Appendix C

Species Description
C1 Maccullochella mariensis (Mary River Cod)

C1.1 Description

Maccullochella mariensis (Mary River Cod) is a yellowish to pale green fish that grows up to 20 kg and 70 cm (Simpson & Jackson 2000); however this species generally grows up to 5 kg. It has dark heavily reticulated mottling on the back and sides, sometimes extending onto the belly. The belly is grey-green to whitish. The fins are clear to dark with grey-green mottling on the bases, with whitish margins (McDowall 1996).

C1.2 Status

This species is listed as Endangered under the Commonwealth’s EPBC Act.

C1.3 Ecology

The Mary River Cod occurs mainly in pools within relatively undisturbed tributaries (Wager & Jackson 1993). They prefer relatively large, deep (0.8 to 3.2 m) and shaded pools with abundant woody debris and slow flowing water (Simpson & Jackson 2000; EES 2003). However, they are also known to use smaller tributary streams during late winter when they migrate from their main home range (Merrick & Schmida 1984). Another study reports that adult Cod can move in excess of 30 km either upstream or downstream during high stream flows at any time of year (Simpson & Jackson 2000).

These Cod are ambush predators and adults mainly consume fish (DSEWPC 2010b). Submerged logs and branches (snags) are used as cover from which to ambush prey, as resting sites, and as nesting sites (DSEWPC 2010b). The Cod are often found within metres of woody debris structures (Simpson & Mapleston 2002).

The Mary River Cod is territorial and between periods of movement it occupies a particular home range between 70 m and 1 km in length for up to several years (Simpson & Mapleston 2002). Home range size is not related to the size of the fish, and does not change seasonally (Simpson & Jackson 2000). Spawning occurs during spring when water temperatures reach above 20 degrees Celsius (Harris & Rowland 1996). Mary River Cod use hollow logs as spawning sites, and they deposit their eggs as a layer, where they adhere to the hard surface inside pipes or logs (Simpson & Mapleston 2002). The habitat of hatchlings and juveniles is poorly known however larvae of the closely-related Murray River Cod are known to remain in the river channel and disperse widely in the currents at night (Humphries, 2005; Koehn and Harrington, 2005). Larvae appear to move into the current at night, when they drift downstream to new pools (King 2004).

According to a radio-tracking study by Simpson and Mapleston (2002), 95% of Mary River Cod observed were in water between 1 m and 3 m deep, with the fish strongly avoiding shallow areas (Simpson 1994). Preliminary observations suggest that one and two-year-old fish use shallow, flowing reaches more than adults do (Simpson & Mapleston 2002). During this study Cod were frequently found immediately downstream of a constriction of the stream (e.g. a riffle) where food was presumably concentrated by the water flow. The EES (2003) states that the Cod require good ecosystem health, good water quality, and intact remnant riparian vegetation, however Simpson & Mapleston (2002) have recorded this species in a varied range of physiochemical parameters such as pH, conductivity, dissolved oxygen content and turbidity. Simpson (1994) also found the Mary River Cod to tolerate a wide range of conditions and Simpson & Jackson (2000) found this species to tolerate high gradient upland stream habitats as well as slow-flowing lower reaches.
C1.4 Distribution

Historically, Mary River Cod were distributed throughout the Mary, Brisbane-Stanley, Albert-Logan and Coomera River Catchments (Wagner & Jackson 1993). Now, this species is found only in the Mary River Catchment and there are reportedly less than 600 individuals remaining (Simpson & Jackson 2000). The distribution of the Mary River Cod has also declined within the Mary River Catchment. It is estimated that this species now occurs in less than 30% of its original range (Simpson & Jackson 2000). Surveys undertaken at the time of the Mary River Cod Research Plan development, indicated Mary River Cod inhabit three main areas in Tinana-Coondoo Creek upstream from Tinana Barrage, Six Mile Creek downstream from Lake Macdonald, and upper Obi Obi Creek (Simpson & Jackson 2000). The estimated total length of where the species is found is within a 51 km range. Mary River Cod have been stocked in impoundments since 1983 (including Lake Macdonald), both within and outside the Mary River Catchment.

