

Environmental and Social Impact Assessment Report (ESIA) – Part 9

Project Number: 51112-001
August 2018

INO: Jawa-1 LNG to Power Project

Prepared by ERM for PT Jawa Satu Power (JSP)

The environmental and social impact assessment is a document of the project sponsor. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "Terms of Use" section of this website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of or any territory or area.



PLTGU Jawa 1 Independent Power Project

ANNEX J: BIODIVERSITY ASSESSMENT & MANAGEMENT PLANNING

Prepared for:

PT Jawa Satu Power (JSP)

www.erm.com

ANNEX J

Critical Habitat Screening Assessment

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
1.	<i>Acridotheres melanopterus</i>	Black-winged Myna	CR	iBAT	X	X		<p>The species is endemic to the island of Java, Indonesia. The last few remaining wild individuals appear restricted to mangrove areas. The remaining wild population has been estimated to number only around 20 individuals.</p> <p>No records exist for the project area and it is unlikely to support any individuals. Historic range is >50,000km² however current range is extremely limited.</p>	Although habitat is present for the species, individuals are likely to have been extirpated from the project area and DMU.	No	<p>The species is recorded in mangrove habitat. Mangrove habitat is present at the project site. Information on the location of the remaining population is not readily available.</p> <p>No recent records of the species have been recorded within the DMU. It is expected that the species has been extirpated from the Project Area and DMU. The thresholds for Criterion 1 or 2 have not been met. Critical Habitat has not been recorded for this species.</p>
2.	<i>Alcedo euryzona</i>	Javan Blue-banded Kingfisher	CR	iBAT	X	X		<p>This species is restricted to rivers in lowland forest and, as such, is suspected to be undergoing a continuing population decline as a result of significant losses in the extent of this habitat throughout its range.</p> <p>There are very few recent records, including two reports of individuals seen in Gunung Halimun National Park in June</p>	Although habitat is present for the species, individuals are likely to have been extirpated from the project area and DMU.	No	<p>The species is recorded to occur along rivers in lowland forest. This habitat type is present within the DMU.</p> <p>The thresholds for Criterion 1 or 2 are likely not to be met. Critical Habitat has not been recorded for this species within the DMU.</p>

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								2009 and 2014. Historic range is >50,000km ² however current range is extremely limited.			
3.	<i>Ardea alba</i>	Great Egret	LC	ERM Survey			X	The species inhabits all kinds of inland and coastal wetlands although it is mainly found along the coast in the winter. The number of mature individuals is estimated at 590,000-2,200,000.	Preferred habitat is located in the DMU	Yes	The species is migratory and was identified in the AoI. Given the large numbers of the species globally, it is unlikely that the numbers within the DMU would meet the thresholds for Critical Habitat
4.	<i>Bubulcus ibis</i>	Cattle Egret	LC	ERM Survey			X	Most populations of this species are partially migratory, making long-distance dispersive movements related to food resources in connection with seasonal rainfall. The species inhabits open grassy areas such as meadows, livestock pastures, semi-arid steppe and open savanna grassland subject to seasonal inundation, freshwater swamps, rice-fields, wet pastures and irrigated grasslands. The population is estimated to number 4,000,000-9,850,000 individuals.	Preferred habitat is located in the DMU	Yes	The species is migratory and was identified in the AoI. Given the large numbers of the species globally, it is unlikely that the numbers within the DMU would meet the thresholds for Critical Habitat Criterion 3.
5.	<i>Bulweria fallax</i>	Jouanin's Petrel	NT	iBAT			X	Species out of range IUCN Red List	-	-	Not assessed
6.	<i>Calidris tenuirostris</i>	Great Knot	EN	iBAT	X		X	This species breeds in north-east Siberia, Russia, wintering mainly in Australia, but also throughout the	Although habitat is present for the species,	No	The species is recorded to occur in estuaries and intertidal mudflats. No individuals were

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								coastline of South-East Asia. On passage during August and October the species stages in estuaries and on intertidal mudflats.	individuals are likely to only occasionally visit the DMU.		recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 or 3 as the population thresholds would not be met within the DMU.
7.	<i>Calonectris leucomelas</i>	Streaked Shearwater	LC	iBAT			X	This species is found in the western Pacific, breeding on the coast and on offshore islands of Japan, Russia, and on islands off the coasts of China, North Korea and South Korea. It migrates south during winter, being found off the coasts of Vietnam, New Guinea, the Philippines, Australia, southern India and Sri Lanka. It is listed as native to Indonesia. The estimated global population is c.3,000,000 individuals	Preferred habitat is located in the DMU	No	The species is migratory and was identified in the AoI. Given the large numbers of the species globally, it is unlikely that the numbers within the DMU would meet the thresholds for Critical Habitat
8.	<i>Centropus nigrorufus</i>	Javan Coucal		EBA		X		The species is endemic to Indonesia, where it occurs on Java. It is now scarce or rare, sparsely distributed, although it may be under-recorded. The population size is preliminarily estimated to fall into the band 2,500-9,999 mature individuals. The species is a sedentary resident of mangroves and associated swamps in the	Preferred habitat is located in the DMU	No	The species is endemic and is an EBA trigger species. The extent of occurrence however does not trigger the endemic/restricted range thresholds under Criterion 3. The DMU is not Critical habitat.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								coastal lowlands. It occurs in freshwater swamps and grassland scrub adjacent to brackish water swamps. Estimated extent of occurrence (EOO) - 100,000km ² :			
9.	<i>Charadrius javanicus</i>	Javan Plover		EBA	X			The species was previously considered to only be found Java and the Kangean Islands, Indonesia, but has also been recently reported from Sumatra, Sulawesi and the Lesser Sundas, including Timor-Leste. Estimated extent of occurrence (EOO) - 1,000,000km ² . It occurs on sandy beaches, mudflats and adjacent open areas around coasts.	Preferred habitat is located in the DMU	No	The species is endemic and is an EBA trigger species. The extent of occurrence however does not trigger the endemic/restricted range thresholds under Criterion 3. The DMU is not Critical habitat.
10.	<i>Egretta sacra</i>	Pacific Egret	Reef LC	ERM Survey			X	This species is migratory. The global population is estimated to number 100,000-1,000,000 individuals. The current population is estimated to be stable. The species inhabits coastal areas and nearby coastal floodplains.	Preferred habitat is located in the DMU	Yes	The species is migratory and was identified in the AoI. Given the large numbers of the species globally, it is unlikely that the numbers within the DMU would meet the thresholds for Critical Habitat Criterion 3.
11.	<i>Fregata andrewsi</i>	Christmas Frigatebird	CR	iBAT	X		X	This species is endemic as a breeding species to Christmas Island (in Australia). Breeding and non-breeding birds have been recorded foraging at low densities in the Indo-Malay Archipelago. The seas around West Java, Indonesia seem to be important during the	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	The species is recorded to occur in open water and nearby areas (Jakarta Bay). No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								non-breeding season, especially in Jakarta Bay.			species under Criterion 1 or 3 as the population thresholds would not be met within the DMU.
12.	<i>Gracula robusta</i>	Nias Myna	Hill	CR	iBAT	X		Project area is outside of the species recorded range	-	-	Not Assessed
13.	<i>Gracula venerata</i>	Tenggara Myna	Hill	EN	iBAT	X		This species is heavily targeted by trappers for the cage bird trade throughout its range and is suspected of undergoing a rapid population decline within the recent past, which is anticipated to be ongoing and to have already reduced numbers of mature individuals to below 10,000 globally.	No preferred habitat within the DMU	No	The species is recorded to occur in forested areas. This habitat type is not present within the DMU. The thresholds for Criterion 1 or 2 have not been met. Critical Habitat has not been recorded for this species.
								Lesser Sundas from Lombok and Sumbawa East to Pantar and Alor. The species is listed as being primarily arboreal.			
14.	<i>Gracupica jalla</i>	Javan Starling	Pied	CR	iBAT	X	X	Wild populations have been reduced to a tiny remnant area in a remote area of central Java and Palau Dua Nature Reserve.	No preferred habitat within the DMU	No	The species is recorded to occur outside of the project area.
15.	<i>Hydrobates matsudairae</i>	Matsudaira's Storm-Petrel		DD	iBAT		X	Species out of range IUCN Red List	-	-	Not assessed
16.	<i>Meiglyptes tristis</i>	White-rumped Woodpecker		EN	iBAT	X	X	The species is restricted to western Java, Indonesia, where it is described as rare. The species is found in primary and secondary forests including rather open	Although habitat is present for the species, individuals are likely to only	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								coastal habitats as well as inland. It is most common at edges, around clearings and in areas of second growth in forest and uses mature rubber stands and orchards. The total population is likely to be fewer than 2,500 mature individuals	occasionally visit the DMU.		triggered for this species under Criterion 1 or 3 as the population thresholds would not be met within the DMU.
17.	<i>Mycteria cinerea</i>	Milky Stork	EN	iBAT	X			The global population of the species is estimated at fewer than 5000 individuals with 100-150 individuals in Java. The species is a predominantly coastal resident in Indonesia and Malaysia, inhabiting mangroves and adjacent, less saline, swamps. It forages on tidal mudflats, in saline pools, freshwater marshes, fishponds and rice-fields.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 or 3 as the population thresholds would not be met within the DMU.
18.	<i>Numenius madagascariensis</i>	Far Eastern Curlew	EN	iBAT	X		X	<p>This species breeds in eastern Russia and winters across SE Asia, including Indonesia. The majority of the population winters in Australia.</p> <p>The global population has recently been estimated at 32,000 individuals. During the wintering season the species is essentially coastal, occurring at estuaries, mangrove swamps, saltmarshes</p>	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 or 3 as the population thresholds would not be met within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								and intertidal flats, particularly those with extensive seagrass.			
19.	<i>Pavo muticus</i>	Green Peafowl	EN	iBAT	X		X	The population estimate for this species is 15,000-30,000 individuals. The only sizeable remaining populations are found in dry forests in Cambodia Myanmar and west-central Vietnam. Outside of this region populations persist throughout SE Asia, including on Java in Indonesia. The sub species contained within Java is considered endemic. Green peafowl are found in a wide range of habitats including primary and secondary forest, both tropical and subtropical, as well as evergreen and deciduous	No dry forested habitats exist within the DMU	No	The species is recorded to occur in forested areas. This habitat type is not present within the DMU. The thresholds for Criterion 1 or 2 have not been met. Critical Habitat has not been recorded for this species.
20.	<i>Phaethon lepturus</i>	White-tailed Tropicbird	LC	iBAT			X	This species can be found across much of the tropical oceans, including the southern Indian Ocean, western and central Pacific, and south Atlantic Ocean. It can be found over pelagic waters and the coast of tropical and subtropical seas. The global population is estimated to number > c.50,000 individuals	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 3 as the population thresholds would not be met within the DMU.
21.	<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	LC	iBAT			X	Not listed in IUCN Red List as present within Indonesia	-	-	Not assessed

