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**Supplementary Survey Targeting Littlejohn's Tree Frog, a Threatened
Species, in the Metropolitan Coal Underground Mining Area and
Surrounds in the Woronora Catchment**

July 2019

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1 INTRODUCTION

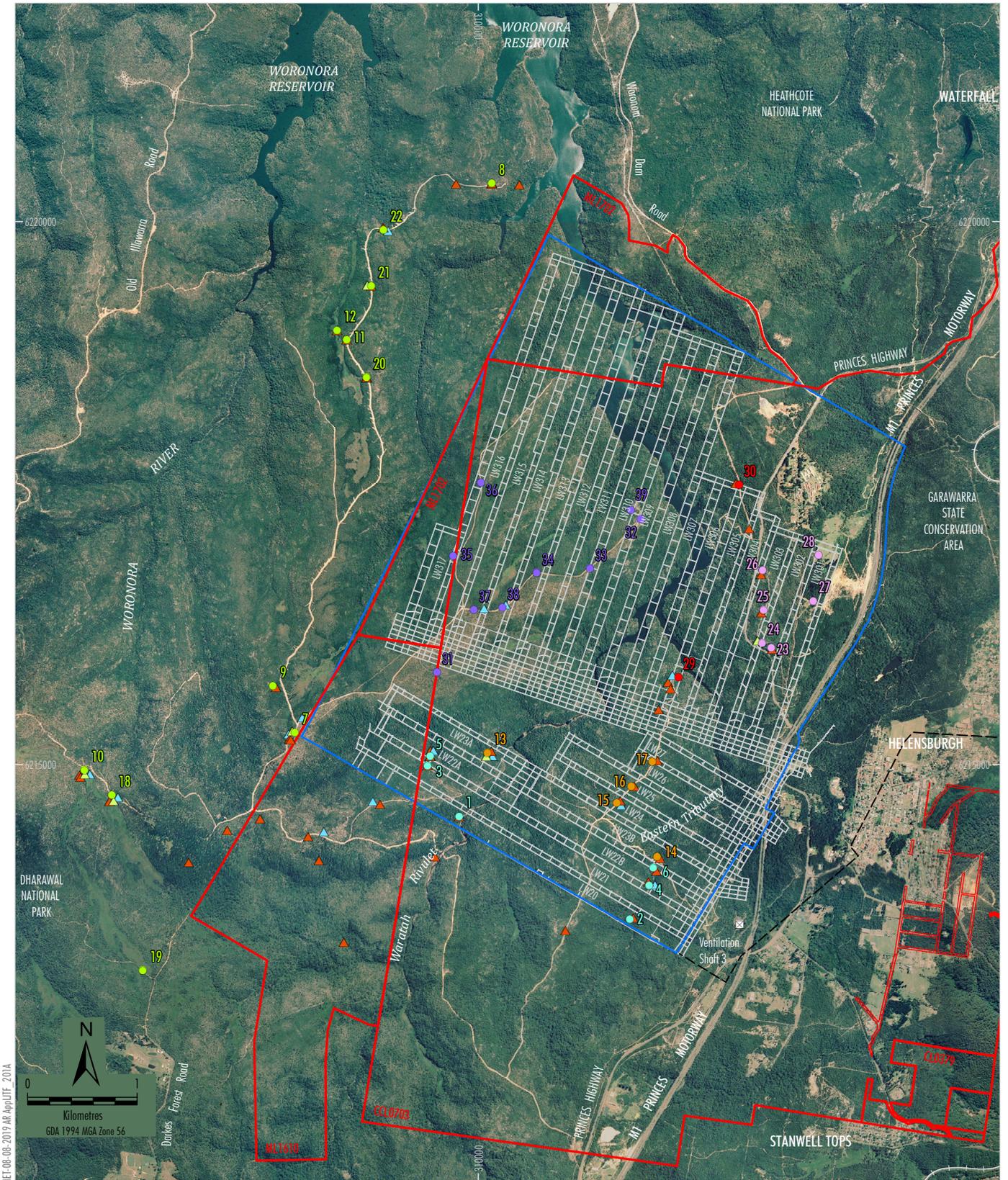
Littlejohn's Tree Frog, *Litoria littlejohni*, is a threatened species first recorded in the spring/summer 2016 amphibian survey in the Metropolitan Coal Underground Mining Area or immediate surrounds during routine yearly surveys (2010-2018) conducted by Cenwest Environmental Services. These yearly surveys are designed to determine any potential impacts of longwall mining on the amphibian assemblage within the mining footprint associated with Longwalls 20-27 and 301- 307.

Littlejohn's Tree Frog was not located in the baseline studies undertaken as part of the Metropolitan Coal Project Environmental Assessment, although the species was known at the time to be present at Darkes Forest located to the south of the Project area. This species was only located by chance when surveys normally carried out in the spring/summer period of each year were pushed forward into late summer – early autumn, due to lack of suitable rainfall in the spring/summer period. Specifically, one adult Littlejohn's Tree Frog was observed at site 24 (Figure 1) over the Longwalls 301-303 area during the spring/summer 2016 survey. No evidence of breeding was observed for this species at this site.

