the TSF footprint included Dwarf Cassowary (*C. benneti*) and Wattled Brushturkey (*A. arfakianus*). Interestingly, very vocal and notable species like the Blyth's Hornbill (*R. plicatus*) were not sighted. These were documented from local informants at Site 1 and 5 and were sighted in the vicinity of the TSF during the 2014 study (BMT WBM 2015).

The bird assemblage documented within the proposed TSF footprint reflects typical lowland rainforest avifauna.

### 7.4.2. Conservation Significant Species and Population Density

Five conservation significance species were documented in the proposed TSF footprint and the proposed pipeline corridor (Table 15). Sclater's Crowned Pigeon (*G. sclaterii*) was the only IUCN conservation significant species recorded from its calls while the rest of species

were documented from local informant interviews. However, *G. sclaterii* and the common Southern Cassowary (*C. casuarius*) population density seems to be low in the proposed TSF footprint. These two birds forage on the forest floor; therefore, if their population density were high, they could have been easily captured on camera traps in Site 3 where the nine cameras recorded continuously for 37 days. This is in contrast to Site 5 where 4 camera traps deployed for 52 days and captured images of the Dwarf Cassowary (*C. benneti*). It is also interesting to note that birds like Palm Cockatoo (*P. aterrimus*) are noisy and their calls can be heard several kilometres away while cassowary droppings (old and new) can be easily spotted on the forest floor. Another obvious and noisy occupant of the lowlands is Blyth's Hornbill (*R. plicatus*). Absence of evidence of their presence in the proposed TSF footprint and the proposed pipeline access road corridor (except for *C. benneti*) during the survey periods may be most easily explicable by seasonality and the fruiting phenology of the trees that provide the fruits these species eat. However, it could also be a product of population decline perhaps due to hunting. This is likely having a negative impact on bird populations and that of other vertebrates. Since the proposed TSF footprint is close to the Indonesian border to the west and Sites 4 and 5 are close to Tabubil township, wildlife trade may be another driving factor.

#### **7.4.3. Significant Habitat**

The forest itself is an important habitat for the birds. If the proposed TSF is to be established, the only way to save their habitat is by protecting nearby forests. The proposed tailings pipeline is likely to clear small area of forest along the pipeline route. Clearing forest will have minimum impact on the bird assemblages.

### **7.5. Herpetofauna**

The herpetofauna documented at Sites 1 and 2 during the 2025 survey was largely a subset of the fauna documented at Ok Birim in 2014 (BMT WBM 2015) and at Bige in 2015 (BMT WBM 2016) (Table 17). Table 17 lists the species of frogs encountered during the 2014 and 2015 studies that were not encountered in the TSF footprint area during 2025. All but one is common, widespread species and failure to detect them in 2025 may be related to seasonal effects (the 2014 survey was conducted in November when rainfall patterns differ markedly from those in August). Similarly, the reptile faunas encountered during the 2014 and 2025 Ok Birim surveys were similar in terms of both diversity and composition. Excluding those species documented solely based on oral testimony, nine species of reptiles were encountered during the 2014 survey (vs 18 in the TSF footprint in the 2025 study). Although species overlap between the surveys was lower than for frogs with just four reptiles (40%) documented during the current survey also being found during the 2014 survey, overlap is almost certainly closer to 100% because the reptile faunas are dominated by common, widespread species.

The herpetofauna documented in the proposed TSF footprint was also similar to that documented at Bige TSF footprint 25 km south of Ok Birim BMT WBM (2016). That study documented a higher diversity of frogs (24 species after one species is removed due to misidentification), including the IUCN Data Deficient *Callulops marmoratus*. However, reptile diversity was the same; excluding species documented exclusively by oral testimony and a

captive specimen of the Green Python (*Morelia viridis*). The Bige study encountered ten reptile species, the same as the 2025 study at Sites 1 and 2.

A number of both frog and reptile species that were not encountered during the 2014 surveys, nor during the 2025 surveys in the TSF footprint, were detected at Site 5. This reflects the different habitats at that site, including the presence of more clear-flowing streams. These include two species of stream-dwelling treefrogs (*Amniphylla arfakiana* and *A. longicrus*, the latter being classified as IUCN Data Deficient).

Table 17 lists the additional frog and reptile species documented during the 2014 Ok Birim survey and the 2015 Bige survey that were not encountered during the 2025 Ok Birim study. It is likely that most if not all of these species occur within the proposed TSF footprint.

**Table 177. Additional herpetofauna species documented at Ok Birim in 2014 and at Bige in 2015.**

| Family               | Species                               | Ok Birim | Bige     | IUCN status |
|----------------------|---------------------------------------|----------|----------|-------------|
| <b>Frogs</b>         |                                       |          |          |             |
| Dicroglossidae       | <i>Limnonectes grunniens</i>          | X        | X        | LC          |
| Microhylidae         | <i>Callulops marmoratus?</i>          | -        | X        | DD          |
| Microhylidae         | <i>Xenorhina tillacki</i>             | -        | X        | LC          |
| Pelodyadidae         | <i>Chlorohyla auae</i>                | X        | X        | LC          |
| Pelodyadidae         | <i>Colleeneremia pygmaea</i>          | X        | -        | LC          |
| Pelodyadidae         | <i>Exochohyla prora</i>               | X        | X        | LC          |
| Pelodyadidae         | <i>Pengilleyia amboinensis</i>        | X        |          | LC          |
| Pelodyadidae         | <i>Litoria nasuta</i>                 | -        | X        | LC          |
| <b>Total species</b> | <b>8</b>                              | <b>5</b> | <b>6</b> |             |
| <b>Reptiles</b>      |                                       |          |          |             |
| Agamidae             | <i>Lophosaurus dilophus</i>           | X        | -        | LC          |
| Gekkonidae           | <i>Gehyra</i> sp.                     | X        | X        | LC          |
| Varanidae            | <i>Varanus indicus</i> group          | -        | X        | LC          |
| Varanidae            | <i>Varanus salvadorii</i>             | -        | X        | LC          |
| Colubridae           | <i>Tropidonophis multiscutellatus</i> | X        | X        | LC          |
| <b>Total species</b> | <b>5</b>                              | <b>3</b> | <b>4</b> |             |

It is likely that a number of additional species occur within the project footprint. For example, the diversity of skinks was moderately low at all of the four main Ok Birim sites compared to most lowland forests of mainland New Guinea (Richards, unpublished data). This is possibly a reflection of the constantly overcast and wet conditions encountered during the survey. Local informants also reported that two species of large varanid lizards, genus *Varanus*, occur within the proposed TSF footprint. They distinguished them from images of *Varanus indicus*-group animals and from *V. salvadorii* during local interviews. The taxonomic status of these species requires confirmation.

Local informants identified numerous other reptile species from the proposed TSF footprint based on images presented during interviews. However, it was apparent that they were positively identifying every image presented for consideration, irrespective of whether the species was likely to occur in the area. We therefore excluded these results from this report.

## 7.6. Odonata

Odonates are considered to be excellent indicators of habitat quality and are frequently used to monitor changes in the environment (Samways & Simaika 2016; Samways 2024). Habitat specialist species, including those closely associated with small forest streams are particularly vulnerable to changes in stream and forest quality. These species also tend to have more limited distributions and are more likely to be of conservation concern. The odonate fauna at Ok Birim was more diverse than the fauna documented around Tabubil (excluding montane species; 52 species vs 40) by Richards & Theischinger (2015). The fauna is also significant for containing number of Data Deficient species and six species of damselflies that appear to be new to science. All of the Data Deficient species and four of the six new species are inhabitants of forest streams and these are recognised as a significant habitat, particularly in the vicinity of Site 5.

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## 10. Appendices

### 10.1. Appendix 1. Plant species list from the proposed TSF footprint and proposed pipeline road corridor.

| No | Family        | Species name                        | Common Name    | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|----|---------------|-------------------------------------|----------------|--------|--------|--------|--------|------|----------------------|
| 1  | Achariaceae   | <i>Pangium edule</i>                |                |        |        | X      |        | LC   |                      |
| 2  | Achariaceae   | <i>Ryparosa calotricha</i>          |                | X      | X      | X      |        | NE   |                      |
| 3  | Actinidiaceae | <i>Saurauia conferta</i>            |                |        | X      |        | X      | LC   |                      |
| 4  | Actinidiaceae | <i>Saurauia poolei</i>              |                |        |        | X      |        | NE   |                      |
| 5  | Anacardiaceae | <i>Anacardium</i> sp.               |                |        | X      |        |        | NE   |                      |
| 6  | Anacardiaceae | <i>Buchanania amboinensis</i>       | Pink satinwood | X      | X      |        |        | LC   |                      |
| 7  | Anacardiaceae | <i>Buchanania macrocarpa</i>        | Pink Satinwood | X      |        |        |        | NE   |                      |
| 8  | Anacardiaceae | <i>Camptosperma brevipetiolatum</i> | Wel            | X      | X      | X      | X      | NE   |                      |
| 9  | Anacardiaceae | <i>Dracontomelon dao</i>            | Walnut         |        | X      |        |        | NE   |                      |
| 10 | Anacardiaceae | <i>Semecarpus forstenii</i>         |                | X      | X      |        |        | LC   |                      |
| 11 | Anacardiaceae | <i>Semecarpus magnificus</i>        |                |        |        | X      | X      | LC   |                      |
| 12 | Annonaceae    | <i>Cananga odorata</i>              |                | X      | X      |        | X      | NE   |                      |
| 13 | Annonaceae    | <i>Cyathocalyx</i> sp.              |                |        | X      |        |        | NE   |                      |
| 14 | Annonaceae    | <i>Friesodielsia subaequalis</i>    |                |        | X      |        |        | NE   |                      |

| No | Family      | Species name                      | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|----|-------------|-----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 15 | Annonaceae  | <i>Goniothalamus aruensis</i>     |             | X      | X      |        |        | NT   |                      |
| 16 | Annonaceae  | <i>Goniothalamus grandiflorus</i> |             | X      |        |        |        | LC   |                      |
| 17 | Annonaceae  | <i>Goniothalamus imbricatus</i>   |             | X      | X      |        | X      | DD   |                      |
| 18 | Annonaceae  | <i>Goniothalamus</i> sp.          |             | X      | X      |        |        | NE   |                      |
| 19 | Annonaceae  | <i>Goniothalamus viridiflorus</i> |             | X      |        |        | X      | NE   |                      |
| 20 | Annonaceae  | <i>Maasia glauca</i>              |             | X      | X      | X      |        | LC   |                      |
| 21 | Annonaceae  | <i>Monoon chloroxanthum</i>       |             |        | X      | X      |        | NE   |                      |
| 22 | Annonaceae  | <i>Phaeanthus</i> sp.             |             | X      |        |        |        | NE   |                      |
| 23 | Annonaceae  | <i>Polyalthia longirostris</i>    |             |        |        | X      |        | NT   |                      |
| 24 | Annonaceae  | <i>Polyalthia</i> sp.             |             |        | X      |        |        | NE   |                      |
| 25 | Annonaceae  | <i>Popowia pisocarpa</i>          |             | X      |        | X      |        | LC   |                      |
| 26 | Annonaceae  | <i>Popowia</i> sp.                |             | X      |        |        |        | NE   |                      |
| 27 | Annonaceae  | <i>Pseuduvaria</i> sp.            |             | X      | X      |        |        | NE   |                      |
| 28 | Annonaceae  | <i>Uvaria</i> sp.                 |             |        | X      |        |        | NE   |                      |
| 29 | Annonaceae  | <i>Xylopia papuana</i>            |             |        |        | X      |        | LC   |                      |
| 30 | Annonaceae  | <i>Xylopia</i> sp.                |             | X      |        |        |        | NE   |                      |
| 31 | Apiaceae    | <i>Schumannia</i> sp.             |             |        |        |        | X      | NE   |                      |
| 32 | Apocynaceae | <i>Alstonia macrophylla</i>       | Milky pine  |        | X      |        | X      | LC   |                      |
| 33 | Apocynaceae | <i>Alstonia scholaris</i>         | Milky pine  |        |        | X      |        | LC   |                      |
| 34 | Apocynaceae | <i>Parsonsia buruensis</i>        |             |        |        |        | X      | NE   |                      |

| No | Family      | Species name                      | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|----|-------------|-----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 35 | Apocynaceae | <i>Parsonsia</i> sp.              |             |        | X      |        |        | NE   |                      |
| 36 | Apocynaceae | <i>Tabernaemontana pandacaqui</i> |             | X      | X      | X      | X      | LC   |                      |
| 37 | Araceae     | <i>Aglaonema</i> sp.              |             |        | X      |        |        | NE   |                      |
| 38 | Araceae     | <i>Alocasia</i> sp.               |             | X      |        |        |        | NE   |                      |
| 39 | Araceae     | <i>Epipremnum pinnatum</i>        |             |        | X      |        |        | NE   |                      |
| 40 | Araceae     | <i>Holochlamys beccarii</i>       |             | X      | X      |        |        | NE   |                      |
| 41 | Araceae     | <i>Homalomena distans</i>         |             | X      | X      | X      |        | NE   |                      |
| 42 | Araceae     | <i>Homalomena magna</i>           |             | X      |        |        |        | NE   |                      |
| 43 | Araceae     | <i>Lasia spinosa</i>              |             | X      | X      |        |        | LC   |                      |
| 44 | Araceae     | <i>Pothos papuanus</i>            |             |        | X      |        |        | NE   |                      |
| 45 | Araceae     | <i>Pothos versteegii</i>          |             |        | X      |        |        | NE   |                      |
| 46 | Araceae     | <i>Rhaphidophora geniculata</i>   |             | X      |        | X      | X      | LC   |                      |
| 47 | Araceae     | <i>Rhaphidophora korthalsii</i>   |             | X      |        |        |        | NE   |                      |
| 48 | Araceae     | <i>Rhaphidophora</i> sp.          |             | X      | X      |        |        | NE   |                      |
| 49 | Araceae     | <i>Schismatoglottis</i> sp.1      |             |        |        | X      |        | NE   |                      |
| 50 | Araceae     | <i>Scindapsus altissimus</i>      |             |        | X      |        |        | NE   |                      |
| 51 | Araliaceae  | <i>Osmoxylon geelvinkianum</i>    |             |        |        | X      |        | NE   |                      |
| 52 | Araliaceae  | <i>Osmoxylon novoguineense</i>    |             |        | X      | X      | X      | NE   |                      |
| 53 | Araliaceae  | <i>Schefflera</i> sp.             |             |        | X      |        |        | NE   |                      |
| 54 | Arecaceae   | <i>Actinorhytis calapparia</i>    |             |        | X      |        |        | LC   |                      |

