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REPORT

Central Térmica de Temane Project - Marine and Coastal Ecology Study

Moz Power Invest, S.A. and Sasol New Energy Holdings (Pty) Ltd

Submitted to:

World Bank Group

Submitted by:

Golder Associados Moçambique Limitada

6th Floor, Millenium Park Building, Vlademir Lenine Avenue No 174

Maputo, Moçambique

+258 21 301 292

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Executive Summary

Moz Power Invest, S.A. (MPI), a company to be incorporated under the laws of Mozambique, together with Sasol New Energy Holdings (Pty) Ltd (SNE), in a joint development agreement is proposing the construction and operation of a gas to power facility, known as the Central Térmica de Temane (CTT) project. During the CTT construction phase, large heavy equipment and materials will need to be brought in by a ship which will remain anchored at sea off the coast of Inhassoro. Equipment and materials will be transferred to a barge capable of moving on the high tide into very shallow water adjacent to the beach to discharge its cargo onto a temporary off-loading jetty (typically containers filled with sand) near the town of Inhassoro. This report presents a description of the baseline marine ecology environment and an assessment of the potential impacts of the construction and operation of the temporary landing facilities, anchorage points for the transhipment vessels, and barge movements between these two locations.

The CTT project will potentially affect marine biodiversity in three main ways; loss and disturbance of marine and coastal ecosystems of concern; loss and disturbance of fauna species of conservation concern, and creation of barriers to movement and collision risk for fauna species of concern. The construction of the temporary landing sites will cause minor land cover changes through vegetation clearance, and changes in local hydrodynamics, the effects of which will impact primary dune and sandy beach habitat. The main direct Project effect will be the possible creation of a transient barrier to movement of individuals of Dugong between southern and northern feeding grounds within the Critical Habitat Area of Analysis, as a result of increased vessel traffic between the anchorage point and beach landing sites, and the associated noise and potential vessel strike effects. However, the potential contribution of the Project to indirect/induced effects, i.e. population influx and increased fishing pressure in Bazaruto Bay, may be much more significant for Dugong populations due to increased rates of accidental bycatch.

Table of Contents

1.0 INTRODUCTION 1

2.0 DESCRIPTION OF THE KEY PROJECT COMPONENTS 4

2.1 Ancillary Infrastructure 5

2.2 Water and electricity consumption 7

2.3 Temporary Beach Landing Site and Transportation Route Alternative 7

2.4 Anchorage Points 9

3.0 LEGISLATION 11

3.1 National Legislation and Policy 11

3.2 International Conventions and Policies 12

3.3 International Best Practise Guidance and Policies 13

3.3.1 Critical Habitat 14

4.0 APPROACH AND METHODOLOGY 16

4.1 Scope of study 16

4.2 Study Area 17

4.3 Desktop review of available information 19

4.4 Impact Assessment Methodology and Rating Criteria 19

5.0 MARINE AND COASTAL BASELINE 21

5.1 Marine and Coastal Oceanography 21

5.1.1 Bathymetry 21

5.1.2 Spatial and temporal variability of physio-chemical regime of water masses 21

5.1.3 Water Circulation 22

5.1.4 Water Quality 26

5.2 Marine and Coastal Ecosystems 27

5.2.1 Coral Reefs 29

5.2.2 Seagrass Beds 29

5.2.3 Mangroves 30

5.2.4 Primary Dunes and Sandy Beaches 31

5.3 Marine and Coastal Fauna 31

5.3.1 Plankton 32

5.3.2 Invertebrates 32
5.3.3 Seahorses 33
5.3.4 Fish (excluding Sharks and Rays) 34
5.3.5 Sharks and Rays 35
5.3.6 Avifauna 36
5.3.7 Cetaceans 36
5.3.8 Dugong 36
5.3.9 Sea Turtles 41
5.3.10 Seals 41
5.4 Protected Areas and Species 41
5.4.1 Protected Areas 41
5.4.1.1 Nationally Designated Areas 41
5.4.1.2 Protected Habitats 42
5.4.2 Nationally Protected Species 42
5.4.3 Marine Species of Conservation Concern 42
5.5 Baseline Conclusion 44
6.0 CRITICAL HABITAT 45
6.1 Critical Habitat Area of Analysis 45
6.2 Species Triggers of CH 47
6.2.1 Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species 47
6.2.2 Criterion 2: Endemic and/or restricted-range species 2
6.2.3 Criterion 3: Migratory and/or congregatory species 2
6.3 Ecosystem Triggers of CH 5
6.3.1 Criterion 4: Highly threatened and/or unique ecosystems 5
6.3.2 Criterion 5: Key evolutionary processes 5
7.0 IMPACT ASSESSMENT 8
7.1 Receptors for Impact Assessment 8
7.2 Identified impacts – Temporary Beach Landing Sites 8
7.2.1 Construction impacts 8
7.2.2 Operational impacts 10
7.2.3 Decommissioning impacts 12

