5.2.1.8 Biodiversity of Importance to Local Communities for Resource Use and Cultural and Spiritual Purposes

Local communities in PNG are linked to the biodiversity values of the surrounding land through their reliance on subsistence-oriented production and a close physical and spiritual relationship to ancestral territories. Subsistence land use in the Upstream Project Area consists of shifting cultivation, hunting and gathering and sago production. Shifting cultivation occurs in all forest types but is restricted by terrain and soil quality. Hunting and gathering is not so constrained and the forest provides a vast array of natural resources to local people. Prey includes pigs, cassowaries, wallabies, bandicoots, megapodes, rats, frogs, possums, snakes, bats, crocodiles, turtles, lizards and birds. Particularly high-value items are birds-of-paradise and cassowaries and, in the lower parts of the Kikori River basin, pig-nosed turtles *(Carettochelys insculpta)*, listed under the IUCN Red List (IUCN, 2010) as vulnerable, but whose flesh and eggs are a significant food source for local communities.

Sago production occurs only in swamp forests and sago from a single palm is usually sufficient for a family for a month. Palm by-products are used for roofing and building.

In addition to relying on the land for subsistence-oriented production, there is a strong spiritual connection with the land, and culturally significant sites often include caves, sacred lakes, swamps and creeks, limestone outcrops, sacred groves, and plant harvest and hunting areas. For example, some sacred sites associated with water link the places of the living (such as villages) with the places of the dead through the journeys travelled by the spirits of dead family and clan members. Sacred sites may be located on land and in watercourses. Both landscapes and waterscapes were considered when recording cultural and spiritual places during the EIS and subsequent preconstruction surveys.