| No | Family        | Species name                       | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|----|---------------|------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 55 | Arecaceae     | <i>Calamus aruensis</i>            | Kanda       | X      |        | X      | X      | NE   |                      |
| 56 | Arecaceae     | <i>Calamus depauperatus</i>        | Kanda       | X      |        |        |        | NE   |                      |
| 57 | Arecaceae     | <i>Calamus longipinna</i>          | Kanda       | X      | X      | X      |        | NE   |                      |
| 58 | Arecaceae     | <i>Calamus schlechterianus</i>     | Kanda       |        | X      |        |        | NE   |                      |
| 59 | Arecaceae     | <i>Calyptrocalyx albertisianus</i> |             | X      |        |        |        | NE   |                      |
| 60 | Arecaceae     | <i>Calyptrocalyx</i> sp.           |             | X      |        |        |        | NE   |                      |
| 61 | Arecaceae     | <i>Caryota rumphiana</i>           |             | X      | X      | X      |        | LC   |                      |
| 62 | Arecaceae     | <i>Cyrtosperma</i> sp.             |             |        | X      |        |        | NE   |                      |
| 63 | Arecaceae     | <i>Hydriastele costata</i>         | Limbum      | X      | X      |        |        | LC   |                      |
| 64 | Arecaceae     | <i>Hydriastele</i> sp.             |             | X      |        |        |        | NE   |                      |
| 65 | Arecaceae     | <i>Licuala bakeri</i>              |             | X      | X      |        |        | NT   |                      |
| 66 | Arecaceae     | <i>Licuala bellatula</i>           |             | X      | X      |        |        | NT   |                      |
| 67 | Arecaceae     | <i>Licuala brevicalyx</i>          |             |        | X      |        |        | NT   |                      |
| 68 | Arecaceae     | <i>Licuala lauterbachii</i>        |             | X      | X      |        |        | LC   |                      |
| 69 | Arecaceae     | <i>Licuala parviflora</i>          |             | X      |        |        |        | LC   |                      |
| 70 | Arecaceae     | <i>Linospadix albertisianus</i>    |             | X      | X      |        |        | LC   |                      |
| 71 | Arecaceae     | <i>Metroxylon sagu</i>             | Saksak      | X      | X      | X      |        | LC   |                      |
| 72 | Arecaceae     | <i>Orania lauterbachiana</i>       |             | X      | X      | X      |        | NE   |                      |
| 73 | Asparagaceae  | <i>Dracaena angustifolia</i>       |             | X      | X      | X      |        | NE   |                      |
| 74 | Asphodelaceae | <i>Dianella ensifolia</i>          |             | X      | X      |        | X      | NE   |                      |

| No | Family       | Species name                  | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|----|--------------|-------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 75 | Aspleniaceae | <i>Applenium nidus</i>        |             |        |        | X      |        | NE   |                      |
| 76 | Aspleniaceae | <i>Diplazium cordifolium</i>  |             | X      | X      |        |        | NE   |                      |
| 77 | Aspleniaceae | <i>Diplazium</i> sp.          |             | X      | X      |        |        | NE   |                      |
| 78 | Aspleniaceae | <i>Stenochlaena palustris</i> |             |        | X      |        |        | NE   |                      |
| 79 | Asteraceae   | <i>Strobocalyx arborea</i>    |             | X      |        | X      |        | LC   |                      |
| 80 | Begoniaceae  | <i>Begonia pinnatifida</i>    |             | X      |        |        |        | NE   |                      |
| 81 | Begoniaceae  | <i>Begonia</i> sp. 1          |             | X      |        |        | X      | NE   | NTS                  |
| 82 | Begoniaceae  | <i>Begonia</i> sp. 2          |             |        | X      |        |        | NE   | NTS                  |
| 83 | Begoniaceae  | <i>Begonia</i> sp. A          |             |        |        | X      |        | NE   |                      |
| 84 | Begoniaceae  | <i>Begonia</i> sp. B          |             |        |        |        | X      | NE   |                      |
| 85 | Blechnaceae  | <i>Blechnum orientale</i>     |             | X      |        |        |        | NE   |                      |
| 86 | Blechnaceae  | <i>Blechnum</i> sp.           |             | X      |        |        |        | NE   |                      |
| 87 | Burseraceae  | <i>Canarium acutifolium</i>   |             |        |        | X      |        | LC   |                      |
| 88 | Burseraceae  | <i>Canarium indicum</i>       | Galip       | X      |        |        |        | NE   |                      |
| 89 | Burseraceae  | <i>Canarium maluense</i>      | Galip       |        | X      |        |        | NE   |                      |
| 90 | Burseraceae  | <i>Canarium oleosum</i>       | Galip       | X      |        |        |        | NE   |                      |
| 91 | Burseraceae  | <i>Canarium</i> sp.           | Galip       | X      | X      |        |        | NE   |                      |
| 92 | Burseraceae  | <i>Canarium vitiense</i>      | Galip       | X      | X      |        |        | NE   |                      |
| 93 | Burseraceae  | <i>Haplolobus floribundus</i> |             | X      | X      | X      |        | LC   |                      |
| 94 | Burseraceae  | <i>Protium macgregorii</i>    |             | X      |        | X      |        | LC   |                      |

| No  | Family            | Species name                    | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-------------------|---------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 95  | Burseraceae       | <i>Protium</i> sp.              |             |        | X      |        |        | NE   |                      |
| 96  | Cannabaceae       | <i>Celtis latifolia</i>         |             |        |        | X      |        | LC   |                      |
| 97  | Cannabaceae       | <i>Celtis philippensis</i>      |             |        |        | X      |        | LC   |                      |
| 98  | Cannabaceae       | <i>Gironniera celtidifolia</i>  |             | X      | X      |        |        | LC   |                      |
| 99  | Cannabaceae       | <i>Gironniera subaequalis</i>   |             |        | X      |        |        | LC   |                      |
| 100 | Cannabaceae       | <i>Trema orientalis</i>         |             |        | X      |        |        | LC   |                      |
| 101 | Cardiopteridaceae | <i>Gonocaryum litorale</i>      |             | X      | X      |        |        | LC   |                      |
| 102 | Celastraceae      | <i>Salacia chinensis</i>        |             | X      | X      |        |        | LC   |                      |
| 103 | Celastraceae      | <i>Salacia ledermannii</i>      |             |        | X      |        |        | NE   |                      |
| 104 | Celastraceae      | <i>Salacia</i> sp.              |             | X      | X      |        |        | NE   |                      |
| 105 | Chloranthaceae    | <i>Sarcandra glabra</i>         |             |        |        |        | X      | NE   |                      |
| 106 | Chrysobalanaceae  | <i>Parastemon versteeghii</i>   |             | X      |        |        |        | LC   |                      |
| 107 | Clusiaceae        | <i>Calophyllum laticostatum</i> | Kalo        |        | X      |        |        | NT   |                      |
| 108 | Clusiaceae        | <i>Calophyllum soulattri</i>    | Kalo        | X      | X      |        | X      | LC   |                      |
| 109 | Clusiaceae        | <i>Calophyllum</i> sp. 1        | Kalo        |        | X      | X      | X      | NE   | NTS                  |
| 110 | Clusiaceae        | <i>Calophyllum</i> sp. A        | Kalo        | X      |        |        |        | NE   |                      |
| 111 | Clusiaceae        | <i>Calophyllum</i> sp. B        | Kalo        | X      |        |        |        | NE   |                      |
| 112 | Clusiaceae        | <i>Calophyllum suberosum</i>    | Kalo        | X      |        |        |        | VU   |                      |
| 113 | Clusiaceae        | <i>Garcinia assugu</i>          | Kandis      | X      |        |        |        | LC   |                      |
| 114 | Clusiaceae        | <i>Garcinia celebica</i>        | Kandis      | X      | X      |        |        | LC   |                      |

| No  | Family         | Species name                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|----------------|----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 115 | Clusiaceae     | <i>Garcinia dulcis</i>           | Kandis      | X      | X      | X      |        | LC   |                      |
| 116 | Clusiaceae     | <i>Garcinia hunsteinii</i>       | Kandis      |        | X      |        | X      | LC   |                      |
| 117 | Clusiaceae     | <i>Garcinia latissima</i>        | Kandis      |        | X      |        | X      | LC   |                      |
| 118 | Clusiaceae     | <i>Garcinia ledermannii</i>      | Kandis      | X      |        | X      |        | NE   |                      |
| 119 | Clusiaceae     | <i>Garcinia mangostifera</i>     | Mangosteen  | X      | X      |        |        | DD   |                      |
| 120 | Clusiaceae     | <i>Garcinia schraderi</i>        | Kandis      |        | X      |        |        | LC   |                      |
| 121 | Clusiaceae     | <i>Garcinia</i> sp.              | Kandis      | X      | X      |        |        | NE   |                      |
| 122 | Clusiaceae     | <i>Garcinia</i> sp. 1            | Kandis      |        |        | X      |        | NE   | NTS                  |
| 123 | Clusiaceae     | <i>Mammea cordata</i>            |             | X      | X      |        |        | NE   |                      |
| 124 | Clusiaceae     | <i>Mammea novoguineensis</i>     |             | X      |        |        | X      | NT   |                      |
| 125 | Combretaceae   | <i>Terminalia impediens</i>      | Okari       | X      | X      |        |        | NT   |                      |
| 126 | Combretaceae   | <i>Terminalia kaernbachii</i>    | Okari       |        | X      |        |        | LC   |                      |
| 127 | Combretaceae   | <i>Terminalia</i> sp.            |             | X      |        |        |        | NE   |                      |
| 128 | Convolvulaceae | <i>Decalobanthus peltatus</i>    |             |        | X      |        |        | NE   |                      |
| 129 | Cornaceae      | <i>Rourea minor</i>              |             | X      | X      | X      |        | NE   |                      |
| 130 | Costaceae      | <i>Hellenia speciosa</i>         |             |        | X      | X      |        | NE   |                      |
| 131 | Costaceae      | <i>Tapeinochilos ananassae</i>   |             |        | X      |        |        | NE   |                      |
| 132 | Cunoniaceae    | <i>Caldcluvia</i> sp.            |             |        | X      |        |        | NE   |                      |
| 133 | Cunoniaceae    | <i>Ceratopetalum succirubrum</i> | Coachwood   | X      |        |        |        | LC   |                      |
| 134 | Cunoniaceae    | <i>Ceratopetalum tetrapterum</i> |             | X      |        |        |        | NE   |                      |

| No  | Family       | Species name                    | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
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| 135 | Cunoniaceae  | <i>Gillbeea papuana</i>         |             |        |        |        | X      | LC   |                      |
| 136 | Cunoniaceae  | <i>Opocunonia nymanii</i>       |             | X      | X      | X      |        | LC   |                      |
| 137 | Cunoniaceae  | <i>Schizomeria serrata</i>      | White Birch | X      | X      |        |        | LC   |                      |
| 138 | Cunoniaceae  | <i>Weinmannia fraxinea</i>      |             | X      |        |        |        | LC   |                      |
| 139 | Cyatheaceae  | <i>Alsophila biformis</i>       | Tree Fern   | X      |        |        | X      | LC   |                      |
| 140 | Cyatheaceae  | <i>Alsophila semiamplectens</i> | Tree Fern   |        | X      |        |        | LC   |                      |
| 141 | Cyatheaceae  | <i>Alsophila vandeusenii</i>    | Tree Fern   | X      |        |        |        | NT   |                      |
| 142 | Cyatheaceae  | <i>Cyathea</i> sp.              | Tree Fern   |        | X      |        |        | NE   |                      |
| 143 | Cyatheaceae  | <i>Sphaeropteris glauca</i>     |             |        | X      |        | X      | LC   |                      |
| 144 | Cyperaceae   | <i>Eleocharis ochrostachys</i>  |             |        | X      |        |        | LC   |                      |
| 145 | Cyperaceae   | <i>Eleocharis tetraquetra</i>   |             | X      |        |        |        | NE   |                      |
| 146 | Cyperaceae   | <i>Hypolytrum compactum</i>     |             |        | X      |        |        | NE   |                      |
| 147 | Cyperaceae   | <i>Hypolytrum nemorum</i>       |             | X      | X      |        | X      | NE   |                      |
| 148 | Cyperaceae   | <i>Mapania cuspidata</i>        |             |        |        | X      |        | NE   |                      |
| 149 | Cyperaceae   | <i>Mapania moseleyi</i>         |             |        |        |        | X      | NE   |                      |
| 150 | Cyperaceae   | <i>Mapania</i> sp.              |             | X      |        |        |        | NE   |                      |
| 151 | Cyperaceae   | <i>Scleria scrobiculata</i>     |             |        | X      |        |        | LC   |                      |
| 152 | Dianella     | <i>Antidesma contractum</i>     |             | X      | X      |        |        | LC   |                      |
| 153 | Dilleniaceae | <i>Dillenia indica</i>          |             | X      | X      | X      |        | LC   |                      |
| 154 | Dilleniaceae | <i>Dillenia papuana</i>         |             | X      | X      | X      |        | LC   |                      |

| No  | Family           | Species name                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|------------------|----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 155 | Dilleniaceae     | <i>Dillenia</i> sp. 1            |             | X      | X      |        |        | NE   | NTS                  |
| 156 | Dipterocarpaceae | <i>Anisoptera thurifera</i>      | PNG Mersawa | X      | X      |        |        | VU   |                      |
| 157 | Dipterocarpaceae | <i>Hopea similis</i>             | Hopea       | X      | x      | x      |        | LC   |                      |
| 158 | Dipterocarpaceae | <i>Vatica rassak</i>             | Vatica      | X      |        | x      |        | LC   |                      |
| 159 | Ebenaceae        | <i>Diospyros foliosa</i>         |             | X      |        | x      |        | LC   |                      |
| 160 | Ebenaceae        | <i>Diospyros papuana</i>         | Ebony       |        | X      |        |        | LC   |                      |
| 161 | Ebenaceae        | <i>Diospyros peekelii</i>        |             |        |        | x      |        | LC   |                      |
| 162 | Ebenaceae        | <i>Diospyros</i> sp.             |             | X      |        |        |        | NE   |                      |
| 163 | Elaeocarpaceae   | <i>Aceratium brassii</i>         |             |        |        |        | x      | LC   |                      |
| 164 | Elaeocarpaceae   | <i>Aceratium parvifolium</i>     |             | X      | X      |        |        | NT   |                      |
| 165 | Elaeocarpaceae   | <i>Elaeocarpus angustifolius</i> | Quandong    | X      | X      |        |        | LC   |                      |
| 166 | Elaeocarpaceae   | <i>Elaeocarpus culminicola</i>   |             | X      |        |        |        | LC   |                      |
| 167 | Elaeocarpaceae   | <i>Elaeocarpus dolichostylus</i> | Quandong    |        | X      | x      | x      | LC   |                      |
| 168 | Elaeocarpaceae   | <i>Elaeocarpus ledermannii</i>   |             |        | X      |        |        | LC   |                      |
| 169 | Elaeocarpaceae   | <i>Elaeocarpus lingualis</i>     |             | X      |        |        |        | LC   |                      |
| 170 | Elaeocarpaceae   | <i>Elaeocarpus miegei</i>        | Quandong    | X      | X      | x      |        | NE   |                      |
| 171 | Elaeocarpaceae   | <i>Elaeocarpus multisectus</i>   |             |        | X      |        | X      | NT   |                      |
| 172 | Elaeocarpaceae   | <i>Elaeocarpus murukkai</i>      | Quandong    |        | X      |        |        | VU   |                      |
| 173 | Elaeocarpaceae   | <i>Elaeocarpus ptilanthus</i>    |             | X      | X      |        |        | LC   |                      |
| 174 | Elaeocarpaceae   | <i>Elaeocarpus</i> sp.           |             |        | X      |        | X      | NE   |                      |