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
22.	<i>Plegadis falcinellus</i>	Glossy Ibis	LC	ERM Survey			X	The species is a nomadic migrant and feeds in very shallow water and nests in freshwater or brackish wetlands with tall dense stands of emergent vegetation and low trees or bushes. The global population is estimated at 230,000-2,220,000 individuals.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 3 as the population thresholds would not be met within the DMU.
23.	<i>Stachyris grammiceps</i>	White-breasted babbler	NT	iBAT		X		This species has a highly restricted and fragmented range, being limited to a small number of remnant forested sites on Java. The estimated extent of occurrence is 68,600km ² .	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 2 as extent of occurrence threshold is not met.
24.	<i>Stachyris melanothorax</i>	Crescent-chested babbler	LC	iBAT		X		Endemic species of Indonesia. The estimated extent of occurrence is 141,000km ² .	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 2 as extent of occurrence threshold is not met.
25.	<i>Stachyris thoracica</i>	White-bibbed babbler	LC	iBAT		X		Endemic species of Indonesia. The estimated extent of occurrence is 142,000km ² .	Although habitat is present for the species, individuals are likely to only	No	No individuals were recorded at the project site. Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
									occasionally visit the DMU.		Criterion 2 as extent of occurrence threshold has not been met.
26.	<i>Vanellus macropterus</i>	Sunda lapwing	CR	iBAT; EBA	X			The species is known with certainty only from the island of Java, where it inhabited marshes and river deltas in the west (on the north coast) and the east (on the south coast). It was described as local and uncommon, apparently only ever encountered in scattered pairs, and has not been recorded since 1940.	Although habitat is present for the species, individuals are unlikely to be present within the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 3 as the DMU is unlikely to support <95% of the species population.
27.	<i>Zosterops flavus</i>	Javan eye	White-eye	VU	iBAT; EBA		X X	The species is no longer abundant at any location and has declined or disappeared from multiple locations across its highly restricted and fragmented range. The population on Java is restricted in range and highly localised. This species occurs in mangroves, coastal scrub, relict coastal forest and scattered trees. The estimated extent of occurrence is 17,700km ² . Historic records for the species exist within 10km of the project site (HBW Live, 2018).	Habitat is present for the species, individuals are likely to occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 3 as the DMU is unlikely to support <95% of the species population. The extent of occurrence for an endemic/restricted range species does meet the threshold for Criterion 2, Tier 2 (being less than 50,000km ²) within the DMU. This species triggers Critical Habitat
28.	<i>Aetomylaeus maculatus</i>	Mottled Ray	Eagle	EN	iBAT	X		The species occurs on the inner continental shelf to depths of about 60 m over soft sandy substrate. It is	Although habitat is present for the species,	No	Although individuals may use the project site, it is not considered that Critical Habitat

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								found in China, India, Indonesia, Malaysia, Singapore, Sri Lanka, Taiwan, and Thailand. It is caught regularly by demersal gillnet and trawl net fisheries that operate throughout its range.	individuals are likely to only occasionally visit the DMU.		would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
29.	<i>Aetomylaeus vespertilio</i>	Ornate Ray	Eagle	EN	iBAT	X		The species occurs on the inner continental shelf to depths of 110 m over soft sandy substrate. The species appears to be naturally uncommon and is rarely observed. Nothing is known of its overall population size or structure.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds and extent of occurrence thresholds for Critical Habitat under Criterion 1, 2 and 3 are unlikely to be met within the DMU.
30.	<i>Anoxypristis cuspidata</i>	Narrow Sawfish		EN	iBAT	X		The species is an Indo-West Pacific species occurring from the northern Persian (Arabian) Gulf to Australia and north to Japan. While the current population size and abundance are unknown, it persists in most of its range states, but in substantially lower numbers than historically. This is a benthic-pelagic fish which is found at depths down to about 40 metres. It tolerates low salinity levels and is found in inshore	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								waters including bays and estuaries.			
31.	<i>Carcharhinus borneensis</i>	Borneo Shark	EN	iBAT	X			The species is known from very few records (most from Borneo), none of which are more recent than 1937. The Borneo Shark is an Indo-West Pacific species, recorded from Borneo (Kalimantan, Indonesia and Sarawak, Malaysia) and possible records also exist from Java. There are no species-specific data available on population numbers	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
32.	<i>Carcharhinus hemiodon</i>	Pondicherry Shark	CR	iBAT	X			<p>The species is a very rare Indo-West Pacific species is known from about 20 specimens in museums. The species was broadly distributed in the Indo-Pacific.</p> <p>The species historic range included the South China Sea; however the only current recorded sightings have been in Sri Lanka. This species inhabits inshore waters. There are no species-specific data available on population numbers.</p>	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 or 3 as the population thresholds are unlikely to be met within the DMU.
33.	<i>Eusphyra blochii</i>	Winghead Shark	EN	iBAT	X			This species is now rarely encountered in both India and Indonesia where it has previously been reported. It occurs on and near continental shelf waters of the Indo-West Pacific from the	Although habitat is present for the species, individuals are likely to only	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								Arabian/Persian Gulf through south Asia to northern Australia and Papua New Guinea. The species occurs on the continental shelves and is mainly found in coastal nearshore waters.	occasionally visit the DMU.		the population thresholds for Critical Habitat are unlikely to be met within the DMU.
34.	<i>Lamiopsis temminckii</i>	Broadfin Shark	EN	iBAT	X			The species has a sporadic distribution off Pakistan, India, Burma, Indonesia (Makassar Straits), Sarawak, and China. It occurs on the continental shelf, mostly close inshore.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
35.	<i>Pristis clavata</i>	Dwarf Sawfish	EN	iBAT	X			The species is now possibly now restricted to tropical waters of northern Australia. Historically, it apparently occurred more widely in the Indian Ocean region and South-East Asia	Unlikely to be present	No	Not Assessed
36.	<i>Pristis</i>	Large-tooth Sawfish	CR	iBAT	X			The species can be found worldwide in tropical and subtropical coastal regions, but it also enters freshwater and has been recorded in rivers. Historically it was widespread in the Indo-Pacific, ranging from South Africa to the Horn of Africa, India, Southeast Asia and Northern Australia	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU. Consultation regarding the

