

Box 5.5 Lake Kutubu

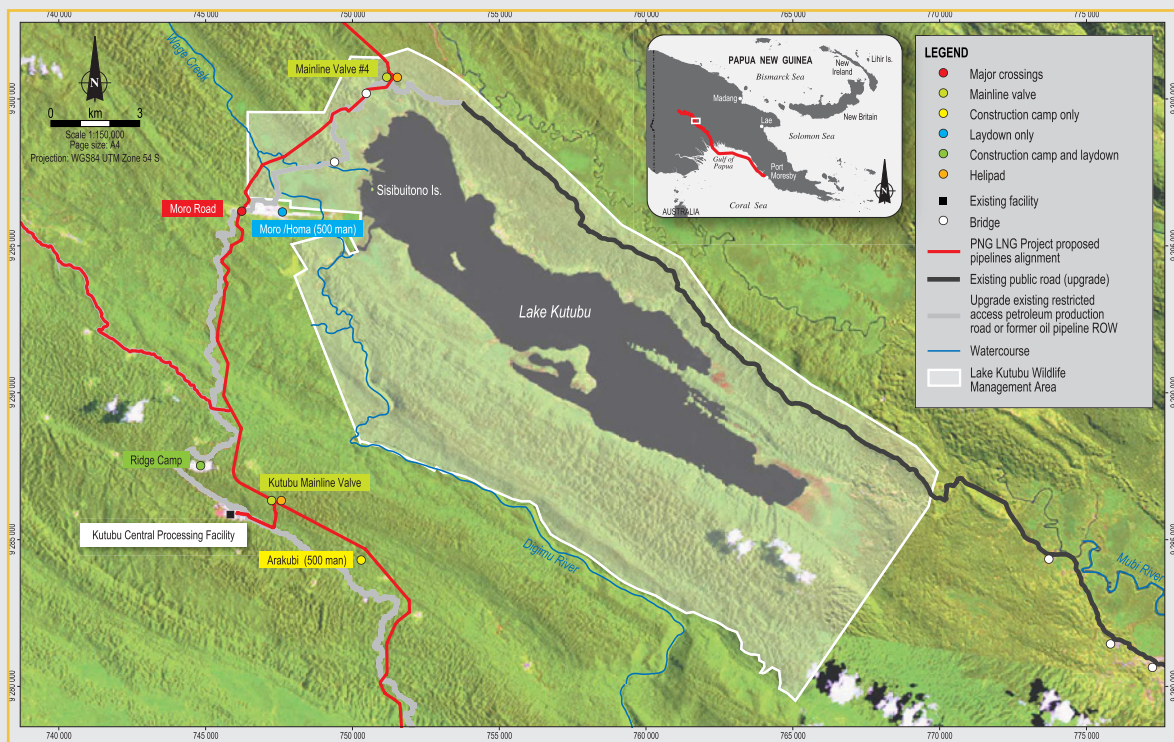
Lake Kutubu is the largest perched lake in PNG and is the second largest lake in PNG after Lake Murray in Western Province. It is one of the only large permanent lakes in the highlands region of the Upstream Project Area. At an elevation of 800 meters above sea level, the lake has a catchment area of 4,924 hectares, is about 19 kilometers long and 4 kilometers wide at its widest point, and has a maximum depth of about 70 meters (Osborne & Totome, 1992). It lies within karst terrain and was formed originally as a result of volcanic-derived debris and ash blocking the valley in which it now lies.

Twelve of the 18 species of fish in Lake Kutubu are endemic, the highest level of lacustrine endemism of any lake in the New Guinea–Australian region. Five of these endemics comprise up to 40 percent of the artisanal fishery and subsistence fish catches in the lake (Enesar, 2005) and provide an important source of dietary protein for the local communities residing within the lake’s catchment.

Lake Kutubu is included in the Lake Kutubu Wildlife Management Area (WMA) (see figure below), and is currently managed under the WMA arrangement. The boundary includes most of the lake’s catchment and approximately 1,000 hectares of surrounding swamp forest. The lake was listed as a Ramsar wetland in 1998 and the Ramsar boundaries match those of the WMA.

Not only does the biodiversity of Lake Kutubu provide significant resources for local communities living around it, but the lake is also the locale for a number of traditional myths. Sisibuitono (see figure below), a myth site of major significance to the Lake Kutubu region, is a small grassy island at the northern end of Lake Kutubu that marks the location of the original mythical tree from which the waters of Lake Kutubu flowed.