| No  | Family          | Species name                      | Common Name  | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------------|-----------------------------------|--------------|--------|--------|--------|--------|------|----------------------|
| 175 | Elaeocarpaceae  | <i>Sloanea forbesii</i>           |              | X      | X      | X      |        | LC   |                      |
| 176 | Elaeocarpaceae  | <i>Sloanea sogerensis</i>         |              | X      | X      |        |        | LC   |                      |
| 177 | Elaeocarpaceae  | <i>Sloanea</i> sp.                |              |        | X      |        |        | NE   |                      |
| 178 | Elaeocarpaceae  | <i>Sloanea tieghemi</i>           |              |        |        | X      | X      | LC   |                      |
| 179 | Ericaceae       | <i>Dimorphanthera</i> sp.         |              | X      | X      |        |        | NE   |                      |
| 180 | Erythroxylaceae | <i>Erythroxylum ecarinatum</i>    |              | X      | X      | X      |        | LC   |                      |
| 181 | Escalloniaceae  | <i>Polyosma buxea</i>             |              |        | X      |        |        | NE   |                      |
| 182 | Escalloniaceae  | <i>Polyosma forbesii</i>          |              |        |        |        | X      | NE   |                      |
| 183 | Euphorbiaceae   | <i>Baccaurea papuana</i>          |              |        | X      |        |        | LC   |                      |
| 184 | Euphorbiaceae   | <i>Claoxylon capillipes</i>       |              | X      |        |        |        | NE   |                      |
| 185 | Euphorbiaceae   | <i>Claoxylon indicum</i>          |              | X      |        |        | X      | LC   |                      |
| 186 | Euphorbiaceae   | <i>Codiaeum variegatum</i>        |              | X      | X      | X      |        | NE   |                      |
| 187 | Euphorbiaceae   | <i>Croton morobensis</i>          |              |        |        |        | X      | LC   |                      |
| 188 | Euphorbiaceae   | <i>Croton</i> sp.                 |              | X      | X      |        |        | NE   |                      |
| 189 | Euphorbiaceae   | <i>Endospermum medullosum</i>     | PNG Basswood |        |        | X      |        | VU   |                      |
| 190 | Euphorbiaceae   | <i>Endospermum moluccanum</i>     |              | X      |        |        | X      | LC   |                      |
| 191 | Euphorbiaceae   | <i>Homalanthus novoguineensis</i> |              |        |        |        | X      | LC   |                      |
| 192 | Euphorbiaceae   | <i>Macaranga fallacina</i>        |              |        |        | X      |        | LC   |                      |
| 193 | Euphorbiaceae   | <i>Macaranga inermis</i>          |              |        | X      |        |        | LC   |                      |
| 194 | Euphorbiaceae   | <i>Macaranga neobritannica</i>    |              | X      | X      | X      |        | LC   |                      |

| No  | Family        | Species name                      | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
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| 195 | Euphorbiaceae | <i>Macaranga punctata</i>         |             | X      | X      |        |        | LC   |                      |
| 196 | Euphorbiaceae | <i>Macaranga quadriglandulosa</i> |             |        |        | X      |        | LC   |                      |
| 197 | Euphorbiaceae | <i>Macaranga</i> sp.              |             | X      | X      |        |        | NE   |                      |
| 198 | Euphorbiaceae | <i>Macaranga triloba</i>          |             |        |        | X      |        | LC   |                      |
| 199 | Euphorbiaceae | <i>Mallotus mollissimus</i>       |             |        |        |        | X      | LC   |                      |
| 200 | Euphorbiaceae | <i>Mallotus paniculatus</i>       |             |        | X      |        |        | LC   |                      |
| 201 | Euphorbiaceae | <i>Manihot esculenta</i>          | Tapiok      |        |        | X      |        | NE   |                      |
| 202 | Euphorbiaceae | <i>Neoscortechinia forbesii</i>   |             | X      | X      | X      |        | LC   |                      |
| 203 | Euphorbiaceae | <i>Pimelodendron amboinicum</i>   |             |        | X      | X      |        | LC   |                      |
| 204 | Euphorbiaceae | <i>Shirakiopsis indica</i>        |             |        |        |        | X      | LC   |                      |
| 205 | Fabaceae      | <i>Archidendron clypearia</i>     |             |        | X      |        |        | LC   |                      |
| 206 | Fabaceae      | <i>Archidendron glabrum</i>       |             | X      |        |        |        | LC   |                      |
| 207 | Fabaceae      | <i>Archidendron lucyi</i>         |             |        | X      | X      |        | LC   |                      |
| 208 | Fabaceae      | <i>Archidendron megaphyllum</i>   |             | X      |        |        |        | DD   |                      |
| 209 | Fabaceae      | <i>Archidendron parviflorum</i>   |             | X      |        |        |        | LC   |                      |
| 210 | Fabaceae      | <i>Archidendron ptenopum</i>      |             |        |        | X      |        | NT   |                      |
| 211 | Fabaceae      | <i>Archidendron</i> sp. A         |             |        | X      |        |        | NE   |                      |
| 212 | Fabaceae      | <i>Archidendron</i> sp. B         |             |        | X      |        |        | NE   |                      |
| 213 | Fabaceae      | <i>Crudia papuana</i>             |             | X      | X      |        |        | LC   |                      |
| 214 | Fabaceae      | <i>Cynometra psilogyne</i>        |             | X      | X      | X      |        | LC   |                      |

| No  | Family           | Species name                       | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|------------------|------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 215 | Fabaceae         | <i>Cynometra schefferi</i>         |             |        |        | X      |        | LC   |                      |
| 216 | Fabaceae         | <i>Cynometra</i> sp.               |             |        | X      |        |        | NE   |                      |
| 217 | Fabaceae         | <i>Falcataria falcata</i>          |             |        |        | X      |        | LC   |                      |
| 218 | Fabaceae         | <i>Inocarpus fagifer</i>           | Ila         |        | X      |        |        | LC   |                      |
| 219 | Fabaceae         | <i>Kingiodendron novoguineense</i> |             |        |        | X      |        | LC   |                      |
| 220 | Fabaceae         | <i>Prioria novoguineensis</i>      |             | X      |        |        |        | LC   |                      |
| 221 | Fabaceae         | <i>Schleinitzia insularum</i>      |             |        | X      |        |        | LC   |                      |
| 222 | Fagaceae         | <i>Lithocarpus vinkii</i>          |             | X      |        |        | X      | VU   |                      |
| 223 | Flagellariaceae  | <i>Flagellaria indica</i>          |             | X      | X      | X      |        | NE   |                      |
| 224 | Gentianaceae     | <i>Fagraea amabilis</i>            |             | X      | X      |        |        | NE   |                      |
| 225 | Gentianaceae     | <i>Fagraea ceilanica</i>           |             |        | X      |        |        | LC   |                      |
| 226 | Gentianaceae     | <i>Utania racemosa</i>             |             | X      | X      | X      |        | LC   |                      |
| 227 | Gesneriaceae     | <i>Aeschynanthus kermesinus</i>    |             |        |        |        | X      | NE   |                      |
| 228 | Gesneriaceae     | <i>Cyrtandra bracteata</i>         |             | X      | X      |        |        | NE   |                      |
| 229 | Gesneriaceae     | <i>Cyrtandra erectiloba</i>        |             | X      | X      |        |        | NE   |                      |
| 230 | Gesneriaceae     | <i>Cyrtandra</i> sp. A             |             | X      | X      |        |        | NE   |                      |
| 231 | Gesneriaceae     | <i>Cyrtandra</i> sp. B             |             |        |        | X      |        | NE   |                      |
| 232 | Gnetaceae        | <i>Gnetum gnemon</i>               | Tulip       | X      | X      | X      |        | LC   |                      |
| 233 | Gnetaceae        | <i>Gnetum latifolium</i>           |             |        |        | X      |        | LC   |                      |
| 234 | Hymenophyllaceae | <i>Trichomanes obscurum</i>        |             | X      |        |        |        | NE   |                      |

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|-----|--------------|--------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 235 | Hypoxidaceae | <i>Curculigo erecta</i>              |             | X      |        | x      |        | NE   |                      |
| 236 | Icacinaceae  | <i>Iodes scandens</i>                |             | X      |        |        |        | NE   |                      |
| 237 | Icacinaceae  | <i>Platea excelsa</i>                |             | X      | X      | X      |        | LC   |                      |
| 238 | Icacinaceae  | <i>Ryticaryum longifolium</i>        |             | X      | X      |        | X      | LC   |                      |
| 239 | Lamiaceae    | <i>Callicarpa pentandra</i>          |             |        | X      |        | x      | LC   |                      |
| 240 | Lamiaceae    | <i>Faradaya splendida</i>            |             | X      | X      |        |        | NE   |                      |
| 241 | Lamiaceae    | <i>Gmelina sessilis</i>              |             | X      |        | x      |        | VU   |                      |
| 242 | Lamiaceae    | <i>Teijsmanniodendron ahernianum</i> |             | X      | X      |        | X      | LC   |                      |
| 243 | Lamiaceae    | <i>Teijsmanniodendron bogoriense</i> |             | X      | X      | x      | x      | LC   |                      |
| 244 | Lamiaceae    | <i>Vitex cofassus</i>                |             |        |        | x      |        | LC   |                      |
| 245 | Lauraceae    | <i>Actinodaphne nitida</i>           |             | X      | X      |        |        | LC   |                      |
| 246 | Lauraceae    | <i>Alseodaphne archboldiana</i>      |             |        |        | x      |        | LC   |                      |
| 247 | Lauraceae    | <i>Cinnamomum ledermannii</i>        | Skin Diwai  |        | X      |        |        | LC   |                      |
| 248 | Lauraceae    | <i>Cinnamomum sp.</i>                | Skin Diwai  | X      | X      |        | x      | NE   |                      |
| 249 | Lauraceae    | <i>Cryptocarya albifrons</i>         |             |        |        | x      |        | EN   |                      |
| 250 | Lauraceae    | <i>Cryptocarya aschersoniana</i>     |             |        | X      |        |        | LC   |                      |
| 251 | Lauraceae    | <i>Cryptocarya brevipes</i>          |             | X      |        |        |        | EN   |                      |
| 252 | Lauraceae    | <i>Cryptocarya caloneura</i>         |             | X      |        |        |        | VU   |                      |
| 253 | Lauraceae    | <i>Cryptocarya densiflora</i>        |             |        | X      |        |        | LC   |                      |
| 254 | Lauraceae    | <i>Cryptocarya depressa</i>          |             |        |        | x      |        | LC   |                      |

| No  | Family    | Species name                       | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------|------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 255 | Lauraceae | <i>Cryptocarya fluminensis</i>     |             | X      |        |        |        | EN   |                      |
| 256 | Lauraceae | <i>Cryptocarya idenburgensis</i>   |             | X      | X      |        |        | LC   |                      |
| 257 | Lauraceae | <i>Cryptocarya mackinnoniana</i>   |             |        | X      | X      |        | LC   |                      |
| 258 | lauraceae | <i>Cryptocarya masseyi</i>         | Massoy      | X      |        |        |        | NT   |                      |
| 259 | Lauraceae | <i>Cryptocarya multipaniculata</i> |             | X      | X      | X      | X      | LC   |                      |
| 260 | Lauraceae | <i>Cryptocarya</i> sp. A           |             | X      | X      |        |        | NE   |                      |
| 261 | Lauraceae | <i>Cryptocarya</i> sp. B           |             | X      |        |        |        | NE   |                      |
| 262 | Lauraceae | <i>Cryptocarya sulcata</i>         |             | X      | X      |        |        | EN   |                      |
| 263 | Lauraceae | <i>Endiandra brassii</i>           |             | X      | X      | X      |        | LC   |                      |
| 264 | Lauraceae | <i>Endiandra engleriana</i>        |             | X      |        |        |        | EN   |                      |
| 265 | Lauraceae | <i>Endiandra forbesii</i>          |             |        | X      |        |        | LC   |                      |
| 266 | Lauraceae | <i>Endiandra</i> sp.               |             | X      | X      |        |        | NE   |                      |
| 267 | Lauraceae | <i>Litsea areolata</i>             |             |        | X      |        |        | NE   |                      |
| 268 | Lauraceae | <i>Litsea collina</i>              |             |        | X      |        |        | VU   |                      |
| 269 | Lauraceae | <i>Litsea discolor</i>             |             |        |        | X      | X      | NE   |                      |
| 270 | Lauraceae | <i>Litsea engleriana</i>           |             | X      |        |        |        | NE   |                      |
| 271 | Lauraceae | <i>Litsea globosa</i>              |             | X      |        |        | X      | VU   |                      |
| 272 | Lauraceae | <i>Litsea guppyi</i>               |             |        |        | X      |        | LC   |                      |
| 273 | Lauraceae | <i>Litsea ledermannii</i>          |             |        |        | X      |        | NE   |                      |
| 274 | Lauraceae | <i>Litsea</i> sp.                  |             | X      |        |        |        | NE   |                      |

| No  | Family        | Species name                         | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|---------------|--------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 275 | Lauraceae     | <i>Litsea umbellata</i>              |             | X      | X      |        |        | LC   |                      |
| 276 | Lecythidaceae | <i>Barringtonia apiculata</i>        | Pau         |        | X      | X      |        | LC   |                      |
| 277 | Lecythidaceae | <i>Barringtonia calyptrata</i>       | Pau         |        | X      | X      |        | LC   |                      |
| 278 | Lecythidaceae | <i>Barringtonia calyptrocalyx</i>    | Pau         | X      |        |        |        | LC   |                      |
| 279 | Lecythidaceae | <i>Barringtonia josephstaalensis</i> | Pau         | X      |        |        |        | NE   |                      |
| 280 | Lecythidaceae | <i>Barringtonia</i> sp. A            | Pau         | X      | X      |        |        | NE   |                      |
| 281 | Lecythidaceae | <i>Barringtonia</i> sp. B            | Pau         | X      | X      |        |        | NE   |                      |
| 282 | Lecythidaceae | <i>Planchonia papuana</i>            |             |        |        | X      |        | LC   |                      |
| 283 | Lindsaeaceae  | <i>Lindsaea repens</i>               |             |        | X      |        |        | NE   |                      |
| 284 | Loganiaceae   | <i>Neuburgia corynocarpa</i>         |             |        |        | X      |        | LC   |                      |
| 285 | Loganiaceae   | <i>Strychnos minor</i>               |             |        |        | X      |        | NE   |                      |
| 286 | Lycopodiaceae | <i>Huperzia serrata</i>              |             | X      |        |        |        | NE   |                      |
| 287 | Lycopodiaceae | <i>Lycopodiella cernua</i>           |             | X      |        |        |        | LC   |                      |
| 288 | Magnoliaceae  | <i>Magnolia tsiampacca</i>           | Wau Beech   |        | X      | X      | X      | DD   |                      |
| 289 | Malvaceae     | <i>Acropogon schumannianus</i>       |             | X      |        |        |        | LC   |                      |
| 290 | Malvaceae     | <i>Commersonia bartramia</i>         |             |        | X      |        |        | NE   |                      |
| 291 | Malvaceae     | <i>Heritiera littoralis</i>          |             |        |        | X      |        | LC   |                      |
| 292 | Malvaceae     | <i>Microcos grandiflora</i>          |             | X      |        | X      |        | NE   |                      |
| 293 | Malvaceae     | <i>Microcos tetrasperma</i>          |             | X      | X      |        | X      | NE   |                      |
| 294 | Malvaceae     | <i>Papuodendron lepidotum</i>        | Bulolo ash  | X      |        |        |        | LC   |                      |