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
											current status of the species indicates that the species has been extirped from the Java Sea (W. White, Pers Comms 2018).
37.	<i>Pristis zijsron</i>	Green Sawfish	CR	iBAT	X			The species has a broad Indo-West Pacific distribution, from South Africa north along the east coast of Africa, through the Red Sea, Persian (Arabian) Gulf, southern Asia, Indo-Australian archipelago, and east Asia as far north as Taiwan and southern China. The species is considered to be rare than historically across its entire range. Australia has some of the last remaining viable populations.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU. Consultation regarding the current status of the species indicates that the species has been extirped from the Java Sea (W. White, Pers Comms 2018).
38.	<i>Rhincodon typus</i>	Whale Shark	EN	iBAT	X			The species has a circumtropical distribution through all tropical and warm temperate seas, apart from the Mediterranean. In Indonesia, the species have been sighted regularly at Weh Island (Aceh), Probolinggo (East Java), Talisayan (East Kalimantan), and Parigi (Central Sulawesi); Probolinggo (eastern Java) and Jakarta Bay.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
39.	<i>Sphyrna lewini</i>	Scalloped Hammerhead	EN	iBAT	X		X	The species is a coastal and semioceanic hammerhead shark	Although habitat is present for the	No	Although individuals may use the project site, it is not

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								that is circumglobal in coastal warm temperate and tropical seas, from the surface and intertidal to at least 275 m depth.	species, individuals are likely to only occasionally visit the DMU.		considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
40.	<i>Stegostoma fasciatum</i>	Zebra Shark	EN	iBAT	X			The species is a broadly distributed continental and insular shelf species of the Indo-West Pacific. It is usually found within a narrow band of shallow coral reef habitat and soft bottom. The species is likely to be locally extinct from several locations throughout Indonesia, including off the coast of Java.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Not Assessed as presumed locally extinct
41.	<i>Urogymnus polylepis</i>		EN	iBAT	X			The species is known to inhabit several large rivers and associated estuaries. The species is known from several disjunct freshwater localities in south and southeast Asia, from India to eastern Indonesia. In Indonesia it is recorded from Java, however there are no recent records of the species of both the Ciliwung and Cisidane drainages.	No preferred habitat within the DMU	No	Not Assessed
42.	<i>Urolophus javanicus</i>	Java Stingaree	CR	iBAT	X			Recorded from off Java, Indonesia, the species is only known from the type specimen and has not been	Habitat may exist for the species, however	No	Not Assessed as presumed locally extinct

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								recorded again since its discovery 150 years ago. Possibly extinct, on the verge of extinction or at least has suffered extreme range restriction and/or population declines	given that it has not been sited for 150 years, it is unlikely to be present		
43.	<i>Alveopora excelsa</i>		EN	iBAT	X			This species is fairly widespread and is uncommon throughout its range. This species is found in the central Indo-Pacific; South-east Asia; Japan; and South China Sea. This species is restricted to reef habitat .There is no species specific population information available for this species. However, there is evidence that overall coral reef habitat has declined.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
44.	<i>Alveopora minuta</i>		EN	iBAT	X			This species is fairly widespread and is uncommon throughout its range. This species is found in the central Indo-Pacific, including the Solomon Islands. This species is restricted to reef habitat .There is no species specific population information available for this species. However, there is evidence that overall coral reef habitat has declined.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
45.	<i>Anacropora spinosa</i>		EN	iBAT	X			This species is fairly widespread and is uncommon throughout its range. This species is found in the	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								central Indo-Pacific, Southeast Asia, Solomons, Japan and the East China Sea, and the oceanic west Pacific. This species is restricted to reef habitat. There is no species specific population information available for this species. However, there is evidence that overall coral reef habitat has declined.			
46.	<i>Holothuria lessoni</i>	Golden Sandfish	EN	iBAT	X			This species is widespread in the Indo-Pacific and is heavily exploited in Indonesia. Found on inner reef flats, coastal lagoons, seagrass beds, or sandflats at depths of 0 to 30 m.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
47.	<i>Holothuria scabra</i>	Golden Sandfish	EN	iBAT	X			This species is widespread throughout the Indo-Pacific between latitudes 30°N and 30°S, from South Africa to the Red Sea, India, China and Japan to Australia, and to Micronesia in the northeast and Tonga in the southeast. This species is distributed mainly in low energy environments behind fringing reefs or within protected bays and shores. Individuals prefer ordinary coastal areas to coral reefs, particularly intertidal seagrass beds	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								close to mangroves. The species is becoming very rare in Indonesia			
48.	<i>Lobophyllia serratus</i>		EN	iBAT	X			This species is fairly widespread and is uncommon throughout its range. This species is found in the central Indo-Pacific and Papua New Guinea. This species is restricted to reef habitat. There is no species specific population information available for this species. However, there is evidence that overall coral reef habitat has declined.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
49.	<i>Millepora boschmai</i>		CR	iBAT	X			This species was only found in the Gulf of Chiriquí, Panama, and most recently, in Indonesia. The population extent and distribution in Indonesia is unknown	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
50.	<i>Montipora setosa</i>		EN	iBAT	X			This species it is not widespread throughout its range and is rare. This species is found in the central Indo-Pacific. It is very poorly known and might be more widely distributed.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
								There is no species specific population information available for this species. This species is found in shallow, protected reef environments, including upper reef slopes. It prefers tropical reef			