Subsequently, Metropolitan Coal committed to undertaking targeted surveys for this species in August/September 2017 to assess the distribution and abundance of Littlejohn's Tree Frog within the Metropolitan mining footprint on the Woronora Plateau. However, the dry weather conditions experienced in August and September 2017 did not provide suitable weather conditions for the conduct of the targeted survey, and the survey was postponed until October/November 2018 following a suitable rain event. This species is most active and likely to be located by its signature call, in autumn and winter under appropriate rainfall conditions.

The October/November 2018 targeted survey was likely suboptimal for detecting the species by its call, but likely optimal for detecting any successful breeding events via observing larvae in pools and hence determining the approximate time of egg laying. The October/November 2018 targeted survey recorded Littlejohn's Tree Frog at control sites 7 and 18, and at test site 13. A recommendation of the October/November 2018 targeted survey was to undertake one more targeted survey for Littlejohn's Tree Frog in 2019 only under optimal survey conditions in June - July following heavy rainfall (> 50mm over a week) with access to sites preferably whilst it still raining. Widespread rainfall fell across the Woronora Plateau in early July 2019, which provided suitable conditions for the conduct of the survey described in this report.

This survey is the second targeted survey aimed at locating Littlejohn's Tree Frog under suitable conditions in the autumn-winter period.



ME1-08-08-2019 AR ApplUF 201A

- LEGEND**
- Mining Lease Boundary
 - Railway
 - Project Underground Mining Area
Longwalls 20-27 and 301-317
 - Existing Underground Access Drive (Main Drift)

- Monitoring Sites**
- Longwalls 20-22 Amphibian Monitoring
 - Longwalls 23-27 Amphibian Monitoring
 - Longwalls 301-303 Amphibian Monitoring
 - Longwalls 305-307 Amphibian Monitoring
 - Longwalls 308-317 Amphibian Monitoring
 - Control Site
- Threatened Fauna**
- ▲ Giant Burrowing Frog
 - ▲ Littlejohn's Tree Frog
 - ▲ Red-crowned Toadlet

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2019)

Peabody
METROPOLITAN COAL
Amphibian Monitoring Locations

Figure 1

2 METHODOLOGY

A subset of 30 existing sites used to survey Longwalls 20-27 and Longwalls 301-307, and nine new sites (31-39) established for Longwalls 308-317 were utilised in this survey including site 3, sites 5, 7-18, 20-27, sites 29 and 30 and sites 31-39 (Figure 1). Sites 1, 2, 4, 19 and 28 were excluded since there was significant walking/travelling time involved in using them or in the case of site 28, very unlikely to provide habitat suitable for Littlejohn's Tree Frog. Site 6 was excluded because of the presence of drilling equipment being used to remediate a section of Tributary C. Site 14 was judged to be unsafe to visit at night and was only surveyed during the day. Site 1 downstream of the Waratah Rivulet crossing was replaced by a site at the intersection of Fire Trail 9H and the Waratah Rivulet (herein referred to as site WRC). In all, 34 sites were used during this survey (Figure 1). Each site is a notional 1 hectare area with the site tag at the centre of the square and usually situated on a track.

Each site was surveyed during the day to describe its attributes (Table 1 in Section 3). At each site the presence of frog larvae, adults and adults identified by signature calls where present were recorded, together with weather conditions. No call play-backs were carried out during the day for the three threatened species with the potential to be present – the Giant Burrowing Frog, the Red-Crowned Toadlet and Littlejohn's Tree Frog. Based on past survey data, call play backs were unsuccessful in detecting threatened species during daylight hours.

Night surveys commenced about 30 minutes to an hour after sunset. Sites were surveyed in the order identified in Table 3 with six to seven sites being surveyed each night before falling temperatures inhibited frogs from calling. Each site was surveyed for 30 minutes (two surveyors @ 15 minutes each). Over ten years of frog survey data provide evidence demonstrating that over 95% of night frog calls and adult observations occur within 15 minutes of arriving at a site (that is after an equivalent half hour one-person search). On arrival at each site, five minutes were set aside listening for frog calls and searching along the associated track and road edges for adults, and larvae where pools were present. Following this initial listening period, call playbacks for Littlejohn's Tree Frog, followed by call playbacks for the Giant Burrowing Frog and Red-crowned Toadlet, were broadcast near the centre of each sampling site. The calls were recorded on an iPhone and played back via a quality Bluetooth speaker.

3 SURVEY SITES

A brief description of the survey sites, including the status of mining and observed impacts, is provided in Table 1. The approximate survey site locations are shown in Figure 1.