Six Mile Creek has also been identified as an important habitat for the Mary River Cod by Pickersgill (1998) and Burrows (2003). At Six Mile Creek, Cod are typically found in slow moving pools with high riparian canopy cover, typically in association with large woody debris (Simpson & Jackson 2000). However, in the Obi Obi Creek they are found in areas with a rocky substrate, little riparian cover and limited woody debris (DSEWPC 2010b).

More recent surveys have located significant numbers of larger Mary River Cod on the main channel of the Mary River (SKM 2009). The Cod has also been reported from Amamoor Creek from McGills Creek to Amamoor Yabba Creek, Kandanga Creek, Glastonbury Creek (Pickersgill 1998), and Widgee Creek (Kennard 2003).

Potential habitat for the Mary River Cod identified in Cooroy Creek, Cudgerie Common, Skyring Creek and Six Mile Creek West. Habitat assessments undertaken for the Significant Impact Assessment of this species identified that the wider area of the Project provides low potential habitat for this species (GHD, 2010a). The proposed works will be undertaken in a small footprint of modified and already disturbed aquatic habitat. Large areas of higher-value habitat is located both upstream and downstream of the disturbance area.

C1.5 Threatening processes

The primary threats to the Mary River Cod include:

- Habitat degradation – extensive land clearing and agricultural practises within the Mary River catchment are likely to have an impact on the habitat of the Mary River Cod. A decrease in riparian vegetation results in a reduction in areas with shade, increasing water temperature and also exacerbating erosion and in-filling of pools, decreasing the water quality (Simpson & Jackson 2000). Clearing of vegetation may also decrease the amount of in-stream debris necessary for the fish's reproductive cycle.

- Overfishing during the late 1800s and early 1900s (DSEWPC 2011).

- Impoundment – dams and weirs pose a significant threat to the Mary River Cod as isolation of populations can occur due to restricted movements within the catchment. The success rate of juveniles passing through dams and weirs is currently unknown (Simpson & Jackson 2000), which may affect the population.

- Competition with non-indigenous fish species.
C2 Mixophyes iteratus (Giant Barred Frog)

C2.1 Description

Mixophyes iteratus (Giant Barred Frog) is a very large, robust ground-dwelling frog up to 115 mm with a pointed snout and well developed hind legs. The dorsal surface is dark olive to black, with darker blotches and an irregular dark vertebral band commencing between the eyes and continuing posteriorly. A dark stripe runs from the snout, through the eye and above the tympanum, terminating at a point above the forelimb (Barker et al. 1995, Straughan 1968).

There are irregular dark spots or mottling on the flanks. The limbs have a series of dark and pale crossbars of similar width. The hidden part of the thigh is black with a few large, yellow spots. The ventral surface is white to yellow with fine mottling on the chin. The pupil is vertical, while the iris is pale silvery-white to pale gold above and darker in the lower portion. The fingers lack webbing, while the toes are fully webbed, with only the last two joints of the fourth toe free (Barker et al. 1995; Cogger 2000; Straughan 1968).

C2.2 Status

This species is listed as Endangered in Queensland (Nature Conservation Act 1992) and nationally (Environment Protection and Biodiversity Conservation Act 1999). It is ranked as a medium priority under the Department of Environment and Resource Management Back on Track species prioritisation framework.

C2.3 Ecology

The Giant Barred Frog call is a deep guttural grunt (Barker et al. 1995). Males call from the forest floor or from crevices under rocks, banks or overhanging tree roots (Cogger et al. 1983; Straughan 1968).