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								environments. This species is found to at least 20 m.			
51.	<i>Pectinia maxima</i>		EN	iBAT	X			This species is not widespread and uncommon throughout its range. This species is found in the Coral Triangle and the Solomon Islands. There is no species specific population information available for this species. This species is found in shallow reef environments, protected from wave action and where the water is slightly turbid.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
52.	<i>Porites eridani</i>		EN	iBAT	X			This species is widespread and uncommon throughout its range. This species is found in the central Indo-Pacific, southeast Asia, and South China Sea. Palau and the Marianas Islands. This species is found in shallow, protected reef environments, generally to depths of 20 m. There is no species specific population information available for this species.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
53.	<i>Porites ornata</i>		EN	iBAT	X			This species is uncommon to rare. This species is found in the central Indo-Pacific, in the Coral Triangle. There is no species specific population information available for this species. This species is found in shallow, protected reef	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								environments, generally to depths of 15 m.			
54.	<i>Thelenota ananas</i>	Prickly Redfish	EN	iBAT	X			This species has a wide distribution range throughout the Indo-Pacific. This species is found along slopes and passes within reef zones and along outer reef flats to depths of 35 m, but is more common in waters from 10-20 m. There is no species specific population information available for this species.	Was not identified within the DMU	No	Not assessed as the species was not identified within the DMU.
55.	<i>Balaenoptera borealis</i>	Sei Whale	EN	iBAT	X			<p>The species has a mainly offshore distribution, occurring in the North Atlantic, North Pacific and Southern Hemisphere. The summer (Jan-Feb) distribution in the southern hemisphere is mainly in the zone 40-50°S in the South Atlantic and southern Indian oceans, and 45-60°S in the South Pacific.</p> <p>Known wintering grounds include a number of former low-latitude whaling grounds, including northeastern Brazil at 7°S, Peru at 6°S, and in earlier years of Angola and the Congo. No records exist for the species in Indonesia, however it</p>	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Individuals are not likely to use the project site. Further, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								may pass through waters during migrations.			
56.	<i>Balaenoptera musculus</i>	Blue Whale	EN	iBAT	X			The species is found in all oceans except the Arctic, but absent from some regional seas such as the Mediterranean, Okhotsk and Bering seas. No quantitative abundance estimates for western North Pacific blue whales are available. The migration patterns of blue whales are not well understood, but appear to be highly diverse. Some populations appear to be resident year-round in habitats of year-round high productivity, while others undertake long migrations to high-latitude feeding grounds.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Individuals are not likely to use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
57.	<i>Manis javanica</i>	Sunda Pangolin	CR	iBAT	X			The species is widely distributed geographically, occurring across mainland and island Southeast East Asia, from southern China and Myanmar through lowland Lao PDR, much of Thailand, central and southern Viet Nam, Cambodia, to Peninsular Malaysia, to Sumatra, Java and adjacent islands. There is virtually no information available on population levels of any species of Asian pangolin and	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
								no comprehensive population estimates. This species is found in primary and secondary forest, including lowland dipterocarp forest, and cultivated areas including gardens and oil palm and rubber plantations, including near human settlements.			
58.	<i>Nycticebus javanicus</i>	Javan Loris	Slow	CR	iBAT	X		This species is nocturnal and arboreal, and is found in secondary disturbed forest, in plantations and to some extent in primary forests. This species has been recorded at very low densities. Several surveys in large forest blocks revealed few or no slow loris (Ujung Kulon, Halimun-Salak, Gede Pangrango, Masigit Kareumbi, Slamet, and Dieng). Some small isolated populations persist in gardens and agricultural lands	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is widespread and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
59.	<i>Otomops formosus</i>	Java Mastiff Bat	Giant	DD	iBAT		X	The locality of this species is Tjibadak in western Java, Indonesia. The species is represented by four specimens collected in western Java (two in 1939 and two in 1990). This species could be more widespread than is currently known. The extent of occurrence is not known for this species.	Unlikely to be present		No individuals were recorded at the project site. It is unlikely that the species would be present within the DMU as the recorded sightings are in Western Java.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
60.	<i>Rhinolophus canuti</i>	Canut's Horseshoe Bat	VU	iBAT	X			This species is known from two localities on Java, Bali and one on Nusa Barong in Indonesia. This is a cave roosting species, probably in large colonies. It requires caves and intact forest, although it may occasionally forage over cultivated landscapes. Current records are restricted to Bali.	Unlikely to be present		No individuals were recorded at the project site. It is unlikely that the species would be present within the DMU as the recorded sitings are in Bali.
61.	<i>Chelonia mydas</i>	Green Turtle	EN	iBAT	X		X	The species has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters (Atlantic Ocean – eastern central, northeast, northwest, southeast, southwest, western central; Indian Ocean – eastern, western; Mediterranean Sea; Pacific Ocean – eastern central, northwest, southwest, western central).Indonesia has a few nesting beaches, one in the Meru Betiri National Reserve in East Java. The species live within shallow bays and protected shores	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 and 3 as neither nesting nor foraging has not been recorded at the site hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
62.	<i>Crocodylus siamensis</i>	Siamese Crocodile	CR	iBAT	X			The historic range of the Siamese crocodile included most of Southeast Asia. This species is now extinct in the wild or nearly extinct from most countries except Cambodia. Formerly it was found	Although habitat is present for the species, individuals are likely to have been extirpated		Not Assessed as presumed locally extinct.

No	Species	Common name	IUCN	Source	Criterion 1	Criterion 2	Criterion 3	Species information	Habitat within DMU	Record in AoI	CH Rationale
63.	<i>Eretmochelys imbricata</i>	Hawksbill Turtle	CR	iBAT	X		X	in Cambodia, Indonesia (Borneo and possibly Java), The species has a wide range, found predominantly in tropical reefs of the Indian, Pacific, and Atlantic Oceans. The species has been recorded in Jakarta Bay near to the project site. The habitat of the species for nesting is sandy beaches.	from the project area and DMU. Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although individuals may use the project site, none were identified during survey. It is not considered that Critical Habitat would be triggered for this species under Criterion 1 and 3 as neither nesting nor foraging has not been recorded at the site hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.
64.	<i>Orcaella brevirostris</i>	Irrawaddy Dolphin	EN	IUCN	X			Irrawaddy Dolphins inhabit coastal, shallow tropical and subtropical waters. They are often associated with river mouths or estuaries. They have a relatively high site fidelity.	Although habitat is present for the species, individuals are likely to only occasionally visit the DMU.	No	Although the project site could represent suitable habitat, it is not considered that Critical Habitat would be triggered for this species under Criterion 1 as the species is restricted known areas and dolphins do not have a common occurrence at the site and hence the population thresholds for Critical Habitat are unlikely to be met within the DMU.

Contents

<i>J. Biodiversity Offset Assessment</i>	<i>1</i>
<i>J.1 Background.....</i>	<i>1</i>
<i>J.2 Relevant Environmental Standards and Guidelines</i>	<i>1</i>
<i>J.3 Offset Rules.....</i>	<i>2</i>
<i>J.4 Residual impacts on biodiversity values</i>	<i>3</i>
<i>J.5 Biodiversity Offset Metric.....</i>	<i>4</i>
<i>J.6 BIODIVERSITY OFFSET CALCULATIONS AND RESULTS.....</i>	<i>4</i>
<i>J.6.1 Impact Site Habitat Hectare Calculations.....</i>	<i>4</i>
<i>J.6.2 Candidate Offset Site Habitat Hectare Calculations.....</i>	<i>6</i>
<i>J.7 Options for Biodiversity Offsets</i>	<i>8</i>
<i>J.8 Biodiversity offset Actions</i>	<i>11</i>
<i>J.9 Next Steps.....</i>	<i>13</i>

J. BIODIVERSITY OFFSET ASSESSMENT

J.1 BACKGROUND

Biodiversity offsets are designed to compensate for the residual biodiversity losses due to the Project. They are defined as (BBOP 2012):

“Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people’s use and cultural values associated with biodiversity.”

This section provides an analysis of the biodiversity offset options available for the Jawa 1 Project to achieve a no-net-loss of biodiversity values for Natural Habitats, as required by the ADB SPS.

J.2 RELEVANT ENVIRONMENTAL STANDARDS AND GUIDELINES

The relevant standards applicable to this project are:

- Asian Development Bank (ADB) Safeguard Policy Statement (SPS); and
- International Finance Corporation (IFC) Performance Standards (PS) (in particular, IFC PS6 *Biodiversity Conservation and Sustainable Management of Living Natural Resources*)

ERM has undertaken a biodiversity offsets assessment based on the guidance contained in the Business and Biodiversity Offset Program (BBOP) resource documents:

- Biodiversity Offset Design Handbook (*BBOP, 2012a*); and
- Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets (*BBOP, 2012b*).

The ADB SPS requires that standards are met in relation to Natural, Modified and Critical Habitats. These standards are outlined in **Table J-1** below.