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------------------|----------------------|--------------------------|-----------------------|--|---|
| WRC ¹ | - | N6214183 E309672 | 215 | Around 0.5 – 1 megalitres per day (ML/day) flowing over Waratah Rivulet Crossing at the intersection with Fire Trail 9H. Many rock pools up and downstream. The site chosen instead of downstream site 1 (consistent with the October/November 2018 targeted survey). | Outside mining footprint. |
| 3 | T | N621499 E309538 | 240 | 1st order tributary with road depression, along an ephemeral stream. July 2019: No flow through this first order drainage line with one small pool upstream of the track. Lower pool empty. | Site 3 undermined by Longwall 21. Rehabilitation/erosion control works have made it more difficult to determine if any physical impacts at this site. No visible changes to riparian/valley side vegetation. |
| 5 | T | N6215081 E309562 | 220 | 1st order tributary north of Fire Trail 9C flowing into the Waratah Rivulet. Bedrock creek bed, July 2019: Main pool completely dry. Small rain-filled depressions on the rock platform and a few isolated pools upstream and downstream of the site. No flow in the drainage line. | Site 5 undermined by Longwall 22A. This once permanent pool now appears to be permanently dry. Appears to be permanent loss of flows diverted to subsurface under all flow regimes. Resurfaces near site 13 further downstream. No visible changes to riparian/valley side vegetation. |
| 7 | C | N6215298 E308325 | 327 | Fire Trail 9E, roadside culvert site draining to the first-order stream, with the potential for small ponds of water to be present. Significant site recovery after grader work reported in spring/summer 2012 report. July 2019: No free water present but the area remained damp in the culvert. | Control |
| 8 | C | N6220353 E310125 | 260 | On Fire Trail 9, depression-soak along-track fed on seepage off a series of rock ledges. Significant site recovery following trackwork as reported in spring/summer 2012 report. July 2019: Roadside has been recently slashed and no free water but surrounding soil damp. | Control |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|----------------------|--------------------------|-----------------------|---|---|
| 9 | C | N6215726 E308124 | 300 | Off Fire Trail 9, upper Honeysuckle Creek. Headwater swamp in the upper catchment. Significant site recovery from track work as reported in spring/summer 2012. July 2019: No free water present, damp soil in side drain at 3 centimetres (cm) depth. | Control |
| 10 | C | N6215495 E306402 | 310 | Headwater swamp immediately upstream of intersection of Darkes Forest Road /Old Illawarra Road and Woronora River. July 2019: Very low flow coming from the swamp at around 0.001ML/day. Several downstream rainfed minor pools. | Control |
| 11 | C | N6218912 E308800 | 260 | Fire Trail 9, a roadside culvert that ponds water and drains to Bee Creek Swamp to the west. Significant site recovery from grader work reported in spring/summer 2012. July 2019: No free water present and soils dry, under road drain partially blocked by sand-sediment. | Control |
| 12 | C | N6219000 E308711 | 230 | Bee Creek Swamp north, due west of site 11. Headwater swamp with a discontinuous channel. A permanent pool present about 50 metres (m) NNE of piezo site. July 2019: No free water, piezo area dry. 'Permanent' pool dry, including surface soil | Control |
| 13 | T | N6215108 E310084 | 265 | Creek-line, Tributary B, upstream of the confluence with Waratah Rivulet, with significant in-stream and riparian habitat. At terminal point of unnamed Fire Trail off 9H. July 2019: Good flow of around 0.1 ML/day reappears immediately upstream of site 13. Series of pools within the stream. Water murky, with some oil patches and evidence of Fe-Mn staining. Some iron precipitation. Bankside soil damp. Valley side vegetation in good health. | Site 13 undermined by Longwall 23A. Permanent loss of stream continuity immediately upstream of site 13 with upstream flows diverted to subterranean flows that re-emerge immediately upstream of site 13. Relatively minor Fe staining associated with re-emerging flows. No evidence of changes in riparian or valley side vegetation based on visual cues between site 5 (Longwall 22A) and site 13. |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|-------------------------|--------------------------------|-----------------------------|---|--|
| 14 | T | N6214152 E311635 | 272 | <p>Downstream of Tributary C crossing. In most previous surveys this stream has been running with a well-defined riffle and pool system. Woodland/gully forest vegetation is located on either side of banks. The bed is sandstone with low to nil sediments. Bank width varies from 5-10 m. Overhanging bank vegetation with some sedges present but no ferns or rushes.</p> <p>July 2019: Flow estimated at 0.1 ML/day. Rock pools murky and contained Iron precipitation.</p> | <p>Site 14 undermined by Longwall 23B.</p> <p>Surface flow under low flow conditions has been diverted to subterranean flow along an approximately 2 kilometre (km) stream reach commencing near site 6 (undermined by LW 20) and for a significant distance downstream of site 14.</p> <p>Has resulted in large pools at site 14 drying up under prolonged dry periods, and many other pools along this reach, loss of stream connectivity, with periods of recovery following rainfall-induced freshes and floods.</p> <p>Evidence of significant Fe staining and precipitation under some circumstances.</p> <p>No evidence of changes in riparian or valley side vegetation based on visual cues between site 6 (Longwall 20) and immediately below site 14.</p> |
| 15 | T | N6214650 E311267 | 283 | <p>Ridge-top above Longwall 24 with a roadside soak on fire road 9G. Dense sandstone heath woodland with scattered trees with roadside verges cleared. Drops off on the eastern side to form a first-order stream.</p> <p>July 2019: Under survey conditions, no free water was present, but the soil profile was damp. Roadside verge recently slashed.</p> | <p>Site 15 undermined by Longwall 24.</p> <p>No evidence of surface cracking.</p> <p>No evidence of changes in terrestrial vegetation based on visual cues.</p> |
| 16 | T | N6214800 E311400 | 275 | <p>Roadside soak-line fed from rock platform with intermittent woodland-heath vegetation, on fire road 9G.</p> <p>July 2019: No free water was present, but the soil profile was damp. Verge recently slashed.</p> | <p>Site 16 undermined by Longwall 25.</p> <p>No evidence of surface cracking.</p> <p>No evidence of changes in terrestrial vegetation based on visual cues.</p> |
| 17 | T | N6215031 E311593 | 263 | <p>Part of an upland swamp surrounded by mallee heath. Part of this site was substantially damaged by infrastructure works clearing heath vegetation in late 2012, but significant recovery has occurred along the roadside. On Fire road 9G.</p> <p>July 2019: The site was characterised by damp soil and litter beds with no free water present. Verge recently slashed.</p> | <p>Site 17 undermined by Longwall 26.</p> <p>No evidence of surface cracking.</p> <p>No evidence of changes in terrestrial vegetation based on visual cues.</p> |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|-------------------------|--------------------------|-----------------------|--|--|
| 18 | C | N6214721 E3066653 | 281 | Roadside drainage associated with road gutter, crosses road to potentially form a series of small pools with significant litter. Roadside maintenance since 2016 survey but minor impact on site. July 2019: No pools were present and the surrounding ground was damp. | Control |
