An assessment of the lizard fauna on the site of the proposed Vale Nouvelle-Calédonie KO4 Quarry no.4.

Cygnet Surveys & Consultancy

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1. INTRODUCTION

Cygnet Surveys and Consultancy (CSC) were contracted by Vale Nouvelle-Calédonie (VN-C) to provide an expert assessment of the lizard fauna likely to occur within the areas of the proposed development of the KO4 Quarry no.4, and identify the potential occurrence of sensitive species or habitat of conservation significance for lizards on these areas.

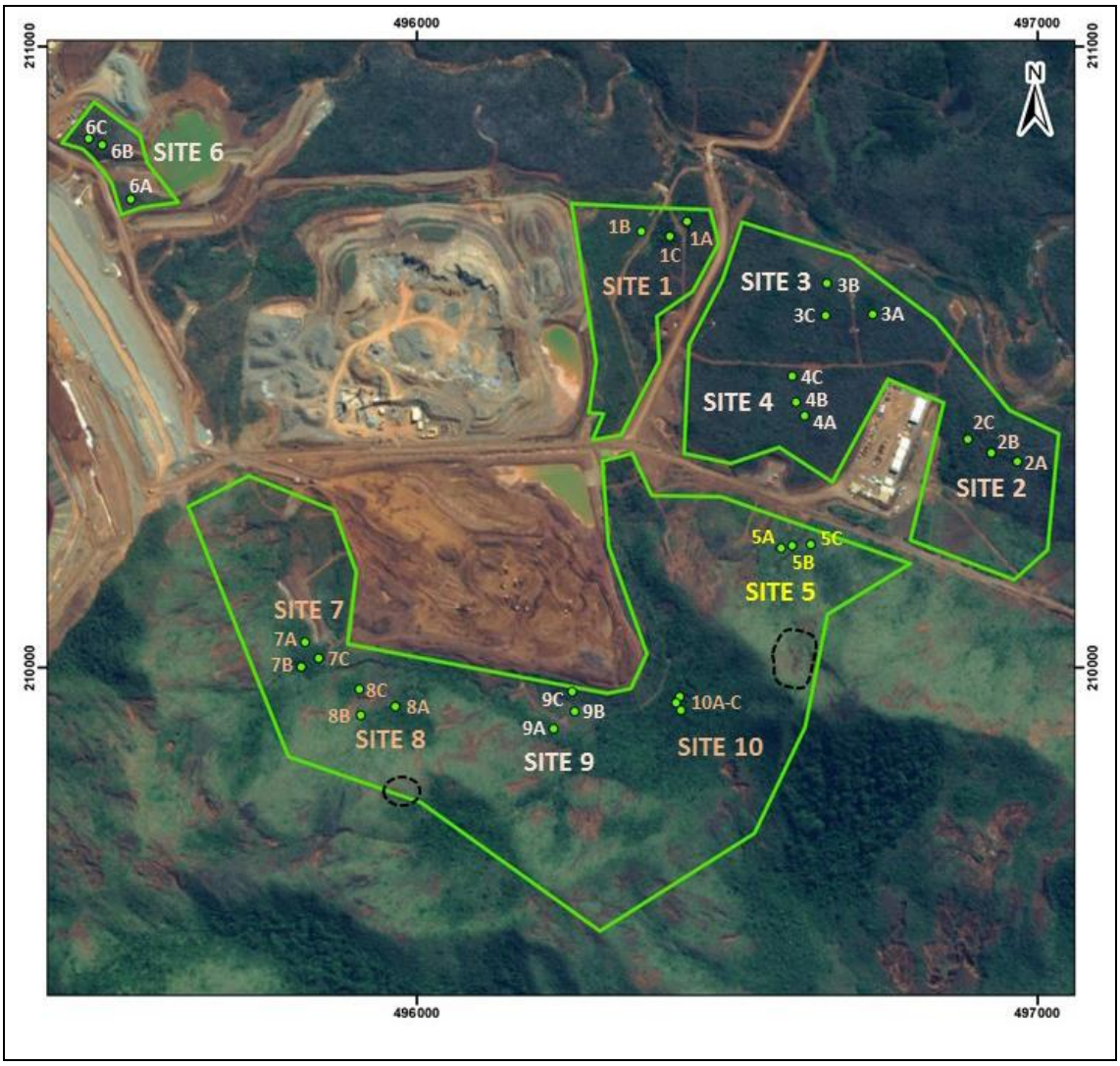
A number of studies have been commissioned by VN-C to investigate the lizard fauna of the Goro Plateau. The nature of these studies has been to establish monitoring sites for lizards (Sadlier & Swan, 2008), to inventory the lizard fauna in the areas of mine development (Sadlier & Swan, 2009a; Sadlier & Swan, 2010a; Sadlier *et al*., 2011a) including the proposed development of the KO4 sediment storage facility (Sadlier *et al*., 2014d, 2014e, 2015), and to inventory the lizard fauna of proposed areas for preservation (Sadlier & Swan, 2009b and Sadlier *et al*., 2011d). In addition a number of baseline inventory studies have been commissioned to assess the lizard fauna of concessions held by VN-C across the Grand Sud (Sadlier & Swan, 2010b & 2010c; Sadlier *et al*., 2011b, 2011c, 2012, 2013a, 2013b, 2013c, 2014a, 2014b, 2014c).