Table J-1 *Standards required to be met by the ADB SPS in relation to the Modified, Natural and Critical Habitats*

Habitat Classification	Required Standard
Modified Habitat	The borrower/client will exercise care to minimize any further conversion or degradation of such habitat, and will, depending on the nature and scale of the project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of project operations.
Natural Habitat	<p>In areas of natural habitat, the project will not significantly convert or degrade such habitat, unless the following conditions are met:</p> <ul style="list-style-type: none"> • No alternatives are available. • A comprehensive analysis demonstrates that the overall benefits from the project will substantially outweigh the project costs, including environmental costs. • Any conversion or degradation is appropriately mitigated. <p>Mitigation measures will be designed to achieve at least no net loss of biodiversity. They may include a combination of actions, such as post-project restoration of habitats, offset of losses through the creation or effective conservation of ecologically comparable areas that are managed for biodiversity while respecting the ongoing use of such biodiversity by Indigenous Peoples or traditional communities, and compensation to direct users of biodiversity.</p>
Critical Habitat	<p>No project activity will be implemented in areas of critical habitat unless the following requirements are met:</p> <ul style="list-style-type: none"> • There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function. • The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised. <p>Any lesser impacts are mitigated</p>

J.3

OFFSET RULES

Offset rules and metrics are used to outline the approach to govern how offset are undertaken and to define the offset calculation methods used to establish the offsets required.

The BBOP guidance specifically requires the following biodiversity offset design steps:

- Ensuring that the development project meets all applicable laws, regulations and policies pertaining to biodiversity offsets;
- Establishing an effective process for Affected Communities to participate in designing and implementing the biodiversity offset;
- Describing the project's scope and predicted impacts on biodiversity, applying and documenting the steps in the mitigation hierarchy and using defensible metrics that properly account for biodiversity to calculate residual impacts;
- Identifying suitable opportunities (potential offset sites, activities and mechanisms) for achieving "like-for-like or better" biodiversity gains to balance the losses due to the development;
- Quantifying the required biodiversity gains to achieve a no net loss or net gain outcome of biodiversity values and selecting the preferred locations and activities to provide these gains; and
- Setting the specific offset activities and locations in a biodiversity offset management plan to guide implementation.

Additionally, IFC PS 6 outlines requirements for the implementation of a biodiversity offset, including:

- Clarifying the roles and responsibilities of all stakeholders;
- Setting up the legal arrangements to secure the biodiversity offset site(s);
- Developing a comprehensive biodiversity offset management plan;
- Establishing appropriate financial mechanisms to ensure that all necessary gains are delivered; and
- Setting up a system for monitoring, evaluation and adaptive management for the implementation of the conservation outcomes required for the offset.

ERM has used the approach as outlined by the Business and Biodiversity Offset Program (BBOP) (BBOP 2012a; BBOP 2012b), ADB SPS and IFC PS6 when developing the biodiversity offset approach for the Jawa 1 Project.

J.4

RESIDUAL IMPACTS ON BIODIVERSITY VALUES

The Jawa 1 Project will result in:

- Permanent loss of Natural Habitat, estimated to be 0.33ha of mangrove habitat;
- No impacts to Critical Habitat values have been identified; and
- No impacts to marine Natural Habitat is likely to occur following construction.

As required by the ADB SPS, a no-net-loss of biodiversity values is required to be achieved. In this regard, biodiversity offsets are required to offset the loss of 0.33ha of mangrove habitat.

J.5

BIODIVERSITY OFFSET METRIC

A biodiversity offset metric has been developed to determine the offsets required to offset residual impacts on biodiversity for the Jawa 1 Project. ERM has used the Habitat Hectare model (BBOP 2012a) to calculate the offset “quantum” required to compensate for the residual values lost.

This model captures the *type* (habitat and species), *amount* and *condition* of the habitat biodiversity values present on the impacted site and candidate offset sites. The basis of the analysis is calculating the change in condition (*loss*) at the impact site compared to the *gain* in condition at candidate offsets sites over time from management.

Offset metrics have been designed for the terrestrial biodiversity values using data on:

- Classification of habitat classes in the impact area (*Type*);
- Area of habitat classes from spatial analysis (*Amount*); and
- Land class condition assessment from field data (*Condition*).

Given that a candidate offset site has not been identified to offset the impacts of the Project, the range of Habitat Hectare values that would be required for an offset site has been determined. Two scenarios have been used to calculate the range of habitat hectares required based on area and condition values scores:

1. First scenario calculates the area required if the offset site is in high condition; and
2. Second scenario considers the offset site to be in low condition for the habitat types assessed.

This analysis will provide the range of habitat hectare values and hence the maximum and minimum area required to achieve the offset for each habitat type.

J.6

BIODIVERSITY OFFSET CALCULATIONS AND RESULTS

J.6.1

Impact Site Habitat Hectare Calculations

Habitat Baseline Condition Scores

The residual impact Habitat Hectare calculations are used to quantify the residual value of the impacted habitats. Areas of habitat types within the Project Area have been determined based on Habitat condition scores. These scores are used to set a baseline condition of the impact site against a habitat condition benchmark (set at a value of 1). The Habitat Hectare model relies on scores to define ‘vegetation quality’ being the degree to which the current vegetation differs from a ‘benchmark’ representing characteristics of a mature and apparently long-undisturbed stand of the same vegetation

community. Essentially, this method attempts to assess how ‘natural’ a site is by comparing it to the same vegetation type in the absence of major ecosystem changes that have occurred (Parkes et al 2003).

Table J-2 outlines the habitat class condition scores applied. These scores have been derived based on the definitions contained in IFC PS6 for “natural” and “modified” habitats and the definition of “degradation” of habitats (IFC, 2012). The scores applied have been derived to reflect the relative difference **(and hence ability to restore) the habitat.**

The mangrove habitat identified at the Jawa 1 Project is considered to be degraded habitat.

Table J-2 *Habitat Condition Scores (A)*

Condition	Definition	Value
Benchmark	Being habitats in a mature condition with only native origin vegetation, a diversity of species of a mature or senescent state; and no sign of human disturbance (such as the presence of waste, vegetation removal).	1
Natural	High condition is defined as habitat largely of native origin, and/or where human activity has not essentially modified the primary ecological functions and species composition. Some disturbance is likely present such as vegetation removal, waste and minor introduction of invasive species.	0.75
Modified	Moderate condition habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition	0.5
Degraded	Degraded condition is defined as significant conversion or degradation of the habitat such as the elimination or severe diminution of the integrity of a habitat caused by a major and/or long-term change in land or water use; or (ii) a modification that substantially minimizes the habitat’s ability to maintain viable populations of its native species	0.25

Habitat Hectare Calculation Formula (Impact Site)

The following formula has been used to calculate the Habitat Hectares of the residual values of the impacted habitats:

Area of Habitat Type (A) x Habitat Type Condition (B) = Habitat Hectares

Results of Habitat Hectare Calculations for the Impact Site

The results of the calculations are outlined in **Table J-3.**

Table J-3 **Calculation of Impact Area Habitat Hectares**

Habitat Type	Habitat Type Condition	Condition Score(A)	Habitat Type Area* (B)	Habitat Hectares Impact Area
Mangrove	Natural	0.75	0.33	0.248

**Areas of residual impacts on natural habitat (See section 2.1)*

The number of Habitat Hectares that require to be offset to achieve a no-net-loss of biodiversity values is 0.0825 Habitat Hectares for mangrove patches.

J.6.2 **Candidate Offset Site Habitat Hectare Calculations**

The management of candidate offset sites enables biodiversity value “gains” and hence enables impacts to be offset (that is, compensate for losses). This is calculated based on the expected outcomes from positive interventions from management actions at the offset site to improve biodiversity values.

The gains in condition value are relative to the existing condition of the offset site. Sites with an existing high condition are likely to have an incrementally smaller improvement in biodiversity condition values through management over time. Sites with a lower baseline condition have a greater capacity to improve from conservation management over time.

Offset Gain Period

The time period chosen for management of the offset areas has been 25 years. This period has been chosen as this equates to the agreed lease arrangement time for the operation of the Project.