| 20 | C | N6218565 E308980 | 227 | Potential extensive roadside soaks on Fire Trail 9 extending along and across the track a distance of 75 m, parallel with Bee Creek. Cleared roadside verge edged by extensive mallee heath. Significant site recovery in habitat quality from 2012 roadside maintenance. July 2019: No free water and soil damp and drying out. | Control |
| 21 | C | N6219407 E309023 | 239 | On Fire Trail 9 - Potential roadside soak extending approximately 100 m along the road with clumps of <i>Juncus</i> sp. present. Significant site recovery in habitat quality from 2012 roadside maintenance. July 2019: Roadside slashed. No free water and soil damp and drying out. | Control |
| 22 | C | N6219927 E309133 | 222 | Source reach of a first-order stream on Fire Trail 9. Cleared roadside verge edged by extensive mallee heath. Significant site recovery in habitat quality from 2012 roadside maintenance. July 2019: No free water, soil damp but drying out. Verge recently slashed. | Control |
| 23 | T | N6216060 E312678 | 270 | A vegetation ecotone centred on a Fire Trail running directly above Longwall 302. A 75cm deep, well-sheltered gutter runs alongside the fire trail parallel with a buried water pipeline. On the northern side of the fire-trail is the southern boundary of an Upland Swamp and to the south of the fire trail is the boundary of a Sandstone Gully Apple Peppermint Forest. July 2019: There was no free water present, but the soil profile was damp. | Site 23 undermined by Longwall 302. The track running parallel with Princes Highway had been upgraded and widened sometime in 2017. This has impacted site 23 to some extent but unlikely to interfere significantly with the outcomes of the amphibian survey. |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|-------------------------|--------------------------------|-----------------------------|---|--|
| 24 | T | N6216105 E312594 | 270 | <p>This site is within a vegetation ecotone, wedged between the boundaries of two vegetation communities, and is directly above Longwall 302. A 75cm deep, well-sheltered gutter runs alongside the fire trail parallel with a buried water pipeline. To the north of the centre of the site is the boundary of the Exposed Sandstone Scribbly Gum Woodland and to the south, the boundary of the Sandstone Gully Apple Peppermint Forest.</p> <p>July 2019: Lower drain dry and upper drain with two small pools. Site moist including road.</p> | <p>Site 24 undermined by Longwall 302.</p> <p>The track running parallel with Princes Highway had been upgraded and widened sometime in 2017. This has impacted site 24 to some extent but is unlikely to interfere significantly with the outcomes of the amphibian survey.</p> |
| 25 | T | N6216409 E312609 | 265 | <p>This site is within a vegetation ecotone, wedged between the boundaries of two vegetation communities, and is directly above Longwall 303. A 75cm deep, well-sheltered gutter runs alongside the fire trail parallel with a buried water pipeline. To the east of the centre of the site is the boundary of an upland swamp with Banksia Thicket dominant. A range of sedge species to 50cm in height was present as dense patches along the fire trail.</p> <p>July 2019: A few shallow pools due to seepage across the road from ridgetop with damp soil present.</p> | <p>Site 25 undermined by LW303</p> <p>The track running parallel with Princes Highway had been upgraded and widened sometime in 2017. This has impacted site 25 to some extent but is unlikely to interfere significantly with the outcomes of the amphibian survey.</p> |
| 26 | T | N6216780 E312650 | 265 | <p>This site is situated along a fire trail wholly within an Upland Swamp Banksia Thicket. This site is directly above Longwall 303. The swamp vegetation is very dense. Along the track are patches of various sedge species.</p> <p>July 2019: There were a few small pools present, and the surrounding soil was damp due to seepage from above the road.</p> | <p>Site 26 undermined by LW303</p> |
| 27 | T | N6216492 E313061 | 300 | <p>This site is located along a fire trail in the northern section of Longwall 301. To the immediate north of the centre of the site, the native vegetation is mainly regenerating Silvertop Ash Ironstone Woodland with dense understorey; to the south, the vegetation is Rock Plate Heath Mallee.</p> <p>July 2019: There was three shallow, muddy pools present drying out.</p> | <p>Site 27 undermined by Longwall 301.</p> |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|----------------------|--------------------------|-----------------------|--|---|
| 29 | T | N6215808 E311833 | 212 | <p>Located on a first order stream running directly into the Woronora River. Immediately upstream is a broken 5 m cliff that facilitates a waterfall. Immediately downstream of the waterfall is a riffle pool system.</p> <p>July 2019: 1st order stream about 1 km from the source immediately below swamp. Consists of the rocky shelf with water flowing at around 0.005ML/day, then flattens out for around 50m with numerous rock pools present on the shelf, before falling away sharply over a lower rock shelf. Surrounded by woodland with a dense understory of shrubs to around 4m with a ground cover of herbs and litter.</p> | <p>Above the pillar between LW305 and 306 and within the angle of draw.</p> <p>Baseline site until undermined.</p> |
| 30 | T | N6217578 E312386 | 258 | <p>July 2019: First order stream 450m below large swamp with water flowing at around 0.025 ML/day, flowing under the formed road via a culvert. Mild slope with a series of stepped pools 1-2 m wide. Surrounded by woodland to 20m and dense understory to 4m, with 3-4cm ground litter.</p> | <p>Just outside the northernmost extent of LW306 and within the angle of draw.</p> <p>Baseline site until undermined.</p> |
| 31 | T | N6215852 E3309626 | 314 | <p>Located on a minor track running east from Track 9E. This site is located on the western edge of a large swamp on a first order tributary. The track is around 5m wide and surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 8m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp. Verge has been recently cut and tends to be dominated by sedges plants that can withstand periods of wet to damp soil.</p> <p>July 2019: No free water was present at the site, but the soil was damp and drying out. Under wetter conditions, pools could form along the roadside.</p> | <p>Mis-located and will be relocated to the northern end of LW308 adjacent to an existing fire road, in the spring/summer amphibian survey.</p> |
| 32 | T | N6217257 E311490 | 264 | <p>Near the terminal point of Fire Trail 9E where the landscape steepens towards the upper reaches of Lake Woronora. Trackside is a sandstone pavement with patches of shallow to deeper soils and surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 8m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp</p> <p>July 2019: Potential for pools to form along the roadside. No free water present and soil patches were damp.</p> | <p>Baseline data available until undermined.</p> <p>Sits above LW 309.</p> |
| 33 | T | N6216807 E311025 | 278 | <p>Locate on Fire Trail 9E. Minor drainage line emanating from the swamp and surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 10m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp to 5m.</p> <p>July 2019: No free water present and surrounding soil damp.</p> | <p>Baseline data available until undermined.</p> <p>Sits above LW 311/within angle of draw.</p> |
| 34 | T | N6216765 E310538 | 287 | <p>Locate on Fire Trail 9E. Minor drainage line emanating from the nearby swamp and surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 10m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp to 5m.</p> <p>July 2019: Roadside verge cut and managed with no free water but soil at site damp.</p> | <p>Baseline data available until undermined.</p> <p>Sits above LW 313</p> |