These studies in combination have identified a rich and diverse lizard fauna of ~25 species on the Goro Plateau and adjacent areas of the Grand Sud. Included are a number of **significant species** which have been identified as of particular conservation concern by virtue having one or more aspects of their biology (habitat preferences, diet, home range, etc.) specialized, and which in combination with their extent of occurrence influences the ability of these species to persist into the future. The richest habitat is humid forest from which 20 species have been recorded, including three species of giant gecko formerly in the genus *Rhacodactylus*, one of which is endemic to the Grand Sud. Tall maquis preforest also has a rich lizard fauna, with up to 14 species recorded from this habitat type, whereas open maquis arbustif or herbaceous maquis typically have a low diversity of species and low abundance. As a result of these studies humid forest and maquis forest have been identified as **significant habitats** for lizards in the region.

This study focuses on areas associated with the development of the KO4 Quarry no.4.

2. STUDY SITES

Ten sites in total were established within the area of development associated with the proposed KO4 Quarry no.4. Four sites were established in the period 15th – 17th October 2014 and six sites in the period 5th – 9th January 2015. A total of 285 trap stations were operational across the study area over the two survey periods.



Sites surveyed in the area of the proposed KO4 Quarry no.4 in October 2014 and January 2015.

- **Green line represents the boundaries of proposed quarry developments.**
- **Individual sites marked with green circles.**
- **Approximate position of peridotite outcropping identified as potential habitat for the threatened skink *Lacertoides pardalis* marked with broken black outline.**
- **Color of site labels correspond to the broad vegetation type (type_n1) - see site habitats below.**

Site	Co-ordinates		Habitat (type_n1)	(type_n2)
Site 1	Transect A Transect B Transect C	-22.30377S x 166.93591E -22.30392S x 166.93521E -22.30399S x 166.93565E	Maquis dense sur sol ferralitique Maquis des sols hydromorphie temporaire Maquis dense sur sol ferralitique	J E J
Site 2	Transect A Transect B Transect C	-22.30723S x 166.94110E -22.30711S x 166.94069E -22.30691S x 166.94032E	Maquis semi ouvert sur sol ferratlitique cuirasse Maquis semi ouvert sur sol ferratlitique cuirasse Maquis semi ouvert sur sol ferratlitique cuirasse	I I I
Site 3	Transect A Transect B Transect C	-22.30466S x 166.93810E -22.30511S x 166.93883E -22.30513S x 166.93808E	Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse	H H H
Site 4	Transect A Transect B Transect C	-22.30659S x 166.93777E -22.30639S x 166.93764E -22.30601S x 166.93758E	Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse	H H H
Site 5	Transect A Transect B Transect C	-22.30850S x 166.93742E -22.30847S x 166.93758E -22.30845S x 166.93787E	Maquis ligno-herbace - semi ouvert Maquis ligno-herbace - semi ouvert Maquis ligno-herbace - semi ouvert	U U U
Site 6	Transect A Transect B Transect C	-22.30350S x 166.92722E -22.30271S x 166.92677E -22.30261S x 166.92656E	Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse Maquis ouvert sur sol ferratique cuirasse	H H H
Site 7	Transect A Transect B Transect C	-22.30992S x 166.92999E -22.31027S x 166.92993E -22.31015S x 166.93019E	Maquis dense sur sol ferralitique Maquis dense sur sol ferralitique Maquis dense sur sol ferralitique	J J J
Site 8	Transect A Transect B Transect C	-22.31085S x 166.93140E -22.31097S x 166.93086E -22.31059S x 166.93083E	Maquis dense sur sol ferralitique Maquis ouvert sur sol ferralitique Maquis dense sur sol ferralitique	J H J
Site 9	Transect A Transect B Transect C	-22.31115S x 166.93387E -22.31090S x 166.93420E -22.31062S x 166.93417E	Maquis dense sur sol ferratique Maquis ouvert sur sol ferratique Maquis ouvert sur sol ferratique cuirasse	J H H
Site 10	Transect A Transect B Transect C	-22.31067S x 166.93584E -22.31077S x 166.93578E -22.31087S x 166.93568E	Maquis dense sur sol ferralitique Maquis dense sur sol ferralitique Maquis dense sur sol ferralitique	J J J