Information provided by the International Union for the Conservation of Nature (IUCN) indicates that mangrove forest growth mature from a seedling to a height of around 14 to 18m in height in 30 years (subject to favourable environmental and site conditions). Further work by Marchand (Marchand M, 2008) indicates that mangrove forests can reach a “mature” condition within 50 years through natural regeneration and selective planting in coastal areas of Indonesia (also subject to favourable environmental and site conditions). A conservative approach has been taken to determine the gain period, with a 50% reduction in estimated maturation stage being applied to the calculations below, assuming that 52% of the value of Benchmark vegetation from Degraded vegetation can be achieved after 25 years.

Offset Gain Scores

Offset gain scores are derived based on the relative gain in condition available from the Habitat Condition Baseline Scores over the offset gain period (based on a 30-50 year timeframe to reach a mature state).

Offset gain scores have been derived based on the relative gain in condition available from the Habitat Condition Scores over the offset gain period (refer to discussion on Ecological Gain Period above). The offset gain scores outlined have been derived based on the relative time frames to achieve ecological restoration and the available Offset Gain Period. In the case of Natural state vegetation, a multiplier of 0.1125 (11.25%) increase in value is estimated to be achieved in 25 years; and 0.15 (15%) increase by 25 years. After 25 years of management, the condition of Natural vegetation would therefore be 90% of the condition of benchmark vegetation (0.75+ 0.15). It is also assumed that offset management over time will have diminishing results; hence the multiplier reduces over time. These gain scores are outlined in **Table J-4**.

ERM has considered the potential rate for failure of plantings; impacts from natural effects (such as coastal erosion) and lost biodiversity value during the time period of management to define these values.

The estimates of gain may vary in practice and require monitoring to determine if the estimation are accurate. Where significant variations occur in estimated value increases, additional management or increases in offset areas managed will need to be applied.

Table J-4 **Offset gain score (C1)**

Existing Site Condition	Base Condition Value	Gain 25 years	Gain 50 years
Natural	0.75	0.1125	0.15
Modified	0.5	0.15	0.2
Degraded	0.25	0.2	0.275

Habitat Hectare Calculation Formula (Offset site)

The formulas used to calculate the offset gains available from candidate offset areas are outlined below:

1. Calculation of Baseline Habitat Hectares:

Candidate Offset Habitat Condition Score (A1) x Area of Habitat Type (B1) = Candidate Offset Habitat Hectares (W)

2. Calculation of Habitat Hectare Gains:

Candidate Offset Habitat Condition Score (A1) + Candidate Offset Habitat Condition Score (Gain) (C1)] x Area of Habitat Type (B1) = Candidate Offset Habitat Hectares Gain (X)

3. Calculation of Offset Habitat Hectares:

Candidate Offset Habitat Hectares Gain (X) - Candidate Offset Baseline Habitat Hectares (W) = Candidate Offset Habitat Hectares (Y)

Results of Habitat Hectare Calculations Required for Offset Sites

Two scenarios have been determined to provide the range of areas required to offset the impacts on Habitats. The offset goal is to achieve the same number of Habitat Hectares impacted at the offset site.

The number of Habitat Hectares that are required to be offset to achieve a no-net-loss of biodiversity values is: 0.0825 Habitat Hectares for mangroves.

The results of the analysis to identify the range of areas required to achieve the offset goal are outlined in **Table J-5** below.

Table J-5 *Candidate Offset site Habitat Hectares*

Habitat Type Condition	Condition Score(A1)	Offset Gain Score (C1)	Habitat Type Area (B1)	Habitat Hectare Offset Area (W)	Habitat Hectare Gain Value (X)	Habitat Hectare Candidate Offset Value (Y)
Natural	0.75	0.15	1.65	1.24	1.49	0.25
Modified	0.5	0.2	1.25	0.625	0.875	0.25
Degraded	0.25	0.275	0.90	0.225	0.4725	0.25

* These areas are calculated using the habitat hectare formulae as outlined above.

From this analysis, the required range of areas of mangroves for difference condition classes to achieve a no-net-loss of biodiversity values for the habitat would be:

- 1.65ha of Natural condition mangroves; or
- 1.25ha of Modified condition mangroves; or
- 0.90ha of Degraded condition mangroves.

An assessment will be required to be undertaken of the proposed candidate offset site to determine the condition and hence available area to achieve a no-net-loss of biodiversity values. The chosen offset site is likely to contain a range of condition types and this will affect the final size of the offset site chosen. As required by the offset rules, it is intended that the site also be connected with other areas of natural habitat, areas of conservation interest or protected areas.

These requirements will be contained within the Biodiversity Offset Plan prepared for the chosen offset site.

J.7

OPTIONS FOR BIODIVERSITY OFFSETS

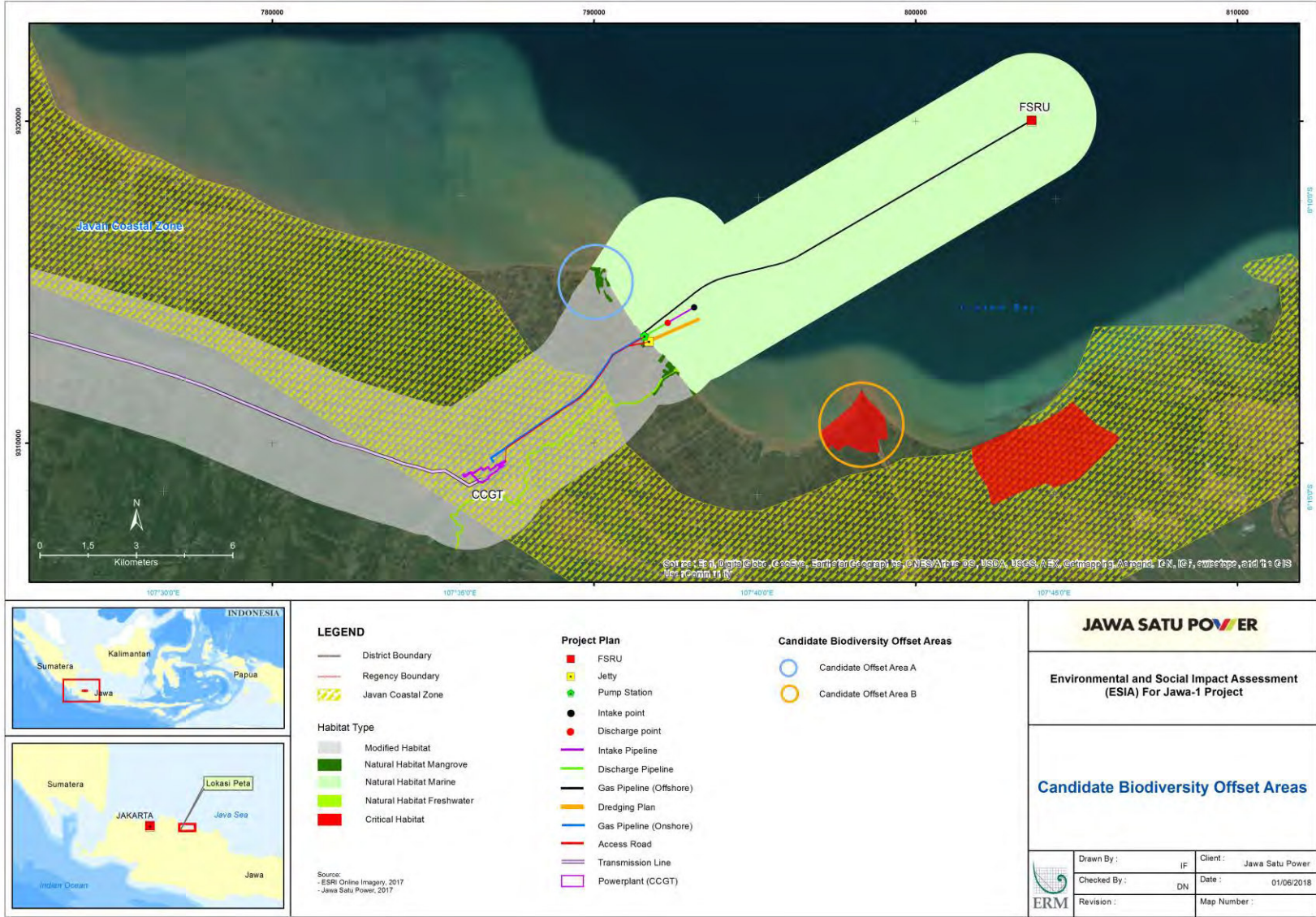
ERM has identified a range of options to deliver the required biodiversity offsets for the Jawa 1 Project. The following options have been identified based on stakeholder consultation, discussions with relevant experts and

research undertaken by ERM. These options relate to the delivery of offsets as required by IFC PS6.