Table 1: Attributes of Monitoring Sites WRC, 3, 5, 7-18, 20-27, 29-39, during the Targeted Littlejohn's Tree Frog Survey, July 13-18, 2019 (Continued)

| Site | Control (C) Test (T) | Northing Easting (WGS84) | Approx. Elevation (m) | Site Description | Status of Mining and Observed Impacts |
|------|----------------------|--------------------------|-----------------------|---|---|
| 35 | T | N6216921 E309770 | 295 | Site 35 is approximately 100m due west of Fire Trail 9D on the edge of the catchment of a large swamp running parallel with the road. Potential for pools to occur at this site under appropriate rainfall conditions. Surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 10m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp to 5m. July 2019: No free water present but soil at the site was damp. | Baseline data available until undermined. On the eastern edge of LW317 and with the angle of draw. |
| 36 | T | N6217598 E310025 | 281 | Located along Fire Trail 9D. Potential for pools to form at this site under appropriate rainfall conditions. Surrounded by woodland dominated by Whipstick Mallee Ash and Stringybark to 10m with a dense understory of mixed heath shrubs and trees to 5m. The roadside verge is managed and cut and dominated by Juncus spp. July 2019: No free water present but soils damp to very wet. | Baseline data available until undermined. Site is located above the pillar adjacent to LW316 and within the angle of draw. |
| 37 | T | N6216428 E309962 | 305 | Located on Fire Trail 9E. Runoff moves west to east across-track with evidence of sand deposition occurring. Surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 6m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp to 3m. Located on the edge of swamp catchment. Roadside verge managed. July 2019: No free water present but soil at the site was damp. | Baseline data available until undermined. Located above LW315 |
| 38 | T | N6216447 E310222 | 302 | Located on Fire Trail 9E. Runoff moves west to east across track with evidence of sand deposition occurring. Surrounded by woodland dominated by Scribbly Gum, Bloodwood and Stringybark to 6m with a dense understory of mixed heath shrubs and trees including Banksia, Acacia, Hakea and Casuarina spp to 3m. July 2019: No free water present but soil at the site was damp. | Baseline data available until undermined. Over LW314. |
| 39 | T | N6217345 E311396 | 257 | Located at the end of Fire Trail 9E. Site is a sandstone platform with an NW aspect. With bare sandstone interspersed with patches of the soil of varying depth with clumps of low heath to 2m dominated by Banksia, Casuarina, Isopogon, Darwinia and Leptospermum spp. July 2019: Pools of free water. | Baseline data available until undermined. Over LW310 |

¹The Waratah Rivulet Crossing (WRC) site was established for ease of access. Surveyed instead of existing site 1 downstream of the crossing (Figure 1).