Lake Kutubu Wildlife Management Area



The northern end of Lake Kutubu



Subsistence catch of Kutubu tandans and fimbriate gudgeons from Lake Kutubu

Plate 5.16: Large cave in the Upstream Project Area



5.2.3.1 Caves

Caves are abundant in the karst of the Upstream Project Area, but only some are important for conservation of cave-dwelling bats as particular species require caves with specific conditions and architecture in which to roost and breed. Large caves in the uplands may support colonies of the extremely rare and critically endangered Bulmer's fruit-bat.

5.2.3.2 Sinkhole Swamps

Sinkhole swamps are microhabitats of ponds at the bottom of dolines or depressions in high-altitude karst on Hides Ridge, where falling leaf litter and other organic debris has impeded the drainage. These are the only habitats where tree frogs and other water-dependent frogs can breed in karst, which tends to have few flowing streams.

5.2.3.3 Upland Streams

Stream condition is important for maintaining populations of torrent-dwelling frogs and birds such as Salvadori's teal (*Salvadorina waigiensis*), torrent-lark (*Grallina bruijni*) and torrent robin (*Monachella muelleriana*). The torrent-dwelling frogs, in particular, require fast-flowing, clear-water, rocky streams with intact riparian vegetation. Such vegetation can also be a specialized habitat for hydromyine rodents and, less commonly in these higher elevations, for birds.

Plate 5.17: Sinkhole swamp on Hides Ridge



5.2.3.4 Swamp Forest

Swamp forests support a range of specialist vertebrates, including the twelve-wired bird-of-paradise (*Seleucidis melanoleuca*), the New Guinea flightless rail (*Megacrex inepta*) and a range of freshwater turtles and crocodiles. The swamp forests are not always wet but are maintained by a drying and wetting regime. Drier conditions promote the growth of trees and a forest structure. Wetter conditions promote palms, particularly sago palms. Ponding converts them to freshwater swamps and, if there is seawater ingress, to mangroves. Dry conditions convert them to drier forest complexes, scrublands or grasslands. Swamp forests tend to be resilient to disturbance but the dependence of these forests on inundation

and restricted drainage means that changes to hydrology may destroy them. Fire can eliminate these complexes if they are developed on peat substrates, which can readily burn when dried out.

Plate 5.18: Swamp forest complexes at Lake Kutubu



5.2.3.5 Stream Refuges in Unstable Landscapes

Areas of mature habitat on stable substrates (for example, stream heads or small plateaus) are disproportionately important as regional fauna refuges in otherwise unstable and landslide-prone areas around the Baia River on the pipelines route from Juha to Hides. Moreover, the dynamic hydrological conditions of major rivers in these unstable landscapes mean that the clearing, earthworks and sedimentation effects of Project construction activities add little damage to what occurs naturally. In these circumstances, it is appropriate to shift the emphasis of environmental management from its usual focus on river crossings to protecting the more stable backwater refuge areas in the general vicinity.

5.2.3.6 Lowland Rivers in Stable Landscapes

The lowland rivers in more stable landscapes provide the habitat for crocodiles and freshwater turtles. Within the Upstream Project Area, there does not appear to be a specialized bird fauna restricted to riverine forest (as there is in gallery forests in dry woodlands). However, some species are notably abundant, including kingfishers and shining flycatchers (*Myiagra alecto*). In the lowlands, riverine forest supports a variety of large fruiting trees and there are consequently many pigeons and parrots. No species is restricted to this habitat, but many birds will take refuge in riverine forest during the drier parts of the year and at hot times of the day, particularly in the lowlands.

Plate 5.19: Pig-nosed turtle (*Carettochelys insculpta*)



5.2.3.7 Off-river Waterbodies

The discovery of breeding New Guinea freshwater crocodiles in a small, off-river waterbody alongside the Baia River during the Project surveys identifies this habitat type in unstable lowland landscapes as a management priority. Such habitats are created by localized damming of runoff by landslides and should therefore be reasonably simple to maintain through construction.

5.2.3.8 Habitats and Flora and Fauna of Cultural Significance

Culturally significant areas, habitats and species may occur throughout and surrounding settled areas in the Upstream Project Area. They may vary from a small swamp that harbors a spirit to a place where medicinal plants are harvested. As such sites are only known to locals and cannot be located by outsiders, local input is included in the preconstruction surveys.

5.3 RISK ANALYSIS AND IDENTIFYING POTENTIAL IMPACTS TO BIODIVERSITY VALUES

The EIS was prepared to assess potential impacts on a range of environmental and social parameters. Twenty-six independent studies carried out by environmental technical specialists, many with long experience in PNG and the Kikori River region, were conducted to assess the potential impacts of the Project and reported as appendices to the EIS and the results summarized in the main body of the EIS¹⁸.