| No  | Family          | Species name                      | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------------|-----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 295 | Malvaceae       | <i>Pterocymbium beccarii</i>      | Amberoi     |        |        |        | x      | VU   |                      |
| 296 | Malvaceae       | <i>Sterculia ampla</i>            |             | X      | X      | X      | X      | LC   |                      |
| 297 | Malvaceae       | <i>Sterculia schlechteri</i>      |             |        |        | X      |        | NE   |                      |
| 298 | Malvaceae       | <i>Trichadenia philippinensis</i> |             | X      |        |        |        | LC   |                      |
| 299 | Malvaceae       | <i>Trichospermum pleiostigma</i>  |             |        | X      |        | x      | LC   |                      |
| 300 | Marantaceae     | <i>Phrynium</i> sp.               |             | X      |        |        |        | NE   |                      |
| 301 | Marattiaceae    | <i>Angiopteris evecta</i>         |             | X      | X      |        |        | NE   |                      |
| 302 | Melastomataceae | <i>Astronidium</i> sp.            |             |        |        | x      | x      | NE   |                      |
| 303 | Melastomataceae | <i>Dissochaeta angiensis</i>      |             |        | X      |        |        | NE   |                      |
| 304 | Melastomataceae | <i>Dissochaeta schumannii</i>     |             | X      | X      |        |        | NE   |                      |
| 305 | Melastomataceae | <i>Medinilla brassii</i>          |             |        | X      |        |        | NE   |                      |
| 306 | Melastomataceae | <i>Medinilla</i> sp.              |             | X      | X      |        |        | NE   |                      |
| 307 | Melastomataceae | <i>Medinilla teysmannii</i>       |             | X      |        |        |        | NE   |                      |
| 308 | Melastomataceae | <i>Melastoma cyanoides</i>        |             | X      | X      |        |        | NE   |                      |
| 309 | Melastomataceae | <i>Memecylon insigne</i>          |             |        |        |        | x      | NE   |                      |
| 310 | Melastomataceae | <i>Memecylon lilacinum</i>        |             |        |        | x      |        | LC   |                      |
| 311 | Melastomataceae | <i>Memecylon</i> sp.              |             | X      | X      |        |        | NE   |                      |
| 312 | Melastomataceae | <i>Pternandra rostrata</i>        |             |        |        |        | x      | LC   |                      |
| 313 | Melastomataceae | <i>Sonerila papuana</i>           |             |        |        |        | x      | NE   |                      |
| 314 | Meliaceae       | <i>Aglaia argentea</i>            |             | X      |        | x      | x      | LC   |                      |

| No  | Family    | Species name                   | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------|--------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 315 | Meliaceae | <i>Aglaia brassii</i>          |             |        |        | X      |        | LC   |                      |
| 316 | Meliaceae | <i>Aglaia brownii</i>          |             |        |        | X      |        | LC   |                      |
| 317 | Meliaceae | <i>Aglaia cucullata</i>        | Amoora      | X      |        |        |        | DD   |                      |
| 318 | Meliaceae | <i>Aglaia lepiorrhachis</i>    |             | X      |        |        |        | NT   |                      |
| 319 | Meliaceae | <i>Aglaia parviflora</i>       |             |        |        | X      |        | LC   |                      |
| 320 | Meliaceae | <i>Aglaia rimosa</i>           |             | X      | X      |        | X      | LC   |                      |
| 321 | Meliaceae | <i>Aglaia sapindina</i>        |             |        |        | X      |        | LC   |                      |
| 322 | Meliaceae | <i>Aglaia silvestris</i>       |             |        |        | X      | X      | LC   |                      |
| 323 | Meliaceae | <i>Aglaia</i> sp. 1            |             |        |        | X      |        | NE   | NTS                  |
| 324 | Meliaceae | <i>Aglaia</i> sp. A            |             | X      | X      |        | X      | NE   |                      |
| 325 | Meliaceae | <i>Aglaia</i> sp. B            |             |        | X      |        |        | NE   |                      |
| 326 | Meliaceae | <i>Aglaia tomentosa</i>        |             | X      | X      |        | X      | LC   |                      |
| 327 | Meliaceae | <i>Aphanamixis polystachya</i> |             | X      | X      | X      | X      | LC   |                      |
| 328 | Meliaceae | <i>Chisocheton ceramicus</i>   |             |        |        | X      |        | LC   |                      |
| 329 | Meliaceae | <i>Chisocheton cumingianus</i> |             | X      |        |        |        | NE   |                      |
| 330 | Meliaceae | <i>Chisocheton lasiocarpus</i> |             | X      | X      |        |        | LC   |                      |
| 331 | Meliaceae | <i>Chisocheton</i> sp. A       |             |        | X      |        |        | NE   |                      |
| 332 | Meliaceae | <i>Chisocheton</i> sp. B       |             |        | X      |        |        | NE   |                      |
| 333 | Meliaceae | <i>Chisocheton</i> sp. C       |             | X      |        |        |        | NE   |                      |
| 334 | Meliaceae | <i>Dysoxylum alliaceum</i>     |             | X      |        |        |        | NE   |                      |

| No  | Family         | Species name                          | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|----------------|---------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 335 | Meliaceae      | <i>Dysoxylum</i> sp. 1                |             |        |        | X      |        | NE   | NTS                  |
| 336 | Meliaceae      | <i>Dysoxylum</i> sp. A                |             | X      |        |        |        | NE   |                      |
| 337 | Meliaceae      | <i>Dysoxylum</i> sp. B                |             | X      |        |        |        | NE   |                      |
| 338 | Meliaceae      | <i>Dysoxylum</i> <i>variabile</i>     |             |        |        | X      |        | LC   |                      |
| 339 | Meliaceae      | <i>Epicharis</i> <i>parasitica</i>    |             |        |        | X      |        | LC   |                      |
| 340 | Meliaceae      | <i>Goniocheton</i> <i>arborescens</i> | Red Dysox   |        | X      | X      |        | NE   |                      |
| 341 | Meliaceae      | <i>Prasoxylon</i> <i>excelsum</i>     |             | X      | X      | X      |        | LC   |                      |
| 342 | Meliaceae      | <i>Sandoricum</i> <i>koetjape</i>     |             | X      | X      | X      | X      | LC   |                      |
| 343 | Metteniusaceae | <i>Platea</i> <i>excelsa</i>          |             |        |        | X      |        | LC   |                      |
| 344 | Monimiaceae    | <i>Steganthera</i> <i>hirsuta</i>     |             | X      | X      |        |        | LC   |                      |
| 345 | Monimiaceae    | <i>Steganthera</i> <i>hospitans</i>   |             | X      | X      | X      | X      | NE   |                      |
| 346 | Moraceae       | <i>Artocarpus</i> <i>sepicanus</i>    | Kapiak      |        |        |        | X      | LC   |                      |
| 347 | Moraceae       | <i>Ficus</i> <i>adelpha</i>           |             | X      | X      | X      |        | LC   |                      |
| 348 | Moraceae       | <i>Ficus</i> <i>adenosperma</i>       |             |        |        |        | X      | LC   |                      |
| 349 | Moraceae       | <i>Ficus</i> <i>arfakensis</i>        |             | X      |        | X      |        | LC   |                      |
| 350 | Moraceae       | <i>Ficus</i> <i>aurantiacifolia</i>   |             |        |        | X      | X      | DD   |                      |
| 351 | Moraceae       | <i>Ficus</i> <i>badiopurpurea</i>     |             |        |        | X      |        | LC   |                      |
| 352 | Moraceae       | <i>Ficus</i> <i>bernaysii</i>         |             | X      | X      |        |        | LC   |                      |
| 353 | Moraceae       | <i>Ficus</i> <i>botryocarpa</i>       |             |        | X      |        |        | LC   |                      |
| 354 | Moraceae       | <i>Ficus</i> <i>calopilina</i>        |             |        | X      |        |        | LC   |                      |

| No  | Family   | Species name                   | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|----------|--------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 355 | Moraceae | <i>Ficus copiosa</i>           |             |        |        | x      |        | LC   |                      |
| 356 | Moraceae | <i>Ficus erythrosperma</i>     |             |        |        |        | x      | LC   |                      |
| 357 | Moraceae | <i>Ficus gul</i>               |             |        |        | x      |        | LC   |                      |
| 358 | Moraceae | <i>Ficus hahliana</i>          |             | X      |        |        |        | LC   |                      |
| 359 | Moraceae | <i>Ficus hombroniana</i>       |             |        |        | x      |        | LC   |                      |
| 360 | Moraceae | <i>Ficus itoana</i>            |             |        |        | x      |        | LC   |                      |
| 361 | Moraceae | <i>Ficus melinocarpa</i>       |             |        |        | x      |        | LC   |                      |
| 362 | Moraceae | <i>Ficus morobensis</i>        |             | X      |        |        |        | LC   |                      |
| 363 | Moraceae | <i>Ficus phaeosyce</i>         |             |        |        | x      |        | LC   |                      |
| 364 | Moraceae | <i>Ficus polyantha</i>         |             |        |        |        | x      | LC   |                      |
| 365 | Moraceae | <i>Ficus pungens</i>           |             |        |        | x      |        | LC   |                      |
| 366 | Moraceae | <i>Ficus saccata</i>           |             |        |        |        | x      | LC   |                      |
| 367 | Moraceae | <i>Ficus</i> sp. A             |             | X      | X      |        |        | NE   |                      |
| 368 | Moraceae | <i>Ficus</i> sp. B             |             | X      | X      |        |        | NE   |                      |
| 369 | Moraceae | <i>Ficus subtrinervia</i>      |             |        |        | x      |        | LC   |                      |
| 370 | Moraceae | <i>Ficus subulata</i>          |             |        |        | x      |        | LC   |                      |
| 371 | Moraceae | <i>Ficus variegata</i>         |             |        | X      |        |        | LC   |                      |
| 372 | Moraceae | <i>Ficus wassa</i>             |             |        |        | x      |        | LC   |                      |
| 373 | Moraceae | <i>Parartocarpus venenosus</i> |             | X      | X      |        |        | NE   |                      |
| 374 | Moraceae | <i>Streblus glaber</i>         |             |        | X      |        |        | NE   |                      |

| No  | Family        | Species name                       | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|---------------|------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 375 | Myristicaceae | <i>Endocomia macrocoma</i>         |             |        |        | x      | x      | LC   |                      |
| 376 | Myristicaceae | <i>Gymnacranthera farquhariana</i> |             | X      | X      |        | x      | LC   |                      |
| 377 | Myristicaceae | <i>Horsfieldia basifissa</i>       | Nutmag      | X      |        | x      |        | LC   |                      |
| 378 | Myristicaceae | <i>Horsfieldia hellwigii</i>       |             |        |        | x      |        | LC   |                      |
| 379 | Myristicaceae | <i>Horsfieldia irya</i>            | Nutmag      |        | X      | X      |        | LC   |                      |
| 380 | Myristicaceae | <i>Horsfieldia spicata</i>         | Nutmag      |        | X      | x      |        | LC   |                      |
| 381 | Myristicaceae | <i>Horsfieldia subtilis</i>        | Nutmag      | X      | X      | x      | X      | LC   |                      |
| 382 | Myristicaceae | <i>Myristica crassipes</i>         |             |        |        | x      |        | LC   |                      |
| 383 | Myristicaceae | <i>Myristica fatua</i>             | Nutmag      | X      | X      | X      | x      | LC   |                      |
| 384 | Myristicaceae | <i>Myristica globosa</i>           | Nutmag      | X      | X      |        | x      | LC   |                      |
| 385 | Myristicaceae | <i>Myristica hollrungii</i>        | Nutmag      |        | X      |        |        | LC   |                      |
| 386 | Myristicaceae | <i>Myristica hooglandii</i>        | Nutmag      |        |        |        | x      | NT   |                      |
| 387 | Myristicaceae | <i>Myristica pumila</i>            | Nutmag      |        | X      |        |        | NE   |                      |
| 388 | Myristicaceae | <i>Myristica schleinitzii</i>      | Nutmag      |        |        | x      |        | LC   |                      |
| 389 | Myristicaceae | <i>Myristica scripta</i>           | Nutmag      |        | X      |        |        | LC   |                      |
| 390 | Myristicaceae | <i>Myristica</i> sp.               | Nutmag      | x      | X      |        |        | NE   |                      |
| 391 | Myristicaceae | <i>Myristica subalulata</i>        | Nutmag      | X      | X      | X      | x      | LC   |                      |
| 392 | Myrtaceae     | <i>Decaspermum fruticosum</i>      |             | X      |        |        | x      | LC   |                      |
| 393 | Myrtaceae     | <i>Octamyrtus insignis</i>         |             |        | X      |        |        | LC   |                      |
| 394 | Myrtaceae     | <i>Octamyrtus</i> sp.              |             |        |        |        | x      | NE   |                      |

| No  | Family    | Species name                   | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------|--------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 395 | Myrtaceae | <i>Rhodamnia latifolia</i>     |             | X      | X      | X      |        | LC   |                      |
| 396 | Myrtaceae | <i>Syzygium coalitum</i>       | Laulau      | X      |        |        |        | NT   |                      |
| 397 | Myrtaceae | <i>Syzygium cratermontense</i> |             |        | X      | X      |        | NE   |                      |
| 398 | Myrtaceae | <i>Syzygium effusum</i>        |             | X      | X      |        | X      | LC   |                      |
| 399 | Myrtaceae | <i>Syzygium fibrosum</i>       |             | X      |        |        |        | DD   |                      |
| 400 | Myrtaceae | <i>Syzygium furfuraceum</i>    |             | X      |        | x      |        | LC   |                      |
| 401 | Myrtaceae | <i>Syzygium goniopterum</i>    |             | X      | X      |        |        | LC   |                      |
| 402 | Myrtaceae | <i>Syzygium hemilamprum</i>    |             |        | X      |        |        | LC   |                      |
| 403 | Myrtaceae | <i>Syzygium hylochare</i>      |             | X      |        |        |        | LC   |                      |
| 404 | Myrtaceae | <i>Syzygium leptoneurum</i>    |             | X      |        |        |        | VU   |                      |
| 405 | Myrtaceae | <i>Syzygium leptopodium</i>    |             |        |        |        | X      | LC   |                      |
| 406 | Myrtaceae | <i>Syzygium longipes</i>       |             |        | X      | x      |        | LC   |                      |
| 407 | Myrtaceae | <i>Syzygium megistophyllum</i> |             | X      | X      |        |        | LC   |                      |
| 408 | Myrtaceae | <i>Syzygium nutans</i>         |             | X      | X      |        |        | LC   |                      |
| 409 | Myrtaceae | <i>Syzygium puberulum</i>      |             | X      |        |        |        | LC   |                      |
| 410 | Myrtaceae | <i>Syzygium roemeri</i>        |             |        | X      |        |        | LC   |                      |
| 411 | Myrtaceae | <i>Syzygium samarangense</i>   |             |        | X      |        |        | LC   |                      |
| 412 | Myrtaceae | <i>Syzygium</i> sp. A          |             | x      | X      |        |        | NE   |                      |
| 413 | Myrtaceae | <i>Syzygium</i> sp. B          |             | x      | X      |        |        | NE   |                      |
| 414 | Myrtaceae | <i>Syzygium</i> sp. C          |             |        | X      |        |        | NE   |                      |