4 WEATHER CONDITIONS

The targeted Littlejohn's Tree Frog survey was carried out over 6.5 days and nights in July 2019 (13/7-18/7) (Table 2). Widespread rainfall of around 50mm across the Woronora Plateau in the period 4th – 9th July were deemed to provide appropriate conditions for monitoring the Littlejohn's Tree Frog population above the mining footprint. The weather conditions, sunrise and sunset times and moon phases during the survey period are described in Table 2.

Table 2: Weather Conditions During the Littlejohn's Tree Frog Targeted Survey

| Date | Temperature (°C) ¹ | | Rainfall ² (mm) | Moon rise Moon set | Sunrise Sunset | Comments on Day-time Conditions | Comments on Evening Conditions |
|-----------|-------------------------------|---------|-------------------------------|------------------------------|-------------------|---|--|
| | Maximum | Minimum | | | | | |
| 13/7/2019 | 13.9 | 8.8 | 0 | 1405pm 319am waxing | 659am 1702pm | Cloud free, chill wind, | Cloud free, cold and no breeze |
| 14/7/2019 | 14.9 | 3.6 | 0 | 1448pm 420am waxing | 658am 1703pm | Cloud free, cool to mild, | Cloud free, cold and no breeze |
| 15/7/2019 | 17.1 | 8.3 | 1 | 1536pm 518am waxing | 658am 1704pm | Cloud free, light breeze, cold – mild | Cloud free, light breeze and very cold |
| 16/7/2019 | 19.3 | 7.2 | 0 | 1627pm 612am waxing | 657am 1704pm | Cloud free, cold to mild, light breeze at times | Cloud free, no wind. Very cold |
| 17/7/2019 | 18.4 | 8.3 | 0 | 1720pm 702am Full moon | 657am 1705pm | Cloud free, cold to mild, light breeze at times | Overcast, light breeze and cold |
| 18/7/2019 | 18.6 | 8.3 | 0 | 1816pm 747am waning | 657am 1705pm | Cloud free, cold to mild, light breeze at times | Cloud free, no wind. Very cold |

¹ Data from Bureau of Meteorology (BOM) site Holsworthy (Defence) (Station ID 068263).

² Rainfall data from the Darkes Forest BOM and three Gauges across the mining footprint.

5 RESULTS

5.1 AMPHIBIAN SPECIES RECORDED DURING THE CURRENT SURVEY

Table 3 details the amphibians recorded during the daytime and evening surveys.

5.2 LITTLEJOHN'S TREE FROG CURRENT SURVEY

Four environmental variables are usually required to line up to achieve optimal conditions for amphibian surveys: low to no wind, good rainfall leading up to the survey or during the survey, temperatures above 12-14 degrees C and a late moonrise particularly during the period leading up to a full moon. On this occasion, we were unfortunate to experience a cold front moving across New South Wales after some reasonable rainfall. The cold days and night combined with a wind chill factor made survey conditions very challenging on this occasion.

Littlejohn's Tree Frogs were located only at site 24 (by direct observation of an adult) and at site 32 in response to a call playback, significantly less than expected based on previous surveys.

Table 3: Targeted Littlejohn's Tree Frog 2019 Survey Species Records

| Site Number, (DT) daytime (NT) night time | Date | Amphibian species located on arrival | | Amphibian responses to Littlejohn's Tree Frog Playback calls | Other species responses to Littlejohn's Tree Frog Playback calls |
|--|--|--------------------------------------|--|--|--|
| | | Adult | Tadpole/egg masses | | |
| ¹ WRC DT | 15/7 | 0 | 0 | C signifera L freycinetti | 0 |
| ¹ WRC NT | Not surveyed at night | | | | |
| 3 DT | 16/7 | 0 | 0 | 1 x C signifera | 0 |
| 3 NT | 16/7 | 0 | 0 | 1 x C signifera | 0 |
| 5 DT | 16/7 | 0 | 0 | 0 | 0 |
| 5 NT | 16/7 | 0 | 1 x C signifera 2 x L freycinetti | 0 | 0 |
| 7 DT | 15/7 | 3 x C signifera | 0 | 2 x calls C signifera | 0 |
| 7 NT | 15/7 | 0 | 0 | 0 | 0 |
| 8 DT | 16/7 | 0 | 0 | 0 | 0 |
| 8 NT | 16/7 | 0 | 0 | 0 | 0 |
| 9 DT | 15/7 | 0 | 0 | 0 | 0 |
| 9 NT | 15/7 | 0 | 0 | 0 | 0 |
| 10 DT | 15/7 | 0 | 1 x C. signifera; 3 x L citropa | 0 | 0 |
| 10 NT | 15/7 | 0 | 1 x H. australiacus 2 x L freycinett 1 x L citropa | 0 | 0 |
| 11 DT | 15/7 | 0 | 0 | 0 | 0 |
| 11 NT | 15/7 | 0 | 0 | 0 | 0 |
| 12 DT | 16/7 | 0 | 0 | 0 | 0 |
| 12 NT | 16/7 | 2 x C signifera | 0 | 1 x C signifera | 0 |
| 13 DT | 16/7 | 5 x C signifera | 0 | 2-5 x C signifera | 0 |
| 13 NT | 16/7 | 1 x C signifera | 0 | 2 x C signifera | 0 |
| 14 DT | 18/7 | 0 | 0 | 2 x C signifera | 0 |
| 14 NT | Not surveyed at night due to safety concerns | | | | |
| 15 DT | 18/7 | 0 | 0 | 0 | 0 |
| 15 NT | 19/7 | 0 | 0 | 0 | 0 |
| 16 DT | 18/7 | 0 | 0 | 0 | 0 |
| 16 NT | 19/7 | 0 | 0 | 0 | 0 |
| 17 DT | 18/7 | 0 | 0 | 0 | 0 |
| 17 NT | 19/7 | 0 | 0 | 0 | 0 |
| 19 DT | 15/7 | 0 | 0 | 0 | 0 |
| 19 NT | 15/7 | 0 | 0 | 0 | 0 |
| 20 DT | 15/7 | 0 | 0 | 0 | 0 |
| 20 NT | 15/7 | 0 | 0 | 0 | 0 |