Note: 'Habitat' corresponds to the broad vegetation types (type_n1), and the code for the finer level of vegetation type (type_n2) as determined in field during the course of the surveys.

The representation of vegetation type covered by the 10 sites surveyed was open (33.4%) to semi-open maquis on cuirasse (10.0%), dense maquis on ferralitique soils (36.7%), open maquis on ferralitique soils (6.6%), semi-open ligno-herbaceous maquis at the base of the range (10%), and maquis on hydromorphic soils (3.3%). There are no forest areas of significance within the boundaries of the areas of development for the KO4 Quarry no.4.

Dense maquis with a sedge groundcover – site 1C.

Hydromorphic maquis of dense sedges – site 1B.

Maquis semi-ouvert on cuirasse – site 2A.

Maquis ouvert on cuirasse – site 3C.

Maquis ouvert on cuirasse – site 4B.

Sites 1A & 1C were located in an area of dense maquis with a dense sedge groundcover on soil near a drainage line of the Kwé River. Adjacent to these sites was an area of hydromorphic maquis (sedge) that had previously been burnt (site 1B). Sites 2, 3 and 4 were located on a low rise with an extensive cuirasse cap. These sites were in open to semi-open maquis, with a sparse and scattered ground cover. Site 6 was also in a small area of semi-open maquis on cuirasse with sparse and scattered ground cover located near the base of the KWRSF sediment storage facility.

Site 5 was located semi-open ligno-herbaceous maquis on the lower slopes of the range adjacent to main access road, and sites 7, 8, 9 and 10 in semi-open to dense maquis at the base and lower slopes of the range.

Overview of the range between sites 7 and 9 – note areas of dense maquis in gullies on the lower slopes of the range with intervening areas of open maquis, and widespread open to semi-open maquis on the mid to upper slopes.

Dense maquis in gullies on the lower slopes of the range (site 8A) adjacent to open maquis (site 8B) in foreground – note isolated peridotite outcrops on upper slopes of the range.

Overview of site 9 showing areas of dense maquis in gullies on the lower slopes of the range.

The area of dense maquis at site 10 graded into transitional paraforest towards the base of the range, but lacked large trees.

Dense maquis with a dense sedge understory (above) at site 10 grading to transitional tall maquis/paraforest (right) towards the base of the range.

Outcropping peridotite on the mid slopes of the range in the vicinity of site 5 (below).

Isolated areas of outcropping peridotite surrounded by low but dense ligno-herbaceous maquis were identified on the mid slopes of the range in the vicinity of site 5 and site 8.

3. METHODS

Survey sites at each area were selected according to the following criteria:

- to encompass the full range of habitats so as to assess the species diversity of the study area as completely as possible.
- to target specific habitats in which lizard species of particular conservation concern might occur.
- to obtain an estimate of the number of individuals of each species likely to be affected by the proposed development activities.

Previous studies to assess the diversity and abundance of lizard species in forest and maquis habitats in the Grand Sud have shown that strategically placed glue traps are highly effective in detecting the presence of the majority of day active skink species, and particularly effective in detecting the presence of secretive species. It is also the only effective method for detecting the presence of skink species in areas with a dense understory and groundcover. For these reasons this was the primary method used to detect diurnal and secretive skinks in all habitats across the areas surveyed.