7.3 Identified impacts – Anchorage Points 13
7.3.1 Construction impacts 14
7.3.2 Operational impacts 15
7.3.3 Decommissioning impacts 16
7.4 Identified impacts – Barge Movements 16
7.4.1 Construction impacts 17
7.4.2 Operational impacts 17
7.4.3 Decommissioning phase impacts 19
7.5 Cumulative Impacts 19
8.0 ENVIRONMENTAL ACTION PLAN – TEMPORARY BEACH LANDING SITES 21
9.0 ENVIRONMENTAL ACTION PLAN – ANCHORAGE POINTS 26
10.0 ENVIRONMENTAL ACTION PLAN – BARGE MOVEMENTS 28
11.0 MONITORING PROGRAMME – MARINE ECOSYSTEMS AND SPECIES 29
12.0 CONCLUSIONS 30
13.0 REFERENCES 31

TABLES

Table 1: Critical Habitat identification criteria 14
Table 2: Thresholds for Tiers 1 and 2 of Critical Habitat (GN32, GN89; IFC PS6 2012) 15
Table 3: Scope of marine ecology study as defined in the ToR (Golder, 2015) 17
Table 4: Scoring system for evaluating impacts 19
Table 5: Impact significance rating 20
Table 6: Types of impact 21
Table 7: CITES-listed seahorse species in Mozambican waters 33
Table 8: Shallow-water fish species exp 34
Table 9: Reptile species of conservation concern associated with estuarine and coastal habitats in Study Area 43
Table 10: Critically Endangered and Endangered Species confirmed/with potential to occur in the CHAA 47
Table 11: Endemic species occurring within the CHAA 2
Table 12: Migratory/congregatory species potentially occurring within the CHAA 3
Table 13: Marine ecology receptors for impact assessment 8
Table 14: Temporary beach landing sites – construction impacts 10
Table 15: Temporary beach landing sites – operational impacts 12

Table 16: Temporary beach landing sites – decommissioning impacts 13
Table 17: Anchorage points – construction impacts 15
Table 18: Anchorage points - operational impacts 16
Table 19: Barge movements - operational impacts 18
Table 20: Environmental Action Plan – Temporary Beach Landing Sites 21
Table 21: Environmental Action Plan – Anchorage Points 26
Table 22: Environmental Action Plan – Barge Movements 28
Table 23: Monitoring programme – Marine ecosystems and species 29
Table 24: Critical Habitat Species Screening Results 37

Figure 1: Project Location 3
Figure 2: Examples of gas to power plant sites (source: www.industcards.com and www.wartsila.com) 4
Figure 3: Conceptual layout of CTT plant site 5
Figure 4: Typical beach landing site with barge offloading heavy equipment (source: Comarco) 6
Figure 5: Example of large equipment being offloaded from a barge. Note the levels of the ramp, the barge and the jetty (source: SUBTECH) 6
Figure 6: Heavy haulage truck with 16-axle hydraulic trailer transporting a 360 ton generator (source: ALE) 7
Figure 7: SETA Beach landing site and route at Inhassoro 8
Figure 8: Offshore Anchorage locations 10
Figure 9: Marine Ecology Study Area 18
Figure 10: Spatial distribution of surface salinity in two distinct seasons (ERM, 2017) 22
Figure 11: Bathymetry of the Mozambique Channel and the continental shelf off Madagascar in km (after Simpson 1974) with the major circulatory features indicated. Shaded areas are shallower than 1 km; hatched areas denote upwelling (after Lutjeharms, 2007) 23
Figure 12: Spatial distribution of salinity in the Sofala Bank (PSU) 24
Figure 13: Modelled tidal currents of Bazaruto Bay and adjacent Shelf areas 25
Figure 14: Marine ecoregions in the study area 28
Figure 15: Seagrass beds (green areas) within Bazaruto Bay (Guissamulo, 2006) 30
Figure 16: Crab species in red mangrove, Mangarelane area (Golder Associates, 2015) 31
Figure 17: Squid and cuttlefish caught in Bazaruto Bay (Golder Associates Africa, February 2015). 33
Figure 18: Capture fisheries observed during site visit (Golder Associates Africa, 2015) 35
Figure 19: Dugong distribution in relation to the Study Area (Guissamulo, 2006) 38
Figure 20: Adult dugong distribution 2012-2014 (EWT, 2015) 39
Figure 21: Breeding dugong distribution 2012-2014 (EWT, 2015) 40
Figure 22: Marine Critical Habitat Area of Analysis (CHAA) 46
Figure 23: Critical Habitat (Criterion 1) 6