Giant Barred Frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations between 100 m and 1,000 m. Breeding habitat is typically associated with deep, slow-moving streams in lowland areas (QPWS, unpublished data) and shallow, flowing rocky streams (Covacevich and McDonald, 1993). The species breeds between September and April (Hines, 2002). Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Tadpoles grow to a length of over 100 mm and take up to 14 months before changing into frogs (Meyer et al., 2001). When not breeding, the frogs can disperse some distance away from streams. However the extent to which they disperse away from the stream into the forest is poorly known. They feed primarily on large insects and spiders (DERM 2012).

Relatively little is known regarding the reproductive biology of this species. Amplexus is axillary, but egg deposition has not been documented. A gravid female was found to carry 4,184 eggs with a mean diameter of 1.6 mm. Larvae are present throughout the year and probably over-winter. Laboratory reared metamorphs reach 28-30 mm (Hero & Fickling 1996; Straughan 1966).

Meyer et al., (2001) has described the tadpole as large and of lotic form, with suctorital mouth, muscular tail and reduced fins. They are deep-bodied, ovoid; tail length twice that of body; eyes dorsolateral; yellow-brown above with dark spots/ splotches and dark patch at base of tail; underside silver-white; intestinal mass obscured, heart and lungs visible from below (except near metamorphosis); tail thick and muscular; low-finned; fins opaque with dark flecking (except anterior half of ventral fin); tail musculature
with dark flecking/spots and/or splotches; spiracle sinistral, opening lateroventrally; vent tube opening dextral; oral disc surrounded by papillae; labial tooth row formula: 6(3-6)/3 (1).

C2.4 Distribution
The distribution of *Mixophyes iteratus* is known from Belli Creek, near Eumundi in south-east Queensland to Warrimoo on the mid-coast of New South Wales (Hines *et al.*, 1999). In recent decades the species has experienced dramatic declines in the southern parts of its range (Hines, 2001). In south-east Queensland, the species is only known from a few scattered locations in the Mary River catchment downstream to about Kenilworth, Maroochy River, Upper Stanley River, Caboolture River, Burpengary Creek and Coomera River (Hines, 2001).

The Giant Barred Frog has been recorded at local tributaries south of the project area, including Skyring Creek and Belli Creeks, and on the main channel of the Mary River (Ecotone Environmental Services 2007).

C2.5 Threatening processes
Upstream clearing, changes in water flow regimes, degradation of water quality, disturbance to riparian vegetation, feral animals, domestic stock and weed invasion have been identified as potential threats to the Giant Barred Frog (DSEWPC 2012).

Disturbance to riparian vegetation is particularly important as many populations of the Giant Barred Frog in south-east Queensland, and some populations in north-east NSW such as the Tweed Valley, occur along narrow remnant riparian vegetation on private lands which are readily exposed to such disturbances (DSEWPC 2012). Damage from feral pigs (*Sus scrofa*) has increased greatly overtime in the Conondale Range (Hines & SEQTFRT 2002) and possibly in other areas occupied by the species. While there is potential for direct predation by pigs, the greatest impact is likely to be from increased silt on embryos and tadpoles. Similarly, trampling by domestic stock is also likely to have deleterious impacts on oviposition sites of the species (Knowles *et al.*, 1998).

Chytridiomycosis (a chytrid fungus) is an infectious disease affecting amphibians worldwide. This highly virulent pathogen of amphibians is capable, at the minimum, of causing sporadic deaths in some populations, and 100% mortality in other populations (AGDEH 2006). Chytrid fungus has been identified in individuals of the Giant Barred Frog (Speare & Berger 2000).

Individuals of the Giant Barred Frog have sometimes been killed in the mistaken belief that they are the introduced cane toad (*Rhinella marina*) (Hines & SEQTFRT 2002).

Populations of the Giant Barred Frog now exist in small, isolated patches of forest. The effect that this may have on genetic variation within populations, the general health of individuals and the species’ response to identified threats is unknown (DSEWPC 2012).
C3 References


GHD (2010a) Bruce Highway (Cooroy to Curra) Upgrade Section A (Cooroy Southern Interchange to Sankeys Road) Job No. 128/10A/901, Invitation No. NCHD2267 Significant Impacts Assessment (GHD).