- Option 1: Replanting and management of mangrove habitat along the coastal zone to the West of the Project Area
- Option 2: Replanting and protection of mangrove habitat within habitat identified for the Javan White Eye (*Zosterops flavus*) to the East of the Project Area

The two areas identified for potential biodiversity offsets are shown in **Figure J-1**.

Figure J-1 *Candidate Biodiversity Offset Areas*



The proposed biodiversity offset actions for the biodiversity offset site are outlined below (**Table J-6**). These actions will be refined and included in a Biodiversity Offset Plan for the Jawa 1 project.

Table J-6 *Recommended Offset Management Actions*

S/N	Management Action	Purpose	Description
1.	Management Plan	Defines governance framework for management of offset projects.	The management plan is to provide the roles, responsibilities, accountabilities, actions, resources and budgets available to actively manage biodiversity offset sites. Clear goals and objectives linked to the monitoring and evaluation framework should be set. Development of the management plan would normally be prepared through consultation with key stakeholders and participation of affected local communities.
2.	Patrols and enforcement	Outlines the patrols and enforcement requirements to protect wildlife and forest within the offset area	Patrols of forest areas should be undertaken in conjunction with the land manager to assess poaching, hunting, illegal logging, mining and other activities within the offset area. Prosecution action should be taken against individuals identified who are undertaking illegal activities.
3.	Monitoring and evaluation	Defines approach to monitor the implementation of management actions	The monitoring and evaluation framework is to define an approach to determine the effectiveness of the management actions in achieving biodiversity conservation goals. The approach should look at the institutional, financial and governance frameworks applied as well as relevant biodiversity indicators (species richness, basal area). The monitoring and evaluation should directly relate to goals and objectives set for offset management. The outcomes of the monitoring and evaluation should be used as a basis for (i) reporting to relevant stakeholders; and (ii) informing adaptive management actions, including the periodic update of management plans.
4.	Management of hunting	Manages threats to animals from illegal hunting and poaching.	The management of hunting should aim to monitor and enforce in conjunction with the Indonesia Government and the community, activities that illegally hunt and poach wildlife within the offset site. The approach should include: patrols and surveillance for illegal hunting activities; education and awareness; and incentives.

S/N	Management Action	Purpose	Description
5.	Sustainable forest product use (NTFP)	Manages unsustainable NTFP use.	The sustainable use of NTFP should focus on documenting cultural and heritage usage of NTFP; analysis of sustainable yield for NTFP; identifying alternatives where sustainable collection is identified; and education and awareness on sustainable collection practices.
6.	Management of weeds and pests	Manages threats to biodiversity from introduced weeds and pests.	Managing weeds and pests should: identify and monitor the distribution and abundance of weeds and pests in the area; identify appropriate controls at a spatial and temporal scale; define control techniques and actions. Actions may include active control of weeds or specific hunting programs for pest animals.
7.	Fire management	Manages impacts on biodiversity from inappropriate use of fire.	Managing fire should: identify historical fire regimes within the offset site at a spatial and temporal scale; determine ecological fire regimes based on intensity and frequency of fire; defining and map exclusion zones; consider threatened species responses to fire; and design ecological fire control methods.
8.	Assisted natural regeneration	Promotes biodiversity where natural regeneration is constrained due to past land use or ecological factors.	Assisted natural regeneration should focus on the establishment of relevant plant stock to assist natural regeneration of disturbed areas. Assessment and mapping of areas identified as being suppressed or degraded; determination of suitable plant stock and planting regime; collection and propagation of plant stock; preparation and management of regeneration areas. Local community engagement in horticultural activities is recommended.
9.	Community engagement and development	Provides consultative mechanisms and engages the community in active participation in biodiversity conservation.	Community engagement and development is designed to involve the local community in the management actions developed for each the offset sites. Consultation during the preparation of the management plans is required to ensure that the management actions and approaches are acceptable to the community. This can include direct engagement in undertaking actions (hunting patrols, employment at the nursery; manufacture of nest boxes).Community engagement is an essential component in determining the appropriateness and ensuring success of the sustainable forest practices and NTFP development.
10.	Education and awareness	Provides education and awareness for	Education and awareness approaches are integral to the success of offset management. This should include community engagement surveys; education

S/N	Management Action	Purpose	Description
		local communities to promote conservation.	seminars; posters and flyers; identification of community champions and incentives. Each management action should include an education and awareness component.

J.9

NEXT STEPS

The proposed next steps to implement the approach to implement that biodiversity offset are outlined in **Table J-7**.

Table J-7 *Next Steps to Implement the Biodiversity Offset*

S/N	Action	Responsibility	Timeframe
1.	Conduct consultation with the Indonesian Department of Forestry to determine the area to be subject to management	Consultant and proponent	Within 2 months
2.	Conduct community engagement with landowners in the potential biodiversity offset areas to determine current land use, ownership, income sources and opinions to support offset conservation	Consultant and proponent	Within 3 months
3.	Negotiate the biodiversity offset program with the community with support of the Department of Forestry	Consultant and proponent	Within 5 months
4.	Prepare a MoU with Indonesian Department of Forestry to undertake a 5 year rehabilitation plan for the confirmed area with an ability to continue the rehabilitation and maintenance for 25 years	Consultant and proponent; Indonesian Forestry Dept.	Within 7 months
5.	Undertake a costing of the BOMP and allocate budget on an annual basis (adjusted based on CPI)	Consultant	Within 9 months
6.	Prepare a BOMP for the offset area	Consultant	Within 10 months
7.	Undertake a costing of the BOMP and allocate budget on an annual basis (adjusted based on CPI);	Consultant	Within 11 months
8.	Discuss with local NGOs regarding offset delivery, including an assessment of their capacity and ability to deliver on offset rehabilitation	Consultant	Within 12 months
9.	Make contractual terms to ensure the delivery of the offset plan, including adaptive management frameworks	Proponent	Within 15 months

Title	Wildlife Shepherding Protocol
Document Reference	TBP
Last Updated	4 June 2018
Objective	A document outlining the steps to be undertaken as part of a responsible wildlife shepherding protocol

Wildlife Shepherding Team Requirements

All personnel involved will be briefed on the details of this plan and their respective roles before field activities begin. Personnel will also be equipped with mobile communication devices on the field to ensure that lines of communication are maintained during field activities and that the appropriate persons (e.g. veterinarians, wildlife handlers) are able to respond to exigencies in a timely manner.