| No  | Family        | Species name                    | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|---------------|---------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 415 | Myrtaceae     | <i>Syzygium stipulare</i>       |             | X      |        |        |        | LC   |                      |
| 416 | Myrtaceae     | <i>Syzygium thornei</i>         |             | X      |        |        | x      | LC   |                      |
| 417 | Myrtaceae     | <i>Syzygium trivene</i>         |             | X      |        |        |        | LC   |                      |
| 418 | Myrtaceae     | <i>Syzygium zhenghei</i>        |             |        | X      |        |        | LC   |                      |
| 419 | Myrtaceae     | <i>Tristaniopsis ferruginea</i> | Water Gum   | X      | X      |        |        | LC   |                      |
| 420 | Myrtaceae     | <i>Xanthomyrtus</i> sp.         |             |        |        |        | x      | NE   |                      |
| 421 | Nepenthaceae  | <i>Nepenthes ampullaria</i>     |             |        | X      |        |        | LC   |                      |
| 422 | Nyctaginaceae | <i>Ceodes longirostris</i>      |             | X      | X      | x      | x      | NE   |                      |
| 423 | Nyctaginaceae | <i>Pisonia umbellifera</i>      |             | X      |        | x      |        | LC   |                      |
| 424 | Nymphaeaceae  | <i>Nymphaea</i> sp.             |             |        | X      |        |        | NE   |                      |
| 425 | Ochnaceae     | <i>Schuurmansia elegans</i>     |             |        | X      | x      |        | LC   |                      |
| 426 | Ochnaceae     | <i>Schuurmansia henningsii</i>  |             | X      | X      |        |        | LC   |                      |
| 427 | Oleaceae      | <i>Chionanthus brassii</i>      |             | X      | X      |        |        | NE   |                      |
| 428 | Oleaceae      | <i>Chionanthus ramiflorus</i>   |             |        | X      |        |        | NE   |                      |
| 429 | Oleaceae      | <i>Chionanthus</i> sp.          |             |        |        | x      |        | NE   |                      |
| 430 | Orchidaceae   | <i>Calanthe aceras</i>          |             |        | X      |        |        | NE   |                      |
| 431 | Orchidaceae   | <i>Calanthe hololeuca</i>       |             | X      |        |        |        | NE   |                      |
| 432 | Orchidaceae   | <i>Calanthe</i> sp.             |             | X      |        |        |        | NE   |                      |
| 433 | Orchidaceae   | <i>Goodyera gibbsiae</i>        |             | X      |        |        |        | NE   |                      |
| 434 | Orchidaceae   | <i>Goodyera</i> sp.             |             | X      |        |        |        | NE   |                      |

| No  | Family             | Species name                                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|--------------------|--------------------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 435 | Orchidaceae        | <i>Spathoglottis altigena</i>                    |             |        | X      |        |        | NE   |                      |
| 436 | Orchidaceae        | <i>Tropidia</i> sp.                              |             |        | X      |        |        | NE   |                      |
| 437 | Oxalidaceae        | <i>Averrhoa bilimbi</i>                          |             |        |        |        | X      | LC   |                      |
| 438 | Pandanaceae        | <i>Freycinetia beccarii</i>                      |             |        | X      |        |        | NE   |                      |
| 439 | Pandanaceae        | <i>Freycinetia bicolor</i>                       |             |        | X      |        |        | NE   |                      |
| 440 | Pandanaceae        | <i>Freycinetia linearis</i>                      |             |        | X      |        |        | NE   |                      |
| 441 | Pandanaceae        | <i>Freycinetia</i> sp. A                         |             | X      |        |        |        | NE   |                      |
| 442 | Pandanaceae        | <i>Freycinetia</i> sp. B                         |             |        | X      |        |        | NE   |                      |
| 443 | Pandanaceae        | <i>Pandanus</i> sp.                              |             | X      |        |        |        | NE   |                      |
| 444 | Paracryphiaceae    | <i>Quintinia ledermannii</i>                     |             |        |        |        | X      | NE   |                      |
| 445 | Paracryphiaceae    | <i>Quintinia macrophylla</i>                     |             |        |        |        | X      | NE   |                      |
| 446 | Pentaphragmataceae | <i>Pentaphragma grandiflorum</i>                 |             | X      | X      | X      | X      | NE   |                      |
| 447 | Pentaphylacaceae   | <i>Ternstroemia cherryi</i>                      |             | X      | X      |        |        | LC   |                      |
| 448 | Phyllanthaceae     | <i>Antidesma excavatum</i> var. <i>excavatum</i> |             |        |        | X      | X      | NE   |                      |
| 449 | Phyllanthaceae     | <i>Antidesma</i> sp.                             |             |        | X      |        |        | NE   |                      |
| 450 | Phyllanthaceae     | <i>Aporosa ledermanniana</i>                     |             |        | X      |        |        | NT   |                      |
| 451 | Phyllanthaceae     | <i>Aporosa longicaudata</i>                      |             | X      |        |        |        | LC   |                      |
| 452 | Phyllanthaceae     | <i>Aporosa papuana</i>                           |             | X      | X      |        |        | LC   |                      |
| 453 | Phyllanthaceae     | <i>Aporosa praegrandifolia</i>                   |             |        | X      |        |        | NE   |                      |

| No  | Family         | Species name                      | Common Name   | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|----------------|-----------------------------------|---------------|--------|--------|--------|--------|------|----------------------|
| 454 | Phyllanthaceae | <i>Aporosa</i> sp. A              |               | X      | X      |        |        | NE   |                      |
| 455 | Phyllanthaceae | <i>Aporosa</i> sp. B              |               |        | X      |        |        | NE   |                      |
| 456 | Phyllanthaceae | <i>Bridelia macrocarpa</i>        |               |        | X      | X      |        | NT   |                      |
| 457 | Phyllanthaceae | <i>Cleistanthus insignis</i>      |               |        |        | X      |        | VU   |                      |
| 458 | Phyllanthaceae | <i>Cleistanthus oblongifolius</i> |               |        | X      |        |        | LC   |                      |
| 459 | Phyllanthaceae | <i>Drypetes lasiogynoides</i>     |               | X      |        |        |        | NE   |                      |
| 460 | Phyllanthaceae | <i>Glochidion chlamydogyne</i>    |               |        |        | X      |        | LC   |                      |
| 461 | Phyllanthaceae | <i>Glochidion nesophilum</i>      |               | X      |        |        |        | LC   |                      |
| 462 | Phyllanthaceae | <i>Glochidion novoguineense</i>   |               |        | X      |        |        | LC   |                      |
| 463 | Phyllanthaceae | <i>Glochidion</i> sp. 1           |               | X      |        |        |        | NE   | NTS                  |
| 464 | Phyllanthaceae | <i>Phyllanthus clamboides</i>     |               | X      |        |        |        | LC   |                      |
| 465 | Phyllanthaceae | <i>Phyllanthus lamprophyllus</i>  |               |        |        | X      |        | NE   |                      |
| 466 | Phyllanthaceae | <i>Phyllanthus rubriflorus</i>    |               |        |        | X      |        | LC   |                      |
| 467 | Piperaceae     | <i>Piper aduncum</i>              | Spiked Pepper |        | X      | X      | X      | NE   |                      |
| 468 | Piperaceae     | <i>Piper decumanum</i>            |               |        | X      |        |        | NE   |                      |
| 469 | Piperaceae     | <i>Piper gibbilimum</i>           |               |        |        |        | X      | NE   |                      |
| 470 | Piperaceae     | <i>Piper mestonii</i>             |               | X      | X      |        |        | NE   |                      |
| 471 | Piperaceae     | <i>Piper</i> sp.                  |               |        | X      |        |        | NE   |                      |
| 472 | Pittosporaceae | <i>Pittosporum sinuatum</i>       |               | X      | X      | X      |        | LC   |                      |
| 473 | Pittosporaceae | <i>Pittosporum</i> sp.            |               |        |        | X      | X      | NE   |                      |

| No  | Family        | Species name                    | Common Name           | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|---------------|---------------------------------|-----------------------|--------|--------|--------|--------|------|----------------------|
| 474 | Poaceae       | <i>Bambusa</i> sp.              |                       | X      |        |        |        | NE   |                      |
| 475 | Poaceae       | <i>Nastus</i> sp.               |                       | X      | X      |        |        | NE   |                      |
| 476 | Poaceae       | <i>Neololeba atra</i>           |                       | X      | X      |        |        | NE   |                      |
| 477 | Poaceae       | <i>Oplismenus compostus</i>     |                       |        |        |        | X      | NE   |                      |
| 478 | Podocarpaceae | <i>Podocarpus neriifolius</i>   |                       |        | X      |        |        | LC   |                      |
| 479 | Polygalaceae  | <i>Xanthophyllum papuanum</i>   | New Guinea<br>Boxwood | X      | X      | X      |        | LC   |                      |
| 480 | Polypodiaceae | <i>Davilla rugosa</i>           |                       | X      |        |        |        | NE   |                      |
| 481 | Polypodiaceae | <i>Lycopodium</i> sp.           |                       | X      |        |        |        | NE   |                      |
| 482 | Primulaceae   | <i>Ardisia imperialis</i>       |                       |        | X      | X      | X      | NE   |                      |
| 483 | Primulaceae   | <i>Ardisia</i> sp.              |                       | X      |        |        |        | NE   |                      |
| 484 | Primulaceae   | <i>Conandrium polyanthum</i>    |                       |        | X      |        |        | LC   |                      |
| 485 | Primulaceae   | <i>Conandrium</i> sp.           |                       | X      | X      |        |        | NE   |                      |
| 486 | Primulaceae   | <i>Discocalyx latepetiolata</i> |                       | X      | X      |        |        | NT   |                      |
| 487 | Primulaceae   | <i>Discocalyx</i> sp. A         |                       | X      |        |        |        | NE   |                      |
| 488 | Primulaceae   | <i>Discocalyx</i> sp. B         |                       |        | X      |        |        | NE   |                      |
| 489 | Primulaceae   | <i>Maesa haplobotrys</i>        |                       |        | X      |        |        | NE   |                      |
| 490 | Primulaceae   | <i>Maesa sayersii</i>           |                       |        | X      |        |        | NE   |                      |
| 491 | Primulaceae   | <i>Maesa</i> sp.                |                       | X      | X      |        |        | NE   |                      |
| 492 | Proteaceae    | <i>Finschia chloroxantha</i>    |                       | X      |        |        |        | LC   |                      |

| No  | Family         | Species name                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|----------------|----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 493 | Proteaceae     | <i>Helicia latifolia</i>         |             | x      | X      |        |        | NT   |                      |
| 494 | Proteaceae     | <i>Helicia obtusata</i>          |             |        | X      |        |        | NE   |                      |
| 495 | Proteaceae     | <i>Helicia</i> sp.               |             |        |        |        | X      | NE   |                      |
| 496 | Psilotaceae    | <i>Psilotum</i> sp.              |             |        | X      |        |        | NE   |                      |
| 497 | Pteridaceae    | <i>Pteris orientalis</i>         |             |        |        |        | X      | NE   |                      |
| 498 | Putranjivaceae | <i>Drypetes lasiogynoides</i>    |             |        |        | X      |        | LC   |                      |
| 499 | Rhamnaceae     | <i>Alphitonia incana</i>         |             |        |        |        | X      | LC   |                      |
| 500 | Rhamnaceae     | <i>Ziziphus angustifolia</i>     |             | X      |        |        |        | LC   |                      |
| 501 | Rhizophoraceae | <i>Carallia brachiata</i>        |             | X      | X      |        | X      | LC   |                      |
| 502 | Rhizophoraceae | <i>Gynotroches axillaris</i>     |             | X      | X      |        |        | LC   |                      |
| 503 | Rosaceae       | <i>Prunus dolichobotrys</i>      |             | X      |        |        |        | LC   |                      |
| 504 | Rosaceae       | <i>Prunus gazelle-peninsulae</i> |             | X      | X      | X      | X      | LC   |                      |
| 505 | Rosaceae       | <i>Prunus grisea</i>             |             |        | X      |        |        | LC   |                      |
| 506 | Rosaceae       | <i>Prunus schlechteri</i>        |             | X      |        |        |        | LC   |                      |
| 507 | Rosaceae       | <i>Prunus</i> sp.                |             |        | X      | X      |        | NE   |                      |
| 508 | Rousseaceae    | <i>Carpodetus grandiflorus</i>   |             |        |        |        | X      | LC   |                      |
| 509 | Rubiaceae      | <i>Acronychia pullei</i>         |             |        |        |        | X      | NT   |                      |
| 510 | Rubiaceae      | <i>Amaracarpus grandifolius</i>  |             | X      | X      |        |        | LC   |                      |
| 511 | Rubiaceae      | <i>Amaracarpus</i> sp.           |             |        | X      |        |        | NE   |                      |
| 512 | Rubiaceae      | <i>Anthocephalus chinensis</i>   |             |        |        | X      |        | NE   |                      |

| No  | Family    | Species name                   | Common Name       | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------|--------------------------------|-------------------|--------|--------|--------|--------|------|----------------------|
| 513 | Rubiaceae | <i>Atractocarpus decorus</i>   |                   | X      | X      |        |        | LC   |                      |
| 514 | Rubiaceae | <i>Canthium</i> sp. A          |                   | X      | X      |        |        | NE   |                      |
| 515 | Rubiaceae | <i>Canthium</i> sp. B          |                   |        |        |        | X      | NE   |                      |
| 516 | Rubiaceae | <i>Cyclophyllum caudatum</i>   |                   | X      |        |        |        | NE   |                      |
| 517 | Rubiaceae | <i>Dolianthus buxifolius</i>   |                   |        |        | X      |        | NE   |                      |
| 518 | Rubiaceae | <i>Eumachia leptothyrsa</i>    |                   |        |        |        | X      | LC   |                      |
| 519 | Rubiaceae | <i>Hedyotis</i> sp.            |                   | X      |        |        |        | NE   |                      |
| 520 | Rubiaceae | <i>Hydnophytum</i> sp.         |                   |        |        |        | X      | NE   |                      |
| 521 | Rubiaceae | <i>Ixora</i> sp. A             |                   | X      |        |        |        | NE   |                      |
| 522 | Rubiaceae | <i>Ixora</i> sp. B             |                   |        |        | X      |        | NE   |                      |
| 523 | Rubiaceae | <i>Ixora timorensis</i>        |                   |        |        | X      |        | LC   |                      |
| 524 | Rubiaceae | <i>Lasianthus cyanocarpus</i>  |                   | X      |        |        |        | NE   |                      |
| 525 | Rubiaceae | <i>Lasianthus papuanus</i>     |                   | X      |        |        |        | NE   |                      |
| 526 | Rubiaceae | <i>Lasianthus</i> sp.          |                   | X      |        |        |        | NE   |                      |
| 527 | Rubiaceae | <i>Lasianthus stipularis</i>   |                   |        | X      |        |        | NE   |                      |
| 528 | Rubiaceae | <i>Mussaenda</i> sp.           |                   | X      |        |        |        | NE   |                      |
| 529 | Rubiaceae | <i>Nauclea orientalis</i>      | Yellow Cheesewood | X      |        | X      | X      | NE   |                      |
| 530 | Rubiaceae | <i>Neonauclea obversifolia</i> |                   |        |        | X      |        | LC   |                      |
| 531 | Rubiaceae | <i>Ophiorrhiza rupestris</i>   |                   |        |        |        | X      | NE   |                      |
| 532 | Rubiaceae | <i>Ophiorrhiza</i> sp.         |                   |        |        |        | X      | NE   |                      |