Figure 24: Critical Habitat (Criteria 2-5) 7

FIGURES

Figure 1: Project Location 3

Figure 2: Examples of gas to power plant sites (source: www.industcards.com and www.wartsila.com) 4

Figure 3: Conceptual layout of CTT plant site 5

Figure 4: Typical beach landing site with barge offloading heavy equipment (source: Comarco) 6

Figure 5: Example of large equipment being offloaded from a barge. Note the levels of the ramp, the barge and the jetty (source: SUBTECH) 6

Figure 6: Heavy haulage truck with 16-axle hydraulic trailer transporting a 360 ton generator (source: ALE) 7

Figure 7: SETA Beach landing site and route at Inhassoro 8

Figure 8: Offshore Anchorage locations 10

Figure 9: Marine Ecology Study Area 18

Figure 10: Spatial distribution of surface salinity in two distinct seasons (ERM, 2017) 22

Figure 11: Bathymetry of the Mozambique Channel and the continental shelf off Madagascar in km (after Simpson 1974) with the major circulatory features indicated. Shaded areas are shallower than 1 km; hatched areas denote upwelling (after Lutjeharms, 2007) 23

Figure 12: Spatial distribution of salinity in the Sofala Bank (PSU) 24

Figure 13: Modelled tidal currents of Bazaruto Bay and adjacent Shelf areas 25

Figure 14: Marine ecoregions in the study area 28

Figure 15: Seagrass beds (green areas) within Bazaruto Bay (Guissamulo, 2006) 30

Figure 16: Crab species in red mangrove, Mangarelane area (Golder Associates, 2015) 31

Figure 17: Squid and cuttlefish caught in Bazaruto Bay (Golder Associates Africa, February 2015). 33

Figure 18: Capture fisheries observed during site visit (Golder Associates Africa, 2015) 35

Figure 19: Dugong distribution in relation to the Study Area (Guissamulo, 2006) 38

Figure 20: Adult dugong distribution 2012-2014 (EWT, 2015) 39

Figure 21: Breeding dugong distribution 2012-2014 (EWT, 2015) 40

Figure 22: Marine Critical Habitat Area of Analysis (CHAA) 46

Figure 23: Critical Habitat (Criterion 1) 6

Figure 24: Critical Habitat (Criteria 2-5) 7

APPENDICES

APPENDIX A
Critical Habitat Screening Results – Potential Species Triggers

ACRONYMS / ABBREVIATIONS

Acronym or Abbreviation	Full Term
ADI	Areas of Direct Influence
AII	Areas of Indirect Influence
BANP	Bazaruto Archipelago National Park
BOD	Biological Oxygen Demand
CGGT	Combined Cycle Gas Turbine
CH	Critical Habitat
CHAA	Critical Habitat Area of Analysis
CITES	Convention on International Trade in Endangered Species
COD	Chemical oxygen demand
CORDIO	Coral Reef Degradation in Indian Ocean
CPF	Central Processing Facility
CR	Critically Endangered
CTT	Central Térmica de Temane
DD	Data Deficient
DOC	Dissolved organic carbon
DNAIA	National Directorate of Environmental Impact Assessment
EN	Endangered
ES	Ecosystem Services
EQT	Environmental Quality Target
ESIA	Environmental and Social Impact Assessment
FSO	Floating, Storage and Offloading unit
GN	Guidance Note
IUCN	International Union for the Conservation of Nature
LC	Least Concern
IFC	International Finance Corporation