Wildlife Shepherding Protocol

Step	Activity Description
General approach to wildlife shepherding (scheduled during daylight hours only i.e. 8am to 6pm)	
1	Installation of barriers (if required), which will function as a drift fence to guide target terrestrial fauna in the intended direction of movement and as a barrier to prevent wildlife displacement onto adjacent roads.
2	Systematic pattern of walking through the site, starting from the area furthest from and then gradually moving towards the identified refuge area, in order to shepherd wildlife in an intended direction of movement towards adjacent refuge habitats.
3	In conjunction with (2), the site will be carefully surveyed to check for the presence of target fauna species and any active dens.
4	Site inspection by an ecologist to ensure that no target fauna and active dens remain.
5	Closing of gaps in the barriers (if required) as soon as practicable to prevent target terrestrial fauna from returning to the site.
*To note	Steps (2) and (3) to be carried out repeatedly over a course of up to three weeks for a site no larger than twenty hectares.
General approach for target fauna encounters	
<i>Highly mobile fauna for which a passive shepherding approach is expected to be effective.</i>	
6a	Personnel to remain in place to allow fauna to move on their own accord. Generation of mild human noise disturbance (e.g. talking loudly) may be used to encourage fauna movement. However, no attempt should be made to capture or handle these species, unless the animal is visibly injured in which case experienced wildlife handlers will carefully capture the animal for immediate veterinary attention. If any individual fauna does not move on its own after sufficient time (i.e. up to one hour) has passed, the area where the individual is located should be GPS-marked and left overnight to provide additional opportunity for the individual to move on its own accord. Personnel shall return to the GPS-marked location on the following day to inspect the area. This process will be repeated until the individual has moved.
<i>Fauna for which a passive shepherding approach is expected to be unsafe and/or ineffective in guiding the individual fauna to move in an intended direction.</i>	
6b	A capture-and-release approach will be needed to ensure safe relocation of these fauna from the site prior to construction. Experienced wildlife handlers will carefully capture the animal for subsequent assessment and microchipping (where safe and possible) by a veterinarian. Where sensitive fauna (i.e. Chinese Pangolin) and venomous snakes from are concerned, their capture shall only be carried out by designated wildlife handlers who have been trained in the appropriate handling techniques.
Arboreal and aerial species	

Step	Activity Description
<i>Able to continue utilizing remnant habitats on the site during construction, and will not be excluded by the installed hoarding.</i>	
7	An ecologist shall inspect the tree for the presence of fauna, inhabited tree hollows, and nests.
8	In the event that the presence of arboreal mammals and herpetofauna, birds and/or bats are detected on the tree, tree felling or transplanting must be postponed until the animal has left the tree on its own accord.
9	In the event that an inhabited tree hollow is identified, tree felling or transplanting must be postponed until the animal has left the hollow on its own accord and the entrance to the hollow has been sealed to prevent re-entry.
10	Tree felling or transplanting shall not occur during the prime breeding season for local avifauna. In any case, if active nests are detected on the tree, nests shall be left undisturbed until nesting activities have been completed (i.e. the young have left the nest). In addition, inactive nests shall be removed to minimize the possibility of a new nesting attempt. Tree felling or transplanting shall occur only when no active nests are present on the tree.
11	Notwithstanding the aforementioned steps, after tree felling has occurred, an ecologist shall thoroughly search the fallen tree for any injured or trapped fauna that may have gone undetected. In the event that injured or trapped fauna are found, immediate veterinary attention shall be administered.



PLTGU Jawa 1 Independent Power Project

ANNEX K ELECTROMAGNETIC FIELD ASSESSMENT

Prepared for:

PT Jawa Satu Power (JSP)

www.erm.com

1. METHODOLOGY

The calculation of the impacts of the Electro Magnetic Field (EMF) is one of the factors which must be considered during the design process of a high voltage transmission lines. This will help to determine if the Right of Way (ROW) is sufficient to manage community health and safety issues as a result of the power line.

An excel based software developed by the Electrical Engineering Portal¹ for the calculation of EMF around the transmission and distribution overhead lines is used to calculate EMF for the 500kv transmission line proposed for the Project. The tool can be used to calculate one or two circuit lines in which ground wires can be incorporated. In addition, the tool allows combining and creating examples of power lines where two independent power lines can interact with each other. The EMF calculations used in this tool use the analytical approach described in The Electric Power Research Institute (EPRI) Red Book "Transmission Line Reference Book" and follow the guidance set out by the IFC/WB Group in the Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution. In addition, accuracy of these EMF calculations were checked with others commercial software.

1.1. INPUT DATA

The input data used for setting up the transmission tower and circuit lines is given in **Table 1.1** and shown in **Figure 1.1**.

Table 1.1 *Transmission Line Parameters*

		X [m]	Y [m]	U _{max} [kV]	I[A]	r _A [mm]	d _A [mm]	n	Ph-seq
Circuit 1	L1	-12.675	53.285	500	3724	28.60	450	4	1
	L2	-12.675	40.985	500	3724	28.60	450	4	2
	L3	-13.375	28.585	500	3724	28.60	450	4	3
	g.w.	-8.975	61.2	0	0	10	0	1	0
	g.w.	8.975	61.2	0	0	10	0	1	0
Circuit 2	L3	13.375	28.585	500	3724	28.60	450	4	3
	L2	12.675	40.985	500	3724	28.60	450	4	2
	L1	12.675	53.285	500	3724	28.60	450	4	1

X [m] – horizontal length from the middle of the line; Y [m] – height in which wires are suspended; U_{max} [kV] – maximum permissible line voltage; I [A] – maximum permissible line current (in case of bundle it is; determined for all wires); r_A [mm] – wire radius; d_A [mm] – distance between wires in bundle; n – number of wires in bundle; Ph-seq – phase sequence. 1 – L1, 2 – L2, 3 – L3, 0 – Ground Wire

¹ <http://electrical-engineering-portal.com/download-center/electrical-ms-excel-spreadsheets/emf-td-overhead-lines>

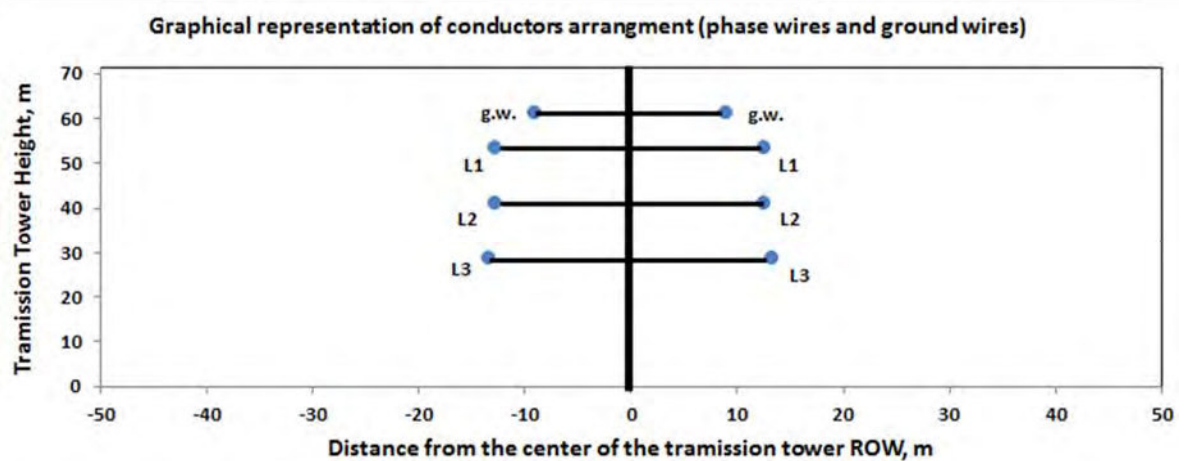


Figure 1.1 *Schematic Representation of Transmission Tower with Power Lines Arrangement*

2. **REGULATIONS**

Electric fields are normally measured in kilovolts per metre (kV/m), while magnetic fields are defined by magnetic flux density, measured in micro-tesla (μT) or milli-gauss. One micro-tesla is equivalent to 10 milli-gauss and 0.7974 Ampere/m. The Environmental, Health and Safety (EHS) Guideline² for Power Transmission and Distribution, published by WBG³, is the relevant guideline used in conducting this assessment. The EHS guideline refers to ICNIRP⁴ for the management of ELF for electricity transmission and distribution. **Table 2.1** shows the ICNIRP reference levels below which the proposed transmission line fields will be assessed against for regulatory compliance.

Table 2.1 *Reference Levels for Exposure to 50 Hz EMF*

Exposure Characteristics	Reference Levels			
	Electric Field Strength (kV/m)	Magnetic Flux Intensity		
		Micro-tesla (μT)	Milli-gauss (mG)	Ampere/m (A/m)
Occupational	10	500	5000	399
General Public	5	100	1000	80

² EHS Guidelines for Power Transmission and Distribution, April 30, 2007

³ World Bank Group

⁴ The International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic field (up to 300GHz) (<http://www.icnirp.de/PubEMF.htm>)