| No  | Family    | Species name                                   | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------|------------------------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 533 | Rubiaceae | <i>Pavetta</i> sp.                             |             | X      |        | X      |        | NE   |                      |
| 534 | Rubiaceae | <i>Plectronia longicauda</i>                   |             |        |        | X      |        | NE   |                      |
| 535 | Rubiaceae | <i>Psychotria chrysantha</i>                   |             |        |        |        | X      | LC   |                      |
| 536 | Rubiaceae | <i>Psychotria micrococca</i>                   |             |        |        | X      |        | LC   |                      |
| 537 | Rubiaceae | <i>Psychotria ramuensis</i>                    |             |        |        | X      |        | VU   |                      |
| 538 | Rubiaceae | <i>Psychotria</i> sp. A                        |             | X      |        |        |        | NE   |                      |
| 539 | Rubiaceae | <i>Psychotria</i> sp. B                        |             |        | X      |        | X      | NE   |                      |
| 540 | Rubiaceae | <i>Psychotria</i> sp. C                        |             |        |        | X      |        | NE   |                      |
| 541 | Rubiaceae | <i>Randia schumanniana</i>                     |             |        | X      |        | X      | LC   |                      |
| 542 | Rubiaceae | <i>Spermacoce remota</i>                       |             |        |        |        | X      | LC   |                      |
| 543 | Rubiaceae | <i>Tarenna sambucina</i>                       |             | X      | X      |        |        | LC   |                      |
| 544 | Rubiaceae | <i>Tarenna sambucina</i> var. <i>buruensis</i> |             |        |        | X      |        | NE   |                      |
| 545 | Rubiaceae | <i>Timonius argenteus</i>                      |             |        |        |        | X      | EN   |                      |
| 546 | Rubiaceae | <i>Timonius belensis</i>                       |             | X      | X      |        |        | LC   |                      |
| 547 | Rubiaceae | <i>Timonius grandifolius</i>                   |             | X      |        | X      |        | LC   |                      |
| 548 | Rubiaceae | <i>Timonius rufescens</i>                      |             | X      | X      |        |        | LC   |                      |
| 549 | Rubiaceae | <i>Timonius timon</i>                          |             |        |        |        | X      | LC   |                      |
| 550 | Rubiaceae | <i>Uncaria lanosa</i>                          |             |        | X      | X      | X      | NE   |                      |
| 551 | Rubiaceae | <i>Uncaria</i> sp.                             |             | X      |        |        |        | NE   |                      |
| 552 | Rubiaceae | <i>Urophyllum glaucescens</i>                  |             |        |        | X      |        | NE   |                      |

| No  | Family      | Species name                   | Common Name    | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-------------|--------------------------------|----------------|--------|--------|--------|--------|------|----------------------|
| 553 | Rutaceae    | <i>Acronychia trifoliolata</i> |                |        |        |        | X      | LC   |                      |
| 554 | Rutaceae    | <i>Flindersia amboinensis</i>  |                | X      |        |        |        | LC   |                      |
| 555 | Rutaceae    | <i>Flindersia pimenteliana</i> | Maple Silkwood |        | X      |        |        | LC   |                      |
| 556 | Rutaceae    | <i>Melicope denhamii</i>       |                |        |        |        | X      | LC   |                      |
| 557 | Rutaceae    | <i>Melicope elleryana</i>      | Pink Eodia     | X      |        |        |        | LC   |                      |
| 558 | Rutaceae    | <i>Melicope reticulata</i>     |                |        |        |        | X      | NE   |                      |
| 559 | Rutaceae    | <i>Melicope</i> sp.            |                | X      | X      |        |        | NE   |                      |
| 560 | Sabiaceae   | <i>Meliosma pinnata</i>        |                |        |        |        | X      | NE   |                      |
| 561 | Salicaceae  | <i>Casearia clutiiifolia</i>   |                | X      | X      | X      |        | NE   |                      |
| 562 | Salicaceae  | <i>Casearia</i> sp.            |                | X      | X      |        | X      | NE   |                      |
| 563 | Salicaceae  | <i>Flacourtia inermis</i>      |                | X      |        |        |        | LC   |                      |
| 564 | Salicaceae  | <i>Flacourtia zippelii</i>     |                |        | X      |        |        | LC   |                      |
| 565 | Salicaceae  | <i>Homalium foetidum</i>       |                | X      |        | X      |        | LC   |                      |
| 566 | Salicaceae  | <i>Xylosma papuana</i>         |                |        |        |        | X      | NE   |                      |
| 567 | Sapindaceae | <i>Cupaniopsis</i> sp.         |                | X      | X      |        |        | NE   |                      |
| 568 | Sapindaceae | <i>Dictyoneura obtusa</i>      |                |        | X      | X      |        | LC   |                      |
| 569 | Sapindaceae | <i>Ganophyllum falcatum</i>    | Scaly Ash      | X      | X      |        |        | LC   |                      |
| 570 | Sapindaceae | <i>Guioa comesperma</i>        |                | X      | X      |        | X      | LC   |                      |
| 571 | Sapindaceae | <i>Harpullia arborea</i>       |                |        |        | X      |        | LC   |                      |
| 572 | Sapindaceae | <i>Harpullia longipetala</i>   |                | X      | X      |        |        | LC   |                      |

| No  | Family          | Species name                   | Common Name  | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|-----------------|--------------------------------|--------------|--------|--------|--------|--------|------|----------------------|
| 573 | Sapindaceae     | <i>Harpullia rhachiptera</i>   |              |        |        |        | X      | NE   |                      |
| 574 | Sapindaceae     | <i>Jagera javanica</i>         |              | X      |        |        |        | LC   |                      |
| 575 | Sapindaceae     | <i>Mischocarpus sundaicus</i>  |              |        |        | X      |        | LC   |                      |
| 576 | Sapindaceae     | <i>Pometia pinnata</i>         | Taun         | X      | X      | X      |        | NE   |                      |
| 577 | Sapindaceae     | <i>Toechima</i> sp.            |              | X      |        |        |        | NE   |                      |
| 578 | Sapotaceae      | <i>Madhuca leucodermis</i>     |              |        | X      |        |        | NT   |                      |
| 579 | Sapotaceae      | <i>Palaquium amboinense</i>    |              |        | X      |        |        | LC   |                      |
| 580 | Sapotaceae      | <i>Palaquium morobense</i>     |              |        |        | X      | X      | EN   |                      |
| 581 | Sapotaceae      | <i>Palaquium ridleyi</i>       |              |        | X      |        |        | LC   |                      |
| 582 | Sapotaceae      | <i>Palaquium supfianum</i>     |              |        | X      |        |        | VU   |                      |
| 583 | Sapotaceae      | <i>Palaquium warburgianum</i>  | Pencil Cedar | X      |        |        |        | NT   |                      |
| 584 | Sapotaceae      | <i>Pichonia lauterbachiana</i> |              | X      |        |        |        | LC   |                      |
| 585 | Sapotaceae      | <i>Planchonella chartacea</i>  |              |        | X      |        |        | LC   |                      |
| 586 | Sapotaceae      | <i>Planchonella keyensis</i>   |              |        | X      |        |        | LC   |                      |
| 587 | Sapotaceae      | <i>Planchonella thyrsoides</i> |              |        | X      | X      | X      | NT   |                      |
| 588 | Sapotaceae      | <i>Pleioluma firma</i>         |              | X      |        |        |        | NT   |                      |
| 589 | Sapotaceae      | <i>Pleioluma macropoda</i>     |              |        | X      |        |        | LC   |                      |
| 590 | Sapotaceae      | <i>Pouteria</i> sp. A          |              | X      |        |        |        | NE   |                      |
| 591 | Sapotaceae      | <i>Pouteria</i> sp. B          |              | X      |        |        |        | NE   |                      |
| 592 | Selaginellaceae | <i>Selaginella kerstingii</i>  |              |        | X      | X      | X      | NE   |                      |

| No  | Family           | Species name                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|------------------|----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 593 | Selaginellaceae  | <i>Selaginella plana</i>         |             |        | X      |        |        | NE   |                      |
| 594 | Selaginellaceae  | <i>Selaginella velutina</i>      |             |        | X      |        |        | NE   |                      |
| 595 | Simaroubaceae    | <i>Quassia indica</i>            |             | X      |        |        |        | LC   |                      |
| 596 | Smilacaceae      | <i>Smilax leucophylla</i>        |             |        | X      |        |        | LC   |                      |
| 597 | Staphyleaceae    | <i>Turpinia pentandra</i>        |             |        | X      | X      |        | LC   |                      |
| 598 | Stemonuraceae    | <i>Gomphandra montana</i>        |             |        |        | X      |        | LC   |                      |
| 599 | Stemonuraceae    | <i>Gomphandra</i> sp.            |             | X      |        |        |        | NE   |                      |
| 600 | Stemonuraceae    | <i>Stemonurus ammui</i>          |             | X      | X      |        |        | LC   |                      |
| 601 | Symplocaceae     | <i>Symplocos cochinchinensis</i> |             |        | X      |        |        | LC   |                      |
| 602 | Symplocaceae     | <i>Symplocos gigantifolia</i>    |             |        |        | X      |        | NE   |                      |
| 603 | Symplocaceae     | <i>Symplocos</i> sp.             |             |        |        | X      |        | NE   |                      |
| 604 | Theaceae         | <i>Gonystylus macrophyllus</i>   |             |        |        |        | X      | LC   |                      |
| 605 | Theaceae         | <i>Ternstroemia merrilliana</i>  |             |        |        | X      |        | NE   |                      |
| 606 | Thelypteridaceae | <i>Coryphopteris klossii</i>     |             |        |        |        | X      | NE   |                      |
| 607 | Thymelaeaceae    | <i>Phaleria coccinea</i>         |             |        |        |        | X      | LC   |                      |
| 608 | Thymelaeaceae    | <i>Phaleria</i> sp.              |             | X      |        |        |        | NE   |                      |
| 609 | Trimeniaceae     | <i>Trimenia papuana</i>          |             |        |        |        | X      | LC   |                      |
| 610 | Urticaceae       | <i>Cypholophus nummularis</i>    |             |        |        | X      |        | NE   |                      |
| 611 | Urticaceae       | <i>Elatostema macrophyllum</i>   |             |        | X      |        |        | NE   |                      |
| 612 | Urticaceae       | <i>Elatostema novoguineense</i>  |             |        |        | X      |        | NE   |                      |

| No  | Family        | Species name                     | Common Name | Site 1 | Site 2 | Site 4 | Site 5 | IUCN | New to Science (NTS) |
|-----|---------------|----------------------------------|-------------|--------|--------|--------|--------|------|----------------------|
| 613 | Urticaceae    | <i>Elatostema</i> sp.            |             |        |        |        | X      | NE   |                      |
| 614 | Urticaceae    | <i>Nothocnide repanda</i>        |             | X      | X      |        |        | NE   |                      |
| 615 | Urticaceae    | <i>Poikilospermum suaveolens</i> |             |        |        |        | X      | NE   |                      |
| 616 | Violaceae     | <i>Rinorea horneri</i>           |             |        |        | X      |        | LC   |                      |
| 617 | Vitaceae      | <i>Cayratia</i> sp.              |             | X      | X      |        |        | NE   |                      |
| 618 | Vitaceae      | <i>Cissus aristata</i>           |             |        | X      |        |        | NE   |                      |
| 619 | Vitaceae      | <i>Cissus hypoglauca</i>         |             |        | X      |        |        | NE   |                      |
| 620 | Vitaceae      | <i>Cissus</i> sp.                |             | X      | X      |        |        | NE   |                      |
| 621 | Vitaceae      | <i>Leea indica</i>               |             |        |        | X      |        | LC   |                      |
| 622 | Vitaceae      | <i>Leea zippeliana</i>           |             |        |        |        | X      | NE   |                      |
| 623 | Vitaceae      | <i>Tetrastigma</i> sp.           |             |        | X      |        |        | NE   |                      |
| 624 | Winteraceae   | <i>Tasmannia piperita</i>        |             |        |        |        | X      | LC   |                      |
| 625 | Winteraceae   | <i>Zygogynum sylvestre</i>       |             |        |        |        | X      | NE   |                      |
| 626 | Zingiberaceae | <i>Alpinia fusiformis</i>        |             |        | X      |        |        | NE   |                      |
| 627 | Zingiberaceae | <i>Alpinia pulchra</i>           |             |        | X      |        | X      | NE   |                      |
| 628 | Zingiberaceae | <i>Alpinia singuliflora</i>      |             |        | X      |        |        | NE   |                      |
| 629 | Zingiberaceae | <i>Alpinia</i> sp. A             |             |        | X      |        |        | NE   |                      |
| 630 | Zingiberaceae | <i>Alpinia</i> sp. B             |             | X      | X      |        |        | NE   |                      |
| 631 | Zingiberaceae | <i>Etlingera</i> sp. A           |             | X      |        |        |        | NE   |                      |
| 632 | Zingiberaceae | <i>Etlingera</i> sp. B           |             | X      |        |        |        | NE   |                      |

| No           | Family        | Species name                 | Common Name | Site 1     | Site 2     | Site 4     | Site 5     | IUCN | New to Science (NTS) |
|--------------|---------------|------------------------------|-------------|------------|------------|------------|------------|------|----------------------|
| 633          | Zingiberaceae | <i>Etlingera</i> sp. C       |             |            | X          |            |            | NE   |                      |
| 634          | Zingiberaceae | <i>Hornstedtia scottiana</i> |             |            | X          | X          |            | NE   |                      |
| 635          | Zingiberaceae | <i>Meistera aculeata</i>     |             | X          | X          | X          |            | NE   |                      |
| 636          | Zingiberaceae | <i>Riedelia corallina</i>    |             | X          | X          |            |            | NE   |                      |
| 637          | Zingiberaceae | <i>Riedelia hollandiae</i>   |             |            |            |            | X          | NE   |                      |
| 638          | Zingiberaceae | <i>Riedelia</i> sp.          |             | X          |            |            |            | NE   |                      |
| <b>Total</b> | <b>113</b>    | <b>638</b>                   |             | <b>314</b> | <b>330</b> | <b>195</b> | <b>138</b> |      | <b>8</b>             |

**10.2. Appendix 2. Survey 1 bat calls analysis and summary report  
by Specialised Zoological.**



**Acoustic analysis and  
bat call identification  
from Ok Birim, Papua New Guinea**

Prepared for **Ecomate Management Ltd**

Version **3 November 2025**

SZ project reference **SZ781**

**Specialised Zoological** ABN 92 265 437 422

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This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2025). Acoustic analysis and bat call identification from Ok Birim, Papua New Guinea. Unpublished report by Specialised Zoological for Ecomate Management Ltd, version 2025-11-03, project reference SZ781.