Plate 5.13: Unbroken low altitude medium crowned forest between Juha and Hides

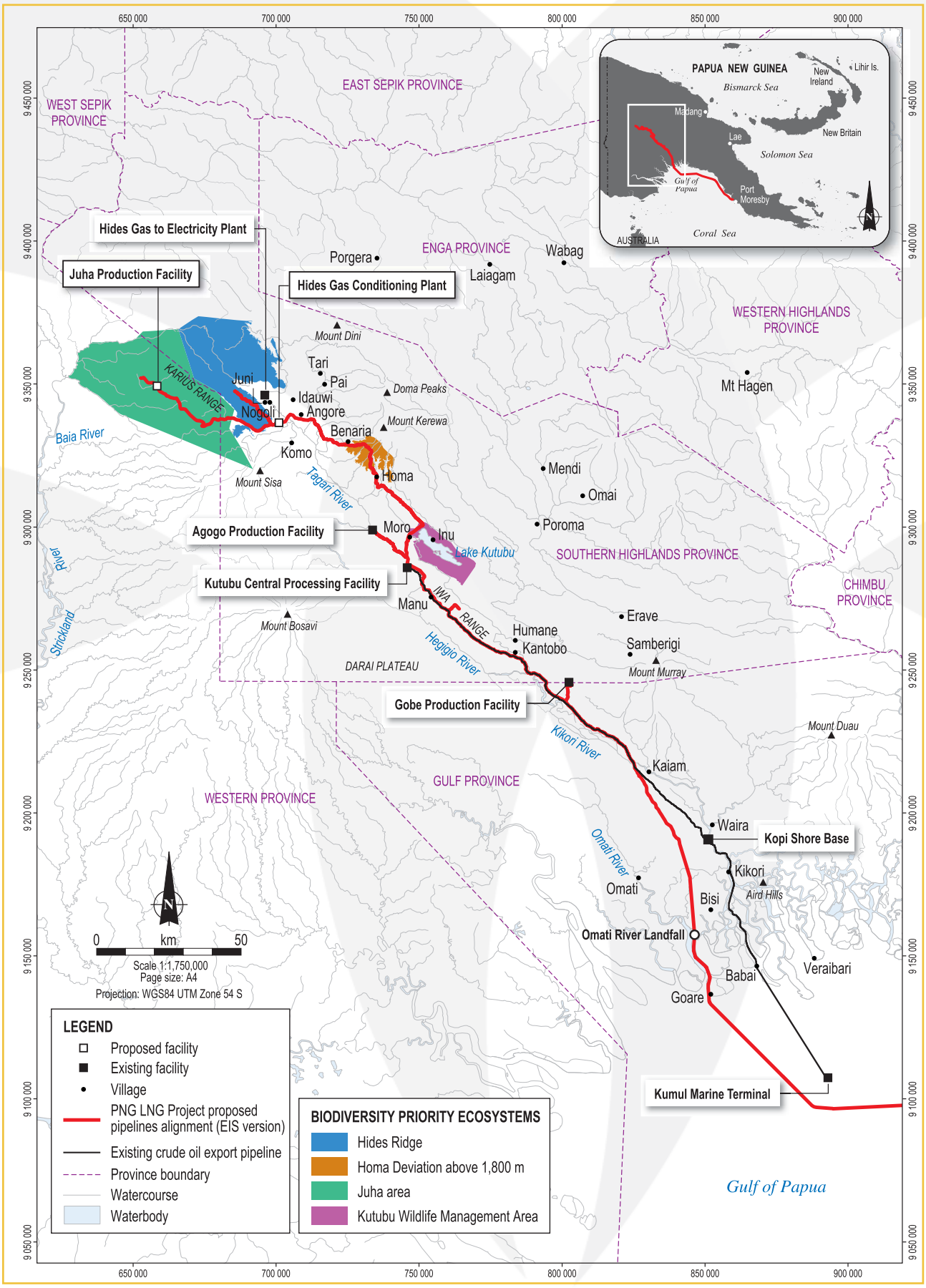
5.2.2 Priority Ecosystems

On the medium-scale, biodiversity management will focus on three 'priority ecosystems', which were identified as part of surveys, and have particularly high biodiversity values associated with them (Figure 5.3). These are the Juha area, Hides Ridge and the high-altitude forest above 1,800 meters on the Homa Deviation[16].
In addition Lake Kutubu qualifies as a priority ecosystem in its own right.

Plate 5.14: Forests at Juha

[16] These were termed 'Special Areas' in Appendix 1 to the EIS but grouped with focal habitats (next section) in the body of the EIS (Chapter 10) as 'noteworthy areas'.

Figure 5.3: Priority ecosystems within the Upstream Project Area



5.2.2.1 The Juha Area

Juha is a remote region where there has been little human influence on the vegetation and fauna and its ecological values are maintained by its difficulty of access. There are one or two small villages nearby but not within the area, and their impact has been minimal to undetectable. This area particularly supports the biodiversity values described in Section 5.2.1 due to the following attributes: (i) the remoteness of the region and the lack of human influence on the vegetation and fauna; (ii) the lack of weeds and other exotics in the area; (iii) the absence or the low populations of wild pigs; (iv) the absence of hunting. Among other biodiversity values that are specifically represented in this area, Juha contains notable concentrations of unique assemblages of frog species. The remoteness and mostly untouched condition of the forests warrant a management focus on access restrictions during construction and operations to prevent the indirect impacts of hunting, logging and induced settlement.

5.2.2.2 Hides Ridge

The high-altitude *Nothofagus* forest on karst above 1,800 meters shares with the higher regions of Mount Sisa and the forests on the Homa Deviation a montane fauna in a mostly undisturbed environment. The existing gas wells were drilled by rigs flown in by helicopter and the flow lines and helicopter pads have been constructed by hand and have had little material impact in this area so its ecological values are maintained by difficulty of access. The epiphytes and ferns developed on trees are the major component of plant biodiversity in this forest type. The forests on Hides Ridge are little disturbed, and only two exotic weeds were recorded, neither of which are invasive. Among other biodiversity values that are specifically represented in this area, Hides Ridge contains (i) unique assemblages of plants, including three remarkable calcium-depositing ferns that are likely restricted to these high-altitude karst areas; (ii) the potential for occurrence of caves of the Critically Endangered Bulmer's fruit-bat (*Aproteles bulmerae*); (iii) a high diversity of high-altitude birds-of-paradise and high concentration of restricted-range, endemic high-altitude birds; (iv) frogs that may have restricted-ranges.

This forest type is sensitive to fire and dieback, and the high altitude means slow growth rates and slow regeneration (Rogers, 2005); slow-growing individuals of *Nothofagus one* meter in diameter may be over 300 years old.