Table 3: Targeted Littlejohn's Tree Frog 2019 Survey Species Records (Continued)

| Site Number, (DT) daytime (NT) night time | Date | Amphibian species located on arrival | | Amphibian responses to Littlejohn's Tree Frog Playback calls | Other species responses to Littlejohn's Tree Frog Playback calls |
|--|------|--------------------------------------|--------------------|--|--|
| | | Adult | Tadpole/egg masses | | |
| 21 DT | 15/7 | 1 F C signifera | 0 | 0 | 0 |
| 21 NT | 15/7 | 0 | 0 | 0 | 0 |
| 22 DT | 16/7 | 0 | 0 | 0 | 0 |
| 22 NT | 16/7 | 0 | 0 | 0 | 0 |
| 23 DT | 17/7 | 0 | 0 | 0 | 0 |
| 23 NT | 17/7 | 0 | 0 | 0 | 0 |
| 24 DT | 17/7 | 1 x L littlejohni | 0 | 0 | 0 |
| 24 NT | 17/7 | 0 | 0 | 0 | 0 |
| 25 DT | 17/7 | 0 | 0 | 0 | 0 |
| 25 NT | 17/7 | 0 | 0 | 0 | 0 |
| 26 DT | 17/7 | 0 | 0 | 0 | 0 |
| 26 NT | 17/7 | 0 | 0 | 1 x C signifera | 0 |
| 27 DT | 17/7 | 0 | 0 | 0 | 0 |
| 27 NT | 17/7 | 0 | 0 | 0 | 0 |
| 29 DT | 18/7 | 2 x C signinea | 0 | 0 | 0 |
| 29 NT | 19/7 | 2 x C signifera | 0 | 1 x C signifera | 0 |
| 30 DT | 17/7 | 0 | 0 | 0 | 0 |
| 30 NT | 17/7 | 0 | 0 | 0 | 0 |
| 31 DT | 13/7 | 0 | 0 | 0 | 0 |
| 31 NT | 13/7 | 0 | 0 | 0 | 0 |
| 32 DT | 13/7 | 0 | 0 | 0 | 0 |
| 32 NT | 13/7 | 0 | 0 | 2 x L littlejohni | 0 |
| 33 DT | 13/7 | 0 | 0 | 0 | 0 |
| 33 NT | 13/7 | 0 | 0 | 0 | 0 |
| 34 DT | 13/7 | 0 | 0 | 0 | 0 |
| 34 NT | 13/7 | 0 | 0 | 0 | 0 |
| 35 DT | 13/7 | 0 | 0 | 0 | 0 |
| 35 NT | 13/7 | 0 | 0 | 0 | 0 |
| 36 DT | 14/7 | 0 | 0 | 0 | 0 |
| 36 NT | 14/7 | 0 | 0 | 0 | 0 |
| 37 DT | 14/7 | 0 | 0 | 0 | 0 |
| 37 NT | 14/7 | 0 | 0 | 0 | 0 |
| 38 DT | 14/7 | 0 | 0 | 0 | 0 |
| 38 NT | 14/7 | 0 | 0 | 0 | 0 |
| 39 DT | 14/7 | 0 | 0 | 0 | 0 |
| 39 NT | 14/7 | 0 | 0 | 0 | 0 |

5.3 CUMULATIVE DISTRIBUTION OF LITTLEJOHN'S TREE FROG FROM 2010- 2019, SITES 1-39

The seven locations where Littlejohn's Tree Frog has been observed since 2016 are recorded in Table 4 below, namely sites 7, 10, 13, 18, 21, 24 and 32. In most cases, only one adult was observed/heard calling and no breeding events were observed. During the spring/summer 2018 survey, three adults were observed at control site 10. As yet, optimal survey conditions for observing/hearing calls of this species have not been available to the survey team. Nevertheless, based on data gathered since 2016, the distribution of the species appears reasonably widespread across the Metropolitan Coal footprint and surrounds, occurring in low numbers. Note that in the 2018 targeted winter survey, two Littlejohn's Tree Frogs were heard calling near the Bureau of Meteorology rainfall recording site at Darkes Forest. However, this is not an official survey site.