## Version history

| Version    | Note          |
|------------|---------------|
| 2025-11-03 | Final version |
|            |               |
|            |               |
|            |               |

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## 1.0 Summary

Bat identifications from bat detector sound files are provided from recordings made from Ok Birim, c. 50 km south of Tabubil, Western Province, Papua New Guinea. The dataset submitted for analysis included a total of 158,764 bat detector sound files from 19 sites and over 19 recording nights.

The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics.

Eight species of bat were identified as being present, (**Tables 1 and 2**). Representative echolocation calls for each identification are illustrated (**Figure 1**). Further information can be provided for verification.

## 2.0 Comments on identifications

Most echolocation call types could be identified and associated with one bat species.

The taxonomy of the Miniopteridae in Papua New Guinea, and indeed across Indo-Australasia, is still to be resolved fully, and the name applied here to the call type of a large species of bent-winged bat is based on the unpublished work of Wiantoro (2020).

The call type *88 mCF* has been attributed to the Fly River Leaf-nosed Bat *Doryrhina muscinus*, but Wollaston's Leaf-nosed Bat *Hipposideros wollastoni* is also a candidate.

The most likely candidate for the source of the *75 mCF* call type, given the geographic location, is the Telefomin Leaf-nosed Bat *Hipposideros corynophyllus*, but capture is required to confirm this attribution.

## 3.0 Methods

The ultrasonic recordings provided were recorded in WAV format with Titley Scientific Anabat Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (SCAN'R parameters) from each putative bat pulse. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language application that performed three tasks:

1. undertook a Discriminant Function Analysis on training data from representative calls from Papua New Guinea;
2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over data ellipses representing one standard deviation of the variation for the defined call types; and

3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition version 25.0.

Species were identified based on information in Armstrong and Aplin (2011, 2014), Leary and Pennay (2011), Robson et al. (2012), and Armstrong et al. (2015 a,b, 2022). Call types are named according to a nomenclatural scheme that has been applied to the bats of Papua New Guinea in numerous publications and consultancy reports—these call types allow comparisons across studies and retrospective re-identification (see Armstrong 2017). Identifications were checked against known distributions from the IUCN Red List ([www.iucnredlist.org](http://www.iucnredlist.org)).

## 4.0 Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was supplied and set up by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general location of the project area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While identifications have been made to the best of our ability given the available materials, and Specialised Zoological reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.
9. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

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**Table 1.** Summary of species identified from all sites combined.

| Scientific name                    | Common name               | Call type  |
|------------------------------------|---------------------------|------------|
| <b>EMBALLONURIDAE</b>              | <b>Sheath-tailed bats</b> |            |
| <i>Mosia nigrescens</i>            | Lesser Sheath-tailed Bat  | 65 i.fFM.d |
| <b>HIPPOSIDERIDAE</b>              | <b>Leaf-nosed bats</b>    |            |
| <i>Aselliscus tricuspidatus</i>    | Trident Leaf-nosed Bat    | 112 sCF    |
| <i>Hipposideros cervinus</i>       | Fawn Leaf-nosed Bat       | 140 sCF    |
| <i>Hipposideros corynophyllus</i>  | Telefomin Leaf-nosed Bat  | 75 mCF     |
| <i>Hipposideros diadema</i>        | Diadem Leaf-nosed Bat     | 58 mCF     |
| <i>Doryrhina muscinus</i>          | Fly River Leaf-nosed Bat  | 88 mCF     |
| <b>MINIOPTERIDAE</b>               | <b>Bent-winged bats</b>   |            |
| <i>Miniopterus tristis grandis</i> | Great Bent-winged Bat     | 38 st.cFM  |
| <b>VESPERTILIONIDAE</b>            | <b>Evening bats</b>       |            |
| <i>Pipistrellus papuanus</i>       | Papuan Pipistrelle        | 50 st.cFM  |

**Table 2.** Species identifications from all recording nights at all sites [see *Table 1* for full species names].

|                     |           |                | <i>Aselliscus tricuspidatus</i> | <i>Hipposideros cervinus</i> | <i>Hipposideros corynophyllus</i> | <i>Hipposideros diadema</i> | <i>Doryrhina muscinus</i> | <i>Miniopterus tristis grandis</i> | <i>Mosia nigrescens</i> | <i>Pipistrellus papuanus</i> |
|---------------------|-----------|----------------|---------------------------------|------------------------------|-----------------------------------|-----------------------------|---------------------------|------------------------------------|-------------------------|------------------------------|
| <b>Swift 642029</b> |           |                |                                 |                              |                                   |                             |                           |                                    |                         |                              |
| 9/08/2025           | -5.718935 | 141.08794<br>2 | X                               | X                            | .                                 | X                           | .                         | .                                  | X                       | .                            |
| 11/08/2025          | -5.718173 | 141.08521<br>5 | X                               | .                            | X                                 | X                           | X                         | .                                  | X                       | X                            |
| 13/08/2025          | -5.722898 | 141.07334<br>8 | .                               | .                            | .                                 | X                           | X                         | .                                  | X                       | .                            |
| 14/08/2025          | -5.722240 | 141.07431<br>5 | .                               | .                            | .                                 | .                           | .                         | .                                  | X                       | .                            |
| 15/08/2025          | -5.724930 | 141.07461<br>2 | .                               | .                            | .                                 | .                           | .                         | .                                  | .                       | .                            |
| 16/08/2025          | -5.724933 | 141.07281<br>3 | X                               | X                            | .                                 | .                           | .                         | .                                  | .                       | .                            |
| 17/08/2025          | -5.725622 | 141.07195<br>8 | .                               | .                            | .                                 | .                           | .                         | .                                  | .                       | .                            |
| 18/08/2025          | -5.725785 | 141.07117<br>3 | .                               | X                            | .                                 | .                           | .                         | .                                  | .                       | .                            |
| 19/08/2025          | -5.721578 | 141.07129<br>3 | .                               | .                            | .                                 | .                           | .                         | .                                  | .                       | .                            |
| <b>Swift 728814</b> |           |                |                                 |                              |                                   |                             |                           |                                    |                         |                              |
| 9/08/2025           | -5.718882 | 141.08840<br>2 | .                               | .                            | .                                 | X                           | .                         | .                                  | .                       | .                            |
| 10/08/2025          | -5.718543 | 141.08648<br>8 | .                               | .                            | .                                 | X                           | .                         | .                                  | X                       | .                            |

|            |           |                | <i>Aselliscus tricuspidatus</i> | <i>Hipposideros cervinus</i> | <i>Hipposideros corynophyllus</i> | <i>Hipposideros diadema</i> | <i>Doryrhina muscinus</i> | <i>Miniopterus tristis grandis</i> | <i>Mosia nigrescens</i> | <i>Pipistrellus papuanus</i> |
|------------|-----------|----------------|---------------------------------|------------------------------|-----------------------------------|-----------------------------|---------------------------|------------------------------------|-------------------------|------------------------------|
| 11/08/2025 | -5.718767 | 141.08603<br>3 | X                               | .                            | X                                 | X                           | .                         | .                                  | X                       | X                            |
| 13/08/2025 | -5.722090 | 141.07296<br>7 | X                               | .                            | .                                 | X                           | .                         | .                                  | X                       | X                            |
| 14/08/2025 | -5.722488 | 141.07457<br>8 | X                               | .                            | .                                 | X                           | X                         | X                                  | X                       | .                            |
| 15/08/2025 | -5.723197 | 141.07382<br>5 | X                               | .                            | .                                 | .                           | X                         | X                                  | X                       | X                            |
| 16/08/2025 | -5.724153 | 141.07256<br>0 | .                               | .                            | .                                 | X                           | .                         | .                                  | X                       | X                            |
| 17/08/2025 | -5.725402 | 141.07079<br>2 | .                               | X                            | .                                 | .                           | .                         | X                                  | X                       | X                            |
| 18/08/2025 | -5.725650 | 141.07097<br>5 | .                               | .                            | .                                 | .                           | .                         | X                                  | X                       | .                            |
| 19/08/2025 | -5.721490 | 141.07129<br>5 | X                               | .                            | X                                 | X                           | X                         | .                                  | X                       | .                            |

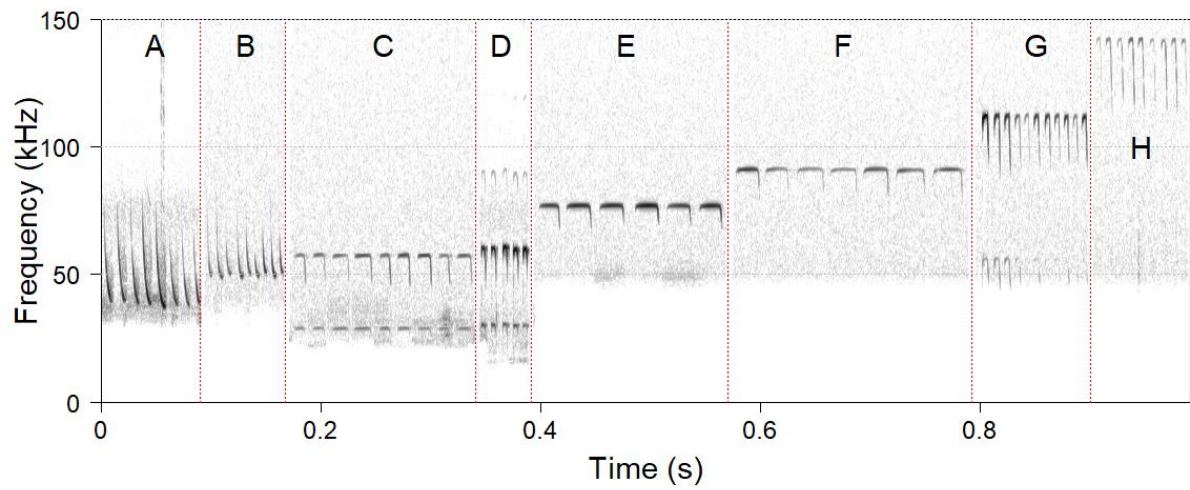


**Figure 1.** Representative echolocation call sequences of species recognised from the recordings (time between pulses has been compressed; **A:** 38 st.cFM *Miniopterus tristis grandis*; **B:** 50 st.cFM *Pipistrellus papuanus*; **C:** 58 mCF *Hipposideros diadema*; **D:** 65 i.fFM.d *Mosia nigrescens*; **E:** 75 mCF *Hipposideros corynophyllus*; **F:** 88 mCF *Doryrhina muscinus*; **G:** 112 sCF *Aselliscus tricuspidatus*; **H:** 140 sCF *Hipposideros cervinus*).

**10.3. Appendix 3. Survey 2 bat calls analysis and summary report by Specialised Zoological.**



**Acoustic analysis and bat  
call identification  
from Ok Birim, Papua New Guinea**

Prepared for **Ecomate Management Ltd**

Version **13 March 2026**

SZ project reference **SZ781**



**Specialised Zoological** ABN 92  
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This report should be included as an appendix in any larger submission to Government, and cited as: Specialised Zoological (2026). Acoustic analysis and bat call identification from Ok Birim, Papua New Guinea: December 2025. Unpublished report by Specialised Zoological for Ecomate Management Ltd, version 2026-03-13, project reference SZ781.

### Version history

| Version    | Note          |
|------------|---------------|
| 2026-03-13 | Final version |
|            |               |
|            |               |
|            |               |

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## 1.0 Summary

Bat identifications from bat detector sound files are provided from recordings made from Ok Birim, c. 50 km south of Tabubil, Western Province, Papua New Guinea.

The December 2025 dataset submitted for analysis included a total of 122,440 bat detector sound files from 16 sites and over 16 recording nights.

The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics.

Sixteen species of bat were identified as being present, (**Tables 1** and **2**). Representative echolocation calls for each identification are illustrated (**Figure 1A and 1B**). Further information can be provided for verification. This builds further on the species list from Specialised Zoological (2025).

## 2.0 Comments on identifications

Most echolocation call types could be identified and associated with one bat species.

The taxonomy of the Miniopteridae in Papua New Guinea, and indeed across Indo-Australasia, is still to be resolved fully, and the name applied here to the call type of a large species of bent-winged bat is based on the unpublished work of Wiantoro (2020).

The call type *88 mCF* has been attributed to the Fly River Leaf-nosed Bat *Hipposideros muscinus*, but Wollaston's Leaf-nosed Bat *Hipposideros wollastoni* is also a candidate.

### 3.0 Methods

The ultrasonic recordings provided were recorded in WAV format with Titley Scientific Anabat Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (SCAN'R parameters) from each putative bat pulse. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language application that performed three tasks:

1. undertook a Discriminant Function Analysis on training data from representative calls from Papua New Guinea;
2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over data ellipses representing one standard deviation of the variation for the defined call types; and
3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition version 25.0.

Species were identified based on information in Armstrong and Aplin (2011, 2014), Leary and Pennay (2011), Robson et al. (2012), and Armstrong et al. (2015 a,b, 2022). Call types are named according to a nomenclatural scheme that has been applied to the bats of Papua New Guinea in numerous publications and consultancy reports—these call types allow comparisons across studies and retrospective re-identification (see Armstrong 2017). Identifications were checked against known distributions from the IUCN Red List ([www.iucnredlist.org](http://www.iucnredlist.org)).