¹⁸ Part III of the EIS presents the impact assessment for the Upstream Project Area. The results of the cultural heritage impact assessments and of the socio-economic impact assessments are given on a Project-wide basis in Chapters 22 and 23 of the EIS, respectively.

Box 5.6: New Guinea's long-beaked echidnas

There are four species of echidna; all occur in New Guinea and one is shared with Australia. The three species of long-beaked echidnas, Sir David's long-beaked echidna (*Zaglossus attenboroughi*), eastern long-beaked echidna (*Z. bartoni*) and western long-beaked echidna (*Z. bruijnii*), are endemic to PNG and all listed as critically endangered by the IUCN (2010). Together with the Australian platypus, they form the ancient monotremes.

Eastern long-beaked echidnas occur in the Upstream Project Area and are large, ant-eating, terrestrial, egg-laying mammals reaching to 0.75 meters in length and weighing up to 9 kilograms. While echidnas are mostly forest animals, if not persecuted, they can occur in grasslands and secondary forest areas. *Zaglossus* are specialised feeders of earthworms, which they detect with their keen sense of smell. Signs that an echidna may be present are the tubular holes that they make with their snouts when foraging.

Hunting has reduced populations of long-beaked echidnas in most populated regions of New Guinea and they have become extinct in several areas. If not persecuted, they can attain moderately abundant populations but this now tends to be localised to inaccessible rugged mountains.

The impact assessment for biodiversity relies on the biodiversity data collected during project surveys and on expert opinion on the dynamics of the habitats and species involved, as well as on the experience that had been gained with other hydrocarbon and resource projects. In such a diverse region as the Upstream Project Area, the knowledge of species biology and of habitat dynamics varies from reasonable to non-existent so impact assessments needed to be guided by a decision system that attempted to produce consistency across discipline assessments. The system had, as its core, the concept of significance of an impact, which in this case had the common English meaning of the word, not classical statistical significance.

For the EIS, significance was derived from two elements: the magnitude of change, including scale and duration of the impact; and the value or sensitivity to change of the receptor (species or habitats). The magnitude of impact was defined for three classes of effects: habitat impacts, population impacts, and other ecological effects that degrade habitat or reduce population viability e.g., barrier effects, fire, exotic species, contamination etc. Categories and definitions of magnitude are shown in Table A5.1 of Appendix 5. The value and/or sensitivity of the receptor related to biodiversity value is shown in Table A5.2 of Appendix 5. Significance was determined by a cross tabulation of impact magnitude and value of the receptor (see Table A5.3 of Appendix 5).

This approach is similar to Esso Highlands Limited's preferred risk-based assessment approach. Both methods utilize criteria concerning magnitude and susceptibility to determine the significance/risk of an impact and appropriate avoidance/mitigation measures to reduce the significance/risk of the identified impacts to acceptable levels.

The impact analysis identified many potential direct impacts on biodiversity: habitat loss, edge effects, barrier effects, physical damage and disturbance to caves, fauna falling in the pipe trench, erosion, movement of spoil and changes to hydrology, materials handling, disposal of hydrotest fluids, dust, loss of breeding and display grounds, noise, lights and other disturbance, Project traffic and other operations. Potential indirect impacts included fire, dieback, the introduction and spread of alien species and diseases, hunting, and enhanced access to the Project Area.

The significance of residual impacts after mitigation of all but seven potential impacts were low. The seven impacts whose residuals were moderate or major and therefore of most significance to biodiversity values were habitat loss in priority ecosystems, edge effects in high-altitude karst, barrier and erosion impacts in deep, steep cuttings in karst¹⁹, and the indirect impacts of fire, the introduction and spread of alien species and diseases, and enhanced access. The latter two are arguably the most significant in that they have the potential for system-wide impacts in the Upstream Project Area forests. All seven residual impacts on the biodiversity values as defined in Section 5.2.1 formed the basis for offsetting and monitoring. Examples of impact analyses are given in Table A5.4 of Appendix 5 and a cross tabulation of the relevance of residual impacts to the biodiversity values are presented in Table A5.5 of Appendix 5.

¹⁹ These barrier and edge effects were divided in the EIS analysis into: 'edge and barrier effects in high altitude karst', 'edge and barrier effects on arboreal species in high karst' and 'erosion, movement of spoil and change to hydrology on arboreal species in high karst'. The expression of these impacts in the Biodiversity Strategy is more useful.