Table 4: Site locations where Littlejohn's Tree Frog have been observed 2010-2019 in the Project Underground Mining Area and Surrounds

| Survey Year | Test Sites 1-6 | Control Sites 7-12 | Test Sites 13-17 | Control Sites 18-22 | Test Sites 23-28 | Test Sites 29-30 | Test Sites 31-39 |
|-----------------------------------|----------------|--------------------|------------------|---------------------|------------------|------------------|------------------|
| 2010 | 0 | 0 | 0 | 0 | NA | NA | NA |
| 2011 | 0 | 0 | 0 | 0 | NA | NA | NA |
| 2012 | 0 | 0 | 0 | 0 | NA | NA | NA |
| 2013 | 0 | 0 | 0 | 0 | NA | NA | NA |
| 2014 | 0 | 0 | 0 | 0 | NA | NA | NA |
| 2015 | 0 | 0 | 0 | 0 | 0 | NA | NA |
| 2016 | 0 | 0 | 0 | 0 | S24 | NA | NA |
| 2017 | 0 | S10 | 0 | S18 | S24 | NA | NA |
| 2018 | 0 | S10 | 0 | S21 | 0 | 0 | 0 |
| Targeted survey 2018 ¹ | 0 | S7 | S13 | S18 | S24 | 0 | NA |
| Targeted survey 2019 ² | 0 | 0 | 0 | 0 | S24 | 0 | S32 |

¹ In 2018, sites 1, 2, 4 and 28 were excluded from the targeted survey, and a new site WRC (at the intersection of Fire Trail 9H and the Waratah Rivulet) was surveyed.

² In 2019 sites 1, 2,4, 6, 18 and 28 were excluded, and WRC used instead of S1.

5.4 OTHER SPECIES OBSERVED IN THE 2019 SURVEY

Four other species of frogs were observed at various sites either by call, as adults or as tadpoles in various stages of larval growth (Table 3 and Table 5). These included the Common Eastern Froglet, Giant Burrowing Frog, Blue Mountains Tree Frog and Southern Rocket Frog.

Table 5: Other Amphibian Species Recorded During the Survey

| Scientific Name | Common Name | Observation | Sites |
|---------------------------------|------------------------------------|--|--------------------------------------|
| <i>Crinia signifera</i> | Common Eastern Froglet. | Adult, calling and in larval stages at sites | WRC, 3, 5, 7, 10, 12, 13, 21, 26, 29 |
| <i>Heleioporus australiacus</i> | Giant Burrowing Frog. ^v | Larval form | 10 |
| <i>Litoria citropa</i> | Blue Mountains Tree Frog. | Larval form | 10 |
| <i>Litoria freycineti</i> | Southern Rocket Frog. | Adult and larval form | WRC, 5, 10 |

^v Listed as vulnerable under the BC Act.

6 CONCLUSIONS

This report presents the results of the targeted survey for Littlejohn's Tree Frog undertaken in July 2019, along with the results of amphibian surveys within the Metropolitan Coal mining footprint and surrounds undertaken to date (2010-2019).

July 2019 survey

1. Five species of frogs were located during the targeted survey as adults, by call or as larval stages, including Littlejohn's Tree Frog (adult and by call).
2. The most widespread species was *Crinia signifera*, a species less affected by cold conditions.
3. Littlejohn's Tree Frog was found by direct observation at site 24 and in response to an Littlejohn's Tree Frog call play back at site 32.
 - i. No breeding events were found for this species.
 - ii. The cumulative data from the spring/summer and targeted surveys 2016 -2019, while confined to the area of the Metropolitan Mine footprint and surrounds on the Woronora Plateau, suggests that the species is likely to be more widespread than previously thought, has a patchy distribution and is found in very low numbers.
 - iii. The sudden appearance of this species from 2016 can be attributed to the spring/summer survey periods being pushed back into autumn due to drought conditions prevailing in the catchment.
4. Very limited breeding events were recorded for *C. signifera*, *L. freycinetti*, *L. citropa* and *H australiacus*. These predate the July 2019 rainfall event.
5. To date, Littlejohn's Tree Frog play back has been very effective in eliciting additional species to commence calling, including birds and mammals, but not particularly effective in eliciting a calling response from Littlejohn's Tree Frog when known to be present.

7 RECOMMENDATION

The July 2019 Littlejohn's Tree Frog targeted survey represents the second targeted survey undertaken for this species. These surveys have established that Littlejohn's Tree Frog is found in very low numbers within the Project underground mining area, and is likely to be more widespread across the Woronora catchment than previously thought. No breeding events have been recorded for Littlejohn's Tree Frog to date.

It is therefore considered that no further targeted surveys are required to be undertaken for Littlejohn's Tree Frog.

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The report was prepared by David Goldney.

Figure 1 was provided by Resource Strategies.

Permission to enter the Woronora Plateau was provided by WaterNSW and Metropolitan Coal.