## 4.0 Limitations

The identifications presented in this report have been made within the following context:

4. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
5. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
6. In the case of the present report, the recording equipment was supplied and set up by Specialised Zoological. The equipment was operated by the third party during the survey.
7. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
8. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
9. While identifications have been made to the best of our ability given the available materials, and Specialised Zoological reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
10. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
11. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.
12. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

## 5.0 References

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**Table 1.** Summary of species identified from all sites combined.

| Scientific name                     | Common name                       | Call type  |
|-------------------------------------|-----------------------------------|------------|
| <b>EMBALLONURIDAE</b>               | <b>Sheath-tailed bats</b>         |            |
| <i>Emballonura diana</i>            | Large-eared Sheath-tailed Bat     | 35 i.fFM.d |
| <i>Emballonura furax</i>            | New Guinea Sheath-tailed Bat      | 50 i.fFM.d |
| <i>Emballonura raffrayana</i>       | Raffray's Sheath-tailed Bat       | 45 i.fFM.d |
| <i>Mosia nigrescens</i>             | Lesser Sheath-tailed Bat          | 65 i.fFM.d |
| <b>HIPPOSIDERIDAE</b>               | <b>Leaf-nosed bats</b>            |            |
| <i>Aselliscus tricuspidatus</i>     | Trident Leaf-nosed Bat            | 120 sCF    |
| <i>Hipposideros cervinus</i>        | Fawn Leaf-nosed Bat               | 140 sCF    |
| <i>Hipposideros diadema</i>         | Diadem Leaf-nosed Bat             | 58 mCF     |
| <i>Hipposideros maggietaaylorae</i> | Maggie Taylor's leaf-nosed bat    | 125 mCF    |
| <i>Hipposideros muscinus</i>        | Fly River Leaf-nosed Bat          | 88 mCF     |
| <b>RHINOLOPHIDAE</b>                | <b>Horseshoe bats</b>             |            |
| <i>Rhinolophus euryotis</i>         | New Guinea Horseshoe Bat          | 55 ICF     |
| <i>Rhinolophus mcintyre</i>         | McIntyre's Horseshoe Bat          | 70 ICF     |
| <i>Rhinolophus philippinensis</i>   | Large-eared Horseshoe Bat         | 44 ICF     |
| <i>Rhinolophus robertsi</i>         | Greater Large-eared Horseshoe Bat | 33 ICF     |
| <b>MINIOPTERIDAE</b>                | <b>Bent-winged bats</b>           |            |
| <i>Miniopterus australis</i>        | Little Bent-winged Bat            | 53 st.cFM  |
| <i>Miniopterus tristis grandis</i>  | Great Bent-winged Bat             | 38 st.cFM  |
| <b>VESPERTILIONIDAE</b>             | <b>Evening bats</b>               |            |
| <i>Pipistrellus papuanus</i>        | Papuan Pipistrelle                | 50 st.cFM  |

**Table 2.** Species identifications from all recording nights at all sites [see *Table 1* for full species names].

|              |           |            | EMBALLONURIDAE | <i>Emballonura dianae</i> | <i>Emballonura furax</i> | <i>Emballonura raffrayana</i> | <i>Mosia nigrescens</i> | HIPPOSIDERIDAE | <i>Aselliscus tricuspidatus</i> | <i>Hipposideros cervinus</i> | <i>Hipposideros diadema</i> | <i>Hipposideros maggetaylorae</i> | <i>Hipposideros muscinus</i> | RHINOLOPHIDAE | <i>Rhinolophus euryotis</i> | <i>Rhinolophus mcintyre</i> | <i>Rhinolophus philippinensis</i> | <i>Rhinolophus robertsl</i> | VESPERTILIONIDAE | <i>Pipistrellus papuanus</i> | MINIOPTERIDAE | <i>Miniopterus australis</i> | <i>Miniopterus tristis grandis</i> |
|--------------|-----------|------------|----------------|---------------------------|--------------------------|-------------------------------|-------------------------|----------------|---------------------------------|------------------------------|-----------------------------|-----------------------------------|------------------------------|---------------|-----------------------------|-----------------------------|-----------------------------------|-----------------------------|------------------|------------------------------|---------------|------------------------------|------------------------------------|
| Swift 728815 |           |            |                |                           |                          |                               |                         |                |                                 |                              |                             |                                   |                              |               |                             |                             |                                   |                             |                  |                              |               |                              |                                    |
| 28/11/2025   | -5.531255 | 141.178128 |                | .                         | .                        | .                             | .                       |                | X                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | X                                 | .                           |                  | .                            |               | X                            | .                                  |
| 29/11/2025   | -5.52919  | 141.176412 |                | .                         | .                        | .                             | .                       |                | X                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | .                                 | .                           |                  | .                            |               | X                            | .                                  |
| 30/11/2025   | -5.529228 | 141.177153 |                | .                         | .                        | .                             | X                       |                | X                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | X                                 | .                           |                  | .                            |               | .                            | .                                  |
| 5/12/2025    | -5.387957 | 141.181817 |                | X                         | .                        | X                             | X                       |                | .                               | .                            | .                           | X                                 | .                            |               | X                           | X                           | .                                 | X                           |                  | X                            |               | .                            | .                                  |
| 6/12/2025    | -5.389992 | 141.179935 |                | .                         | .                        | .                             | .                       |                | .                               | .                            | .                           | .                                 | .                            |               | .                           | .                           | .                                 | X                           |                  | .                            |               | .                            | .                                  |
| 7/12/2025    | -5.389253 | 141.180853 |                | X                         | .                        | .                             | X                       |                | .                               | .                            | .                           | X                                 | .                            |               | X                           | X                           | .                                 | X                           |                  | .                            |               | .                            | X                                  |
| 8/12/2025    | -5.388188 | 141.181353 |                | .                         | .                        | X                             | .                       |                | X                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | X                                 | X                           |                  | .                            |               | .                            | .                                  |
| 9/12/2025    | -5.393552 | 141.180385 |                | .                         | .                        | .                             | X                       |                | X                               | .                            | X                           | .                                 | X                            |               | X                           | X                           | .                                 | X                           |                  | .                            |               | .                            | .                                  |
| Swift 728820 |           |            |                |                           |                          |                               |                         |                |                                 |                              |                             |                                   |                              |               |                             |                             |                                   |                             |                  |                              |               |                              |                                    |
| 28/11/2025   | -5.531448 | 141.178098 |                | .                         | .                        | .                             | X                       |                | X                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | X                                 | X                           |                  | .                            |               | X                            | .                                  |
| 29/11/2025   | -5.530595 | 141.177845 |                | .                         | .                        | .                             | X                       |                | X                               | .                            | .                           | X                                 | .                            |               | X                           | X                           | X                                 | .                           |                  | .                            |               | .                            | .                                  |
| 30/11/2025   | -5.530292 | 141.177292 |                | .                         | .                        | .                             | X                       |                | X                               | .                            | .                           | .                                 | .                            |               | X                           | X                           | X                                 | X                           |                  | .                            |               | .                            | .                                  |
| 5/12/2025    | -5.387552 | 141.183277 |                | .                         | X                        | .                             | .                       |                | .                               | .                            | X                           | .                                 | X                            |               | .                           | X                           | .                                 | X                           |                  | .                            |               | .                            | .                                  |
| 6/12/2025    | -5.390288 | 141.179802 |                | X                         | .                        | .                             | X                       |                | .                               | X                            | X                           | X                                 | .                            |               | X                           | X                           | X                                 | X                           |                  | X                            |               | X                            | .                                  |
| 7/12/2025    | -5.389442 | 141.180855 |                | X                         | .                        | .                             | X                       |                | X                               | X                            | .                           | .                                 | .                            |               | X                           | X                           | .                                 | X                           |                  | .                            |               | .                            | .                                  |
| 8/12/2025    | -5.388217 | 141.181692 |                | X                         | X                        | .                             | X                       |                | .                               | .                            | X                           | .                                 | .                            |               | X                           | X                           | .                                 | X                           |                  | .                            |               | .                            | X                                  |
| 9/12/2025    | -5.392572 | 141.180173 |                | .                         | X                        | .                             | X                       |                | .                               | .                            | .                           | .                                 | X                            |               | .                           | X                           | .                                 | .                           |                  | .                            |               | .                            | .                                  |

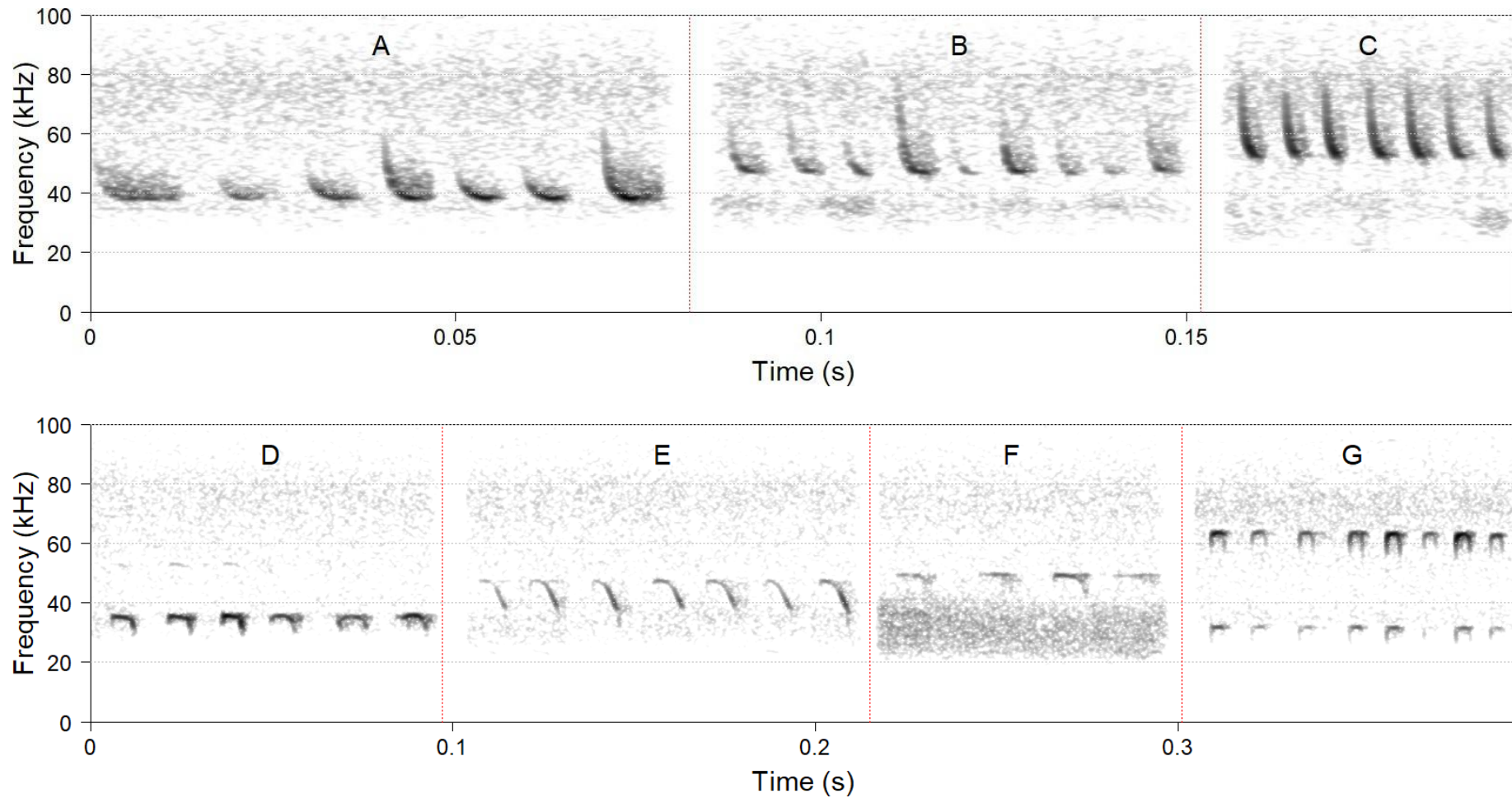


**Figure 1A.** Representative echolocation call sequences of species recognised from the recordings (time between pulses has been compressed; **A:** 38 st.cFM *Miniopterus tristis grandis*; **B:** 50 st.cFM *Pipistrellus papuanus*; **C:** 53 st.cFM *Miniopterus australis*; **D:** 35 i.fFM.d *Emballonura diana*; **E:** 45 i.fFM.d *Emballonura raffrayana*; **F:** 50 i.fFM.d *Emballonura furax*; **G:** 65 i.fFM.d *Mosia nigrescens*).

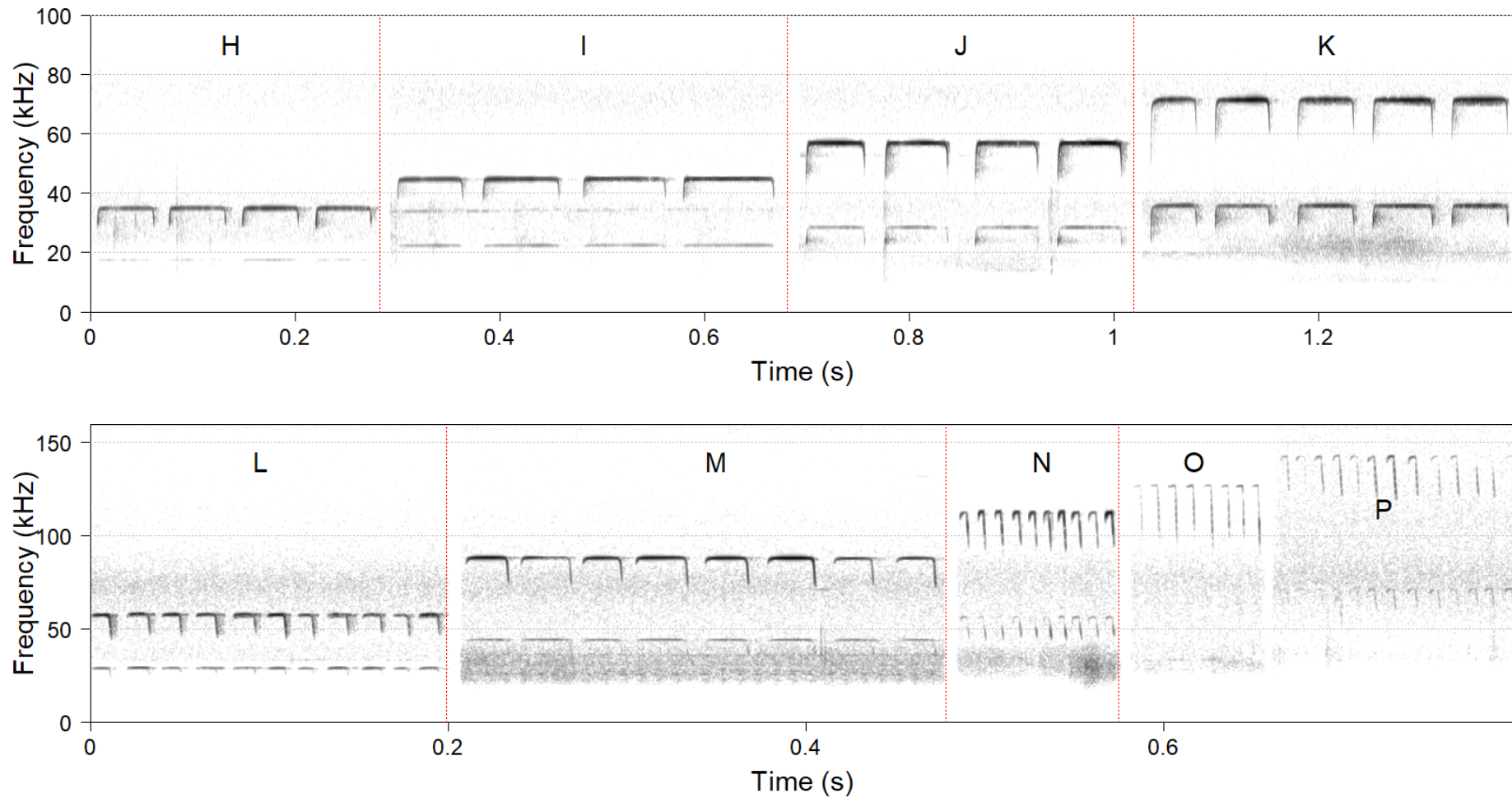


**Figure 1B.** Representative echolocation call sequences of species recognised from the recordings—*continued* (time between pulses has been compressed; **H**: 33 ICF *Rhinolophus robertsi*; **I**: 44 ICF *Rhinolophus philippinensis*; **J**: 55 ICF *Rhinolophus euryotis*; **K**: 70 ICF *Rhinolophus mcintyre*; **L**: 58 mCF *Hipposideros diadema*; **M**: 88 mCF *Hipposideros muscinus*; **N**: 112 sCF *Aselliscus tricuspidatus*; **O**: 125 sCF *Hipposideros maggieta*; **P**: 140 sCF *Hipposideros cervinus*).