Dieback investigative surveys completed in the Upstream Project Area in June 2010 indicate dieback is present in the Hides Ridge area, more specifically, the pathogen *Phytophthora sp*. has been confirmed as causing the dieback. The *Nothofagus* forest in the Hides Ridge area has been historically affected by *Phytophthora sp*. but has been regenerating in recent times.

The Hides Ridge area warrants special erosion control and regeneration systems for construction, but controlling access to this area in the long term in order to eliminate indirect impacts of hunting and weed and pest invasion is the highest priority.

Plate 5.15: Hides Ridge lower montane small crowned forest with *Nothofagus*

Box 5.4: Bulmer's fruit-bat

This cave-dependent flying fox was originally described from subfossil material in an archaeological dig at 1,530 meters above sea level at the Kiowa rock shelter, 2 kilometers east of Chauve Government Station, Chimbu Province in layers dated between 10,000 and 11,000 years before present. Menzies (1977) described the species from 200 skulls that were 'kitchen waste' in a human occupation site in a small entrance to a large limestone cave complex. Living animals were subsequently discovered in 1975 at an altitude of 2,400 meters in Luplupwintem cave close to the main walking track between Tabubil, the Ok Tedi mine and Telefomin (Hyndman & Menzies, 1980).

In 1975, thousands of bats were present at Luplupwintem but, in 1977, only two bats were seen and local informants advised Hyndman and Menzies (1980) that several groups of hunters entered the cave and virtually eliminated the colony. The cave has a 100-meter drop at the entry, so hunters were keen enough to use ropes to get to their prey. A small number of bats were again resident in Luplupwintem in 1992 and 1993 (Flannery & Seri, 1993).

The species is likely to occur more widely as there are two other modern records; an animal shot in 1984 near Telefomin, Sandaun Province, and a recently hunted jawbone given to S. Hamilton in 1995 in the Eastern Highlands (Bonaccorso, 1998).

All that is know about the species' ecology is that it is probably frugivorous and inhabits large, deep, inaccessible caves. It probably commutes large distances to forage.

The Project surveys suggested an undiscovered colony could occur in large caves in the higher karst areas of the Upstream Project Area. This remains unconfirmed but the preconstruction surveys have been made aware of the species and the discovery of a large cave, even though there was no confirmation the species was present, resulted in precautionary redesign of Project components.

5.2.2.3 High-altitude Forest Above 1,800 Meters on the Homa Deviation

The area above 1,800 meters altitude between Homa and Hides has similar qualities to Hides Ridge. It is largely weed-free and has one of the highest mammal diversities in the Upstream Project Area. However, it differs from Hides Ridge in two fundamental ways: it is not a pure karst area and hence has generally better soils, and it is crossed by the walking trail from Homa to the settlement of Benaria. Regarding the biodiversity values, high-altitude forest contains excellent forest area and condition, high diversity of flora and high diversity of fauna. Construction through this area will require similar erosion control and regeneration management as for Hides Ridge.

5.2.2.4 Lake Kutubu Wildlife Management Area

The Lake Kutubu Wildlife Management Area (WMA) of 25,455 hectares is the only WMA that the Project footprint intersects. The high degree of fish endemism and the fact that the area is a WMA warrants special consideration of this area. Other than Lake Kutubu, there are four other government conservation areas in the Upstream Project Area[17], none of which are impacted by the Project. Box 5.5 provides a full description of the Lake Kutubu WMA.

Eleven other areas of particular biodiversity significance in the southern section of the Upstream Project Area have been identified by WWF (Figure 5.4). As yet, none of these WWF significant biological areas have received official recognition as a reserve within PNG.

5.2.3 Focal Habitats

Biodiversity values are captured at the small or local scale in several habitat types and areas that require special focus for avoidance and mitigation measures. These are described below.

[17] Neiru/Aird Hills WMA of 3,963 hectares southeast of Kopi, Libano–Arisai WMA of 3,964 hectares on Libano Creek, Libano–Hose WMA of 7,736 hectares adjoining Libano–Arisai, and Sulamesi WMA of 86,451 hectares on Mount Bosavi.

Figure 5.4: Areas of biodiversity significance recognized by WWF