The number of sites surveyed reflected the extent and diversity of habitats present, and the logistics with regard to accessibility. Each survey site had three transects, each transect representing a site replicate. At each transect one glue-trap was laid at each of 10 stations (each station 5-8 m. apart) along a transect line (except site 6 where each transect had 5 stations due to the very small area of the site). Glue traps were strategically placed under or next to sheltering sites (crevices and cracks created where outcropping cuirasse boulders contact the ground, under and next to logs), in areas of litter or amongst surface debris, and under vegetation. Areas of outcropping peridotite in the area of the KO4 Quarry no.4 were identified and assessed as to their suitability as habitat for the threatened skink *Lacertoides pardalis*. Records are also kept of lizards encountered opportunistically on transects during the course of checking glue traps.

Geckos are usually the less diverse of the two lizard groups present. Geckos are active at night foraging in low shrubs, small trees, or the forest canopy. By day they shelter in retreat sites in standing vegetation or under cover on the ground. Timed nocturnal searches were undertaken in the first two hours after sunset. These night searches generally consisted of walking along tracks through maquis and forest habitats in the general vicinity of survey sites, or through the forest following transect markers. The method used to search for geckos is by detecting the reflection from the eye when a beam of light is directed towards the lizard, or by scanning vegetation with a powerful light at closer range to observe geckos on twigs or branches. Binoculars modified to carry a torch and emit a light beam from below the

eyepieces of the binocular are used to detect eye reflection. This method readily detects both the larger and smaller geckos, but to be effective it generally requires a minimum search distance of 10-15m., and a co-worker is often required to collect the gecko for positive identification while the first observer keeps the animal in sight from a distance. For this survey timed nocturnal searches were undertaken in the major habitat types present as follows: 1.5 person hours in dense open ligno-herbaceous shrubland and the edge of adjacent dense *Gymnostoma* maquis on cuirasse at site 1, and 1.5 person hours in maquis ligno-herbaceous shrubland adjacent to site 6.

The assessments of diversity of individual areas are based on extensive field and research experience on the New Caledonian lizard fauna by the CSC Principal Investigator and also draw support from the results of previous studies by CSC in the Grand Sud.

Typical placement of glue traps under vegetation in herbaceous maquis.

Typical placement of glue traps in the open (above left) and under a log (above right) in forest habitat.

4. RESULTS

***Species Recorded*:** A diversity of twelve species of lizards was recorded across all sites that included eight species of skinks and three species of endemic gecko, as well as the introduced invasive gecko *Hemidactylus frenatus* (this species was recorded from one site and will not be included further in the assessment of diversity of habitats) within the proposed area of development for the KO4 no.4 Quarry in October 2014 and January 2015.

Species	Sites										
	1	2	3	4	5	6	7	8	9	10	Total
Caledoniscincus austrocaledonicus	5	2	4	3	10	2	-	2	3	-	31
Caledoniscincus notialis	2	-	-	-	-	-	6	9	3	6	26
Cryptoblepharus novocaledonicus	1	5	9	5	-	-	-	-	-	-	20
Lioscincus nigrofasciolatus	-	1	-	-	-	-	-	-	-	-	1
Lioscincus tillieri	-	1	1	-	2	1	-	-	-	-	5
Marmorosphax tricolor	4	-	-	1	1	-	1	1	-	5	13
Sigaloseps deplanchei	1	-	-	-	-	-	3	-	1	5	10
Tropidoscincus variabilis	-	-	-	-	2	-	2	3	-	2	9
Bavayia sauvagii	-	-	-	1	1	-	-	-	-	-	2
Bavayia septuiclavis	-	-	-	-	-	-	-	-	-	1	1
Rhacodactylus auriculatus	-	-	-	3	-	-	-	-	-	-	3
Hemidactylus frenatus	-	-	-	1	-	-	-	-	-	-	1
Total	13	9	14	14	16	3	12	15	7	19	122

Five species of skink and three species of gecko were recorded from open or semi-open maquis on a cuirasse surface (sites 2, 3 and 4), including the generalist skink *Caledoniscincus austrocaledonicus* and the maquis specialist gecko *Rhacodactylus auriculatus* and skink *Lioscincus tillieri*. The 'forest' inhabiting species *Marmorosphax tricolor* was also recorded from open maquis at site 4, albeit from a single individual. Two species, the generalist skink *Caledoniscincus austrocaledonicus* and the maquis specialist skink *Lioscincus tillieri*, were recorded from the isolated area of open maquis on cuirasse at site 6. This area is highly degraded and in close proximity to broader areas of development, and the records obtained were unexpected.

By contrast three species of skink, *Marmorosphax tricolor*, *Caledoniscincus notialis* and *Sigaloseps deplanchei*, typically regarded as a 'forest' inhabiting species, were recorded from the area of dense maquis habitat with a dense sedge understory (sites 1A and 1C). The small skink *Cryptoblepharus novocaledonicus* was recorded from open or semi-open maquis on a cuirasse surface in the north of the study area (sites 2, 3, 4 and part of site 1C). This species typically only occurs at coastal locations and close to the shoreline, but has been recorded from more inland areas on rare occasions. It was previously recoded from the vicinity of sites 1-4 in earlier surveys by Sadlier & Shea (2004).

A moderate diversity of five species of skink and one species of gecko were recorded from dense maquis on ferralitique soils at the base of the range (sites 7, 8 and 10), and three species of skink from open maquis at site 9 in this area. Four of these, the skinks *Marmorosphax tricolor*, *Caledoniscincus notialis*, *Sigaloseps deplanchei* and *Tropidoscincus variabilis*, typically regarded as a 'forest' inhabiting species, were recorded in significantly higher densities from the sites in dense maquis with a dense sedge understory compared to sites in open maquis which typically had a lower and more scattered groundcover of sedges. The difference in diversity between these sites is likely attributed to the presence of a denser groundcover of sedges in dense maquis, which provides a suitably moist microhabitat for these 'forest' species.

Areas of outcropping peridotite rocks in low ligno-herbaceous maquis, potential habitat for the threatened skink *Lacertoides pardalis*, were identified on mid to upper slopes of the range backing the KO4 Quarry no.4 in the vicinity of sites 5 and site 8, but were not specifically targeted for investigation during the survey.

***Significant species*:** no threatened species were recorded from the proposed KO4 Quarry no.4 area of development during the surveys in October 2014 and January 2015.

***Significant sites*:**

Much of the area within the boundaries of the proposed KO4 Quarry no.4 area of development consists of open maquis with scattered patches of dense maquis. Both are habitats that typically have a low diversity of lizard species and no species of particular conservation concern reliant upon them.

Areas of outcropping peridotite rocks on the mid-upper slopes of the range backing the KO4 Quarry no.4 could be potential habitat for the threatened skink *Lacertoides pardalis*, but these outcrops are disjunct and scattered across the range, and in most cases lie in close proximity to the upper limits of the southern boundaries of the proposed area of development.

5. SUMMARY

Most of the proposed KO4 Quarry no.4 area of development is predominately open to semi-open maquis. This habitat typically has a very low diversity of lizard species and no species of conservation significance are dependent upon it. The areas of dense maquis on the proposed area of development occur as small patches, mainly in gullies, and are scattered (not continuous) across the Quarry no.4 area. Dense maquis habitat has a marginally more diverse lizard fauna and it is possible the gecko species *Eurydactylodes symmetricus* and *Bavayia goroensis*, two species of conservation significance, could occur in patches of dense maquis. However, the small size and isolation of most areas of dense maquis indicates they are unlikely to contain substantial populations of these lizard species. The threatened skink *Lacertoides pardalis* has been recorded from near the crest of the ranges on Foret Nord to the west of the area of proposed development for the KO4 Quarry no.4. Scattered areas of outcropping peridotite on the upper slopes and crests of ranges along and adjacent to the southern boundary of the area of development were identified as potential habitat for *Lacertoides pardalis*.

6. KEY POINTS

- no species of particular conservation significance were recorded during the survey of the sites investigated on the proposed area of development for the KO4 Quarry no.4.
- potential habitat for the threatened skink *Lacertoides pardalis* was identified on the upper slopes and crests of ranges along near the southern boundary of the proposed area development for the KO4 Quarry no.4.

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