Acronym or Abbreviation	Full Term
NTU	Nephelometric Turbidity Unit
OCGE	Open Cycle Gas Engines
MITADER	Ministry of Land, Environment and Rural Development (Ministério da Terra, Ambiente e Desenvolvimento Rural
MPI	Moz Power Invest, S.A.
NT	Near Threatened
PAR	Photosynthetic Active Radiation
PS	Performance Standard
PSU	Practical Salinity Unit
SEPI	SASOL Exploration Production International
SNE	SASOL New Energy Holdings (Pty) Ltd
SP	Significance Points
TEC	Temane Energy Consortium (Pty) Ltd
VU	Vulnerable

1.0 INTRODUCTION

The Mozambican economy is one of the fastest growing economies on the African continent with electricity demand increasing by approximately 6-8% annually. In order to address the growing electricity demand faced by Mozambique and to improve power quality, grid stability and flexibility in the system, Moz Power Invest, S.A. (MPI), a company to be incorporated under the laws of Mozambique and Sasol New Energy Holdings (Pty) Ltd (SNE) in a joint development agreement is proposing the construction and operation of a gas to power facility, known as the Central Térmica de Temane (CTT) project. MPI's shareholding will be comprised of EDM and Temane Energy Consortium (Pty) Ltd (TEC). The joint development partners of MPI and SNE will hereafter be referred to as the Proponent. The Proponent propose to develop the CTT, a 450MW natural gas fired power plant.

The proposed CTT project will draw gas from the Sasol Exploration and Production International (SEPI) gas well field via the phase 1 development of the PSA License area, covering gas deposits in the Temane and Pande well fields in the Inhassoro District and the existing Central Processing Facility (CPF). Consequently, the CTT site is in close proximity to the CPF. The preferred location for the CTT is approximately 500 m south of the CPF. The CPF, and the proposed site of the CTT project, is located in the Temane/Mangugumete area, Inhassoro District, Inhambane Province, Mozambique; and approximately 40 km northwest of the town of Vilanculos. The Govuro River lies 8 km east of the proposed CTT site. The estimated footprint of the CTT power plant is approximately 20 ha (see Figure 1).

Associated infrastructure and facilities for the CTT project will include:

1) Electricity transmission line (400 kV) and servitude; from the proposed power plant to the proposed Vilanculos substation over a total length of 25 km running generally south to a future Vilanculos substation. [Note: the development of the substation falls outside the battery limits of the project scope as it is part of independent infrastructure authorised separately (although separately authorised, the transmission line will be covered by the Project ESMP, and the Vilanculos substation is covered under the Temane Transmission Project (TTP) Environmental and Social Management Plans). Environmental authorisation for this substation was obtained under the STE/CESUL project. (MICOA Ref: 75/MICOA/12 of 22nd May 2012)];

2) Piped water from one or more borehole(s) located either on site at the power plant or from a borehole located on the eastern bank of the Govuro River (this option will require a water pipeline approximately 11km in length);

3) Access road; over a total length of 3 km, which will follow the proposed water pipeline to the northeast of the CTT to connect to the existing Temane CPF access road;

4) Gas pipeline and servitude; over a total length of 2 km, which will start from the CPF high pressure compressor and run south on the western side of the CPF to connect to the power plant;

5) Additional nominal widening of the servitude for vehicle turning points at points to be identified along these linear servitudes;

6) A construction camp and contractor laydown areas will be established adjacent to the CTT power plant footprint; and

7) Transhipment and barging of equipment to a temporary beach landing site and associated logistics camp and laydown area for the purposes of safe handling and delivery of large oversized and heavy equipment and infrastructure to build the CTT. The transhipment consists of a vessel anchoring for only approximately 1-2 days with periods of up to 3-4 months between shipments over a maximum 15 month period early in the construction phase, in order to offload heavy materials to a barge for beach landing. There are 3 beach landing site options, namely SETA, Maritima and Briza Mar (Figure 7). The SETA site is considered to be

the preferred beach landing site for environmental and other reasons; it therefore shall be selected unless it is found to be clearly not feasible; and

8) Temporary bridges and access roads or upgrading and reinforcement of existing bridges and roads across sections of the Govuro River where existing bridges are not able to bear the weight of the equipment loads that need to be transported from the beach landing site to the CTT site. Some new sections of road may need to be developed where existing roads are inaccessible or inadequate to allow for the safe transport of equipment to the CTT site. The northern transport route via R241 and EN1 is considered as the preferred transport route (Figure 8).

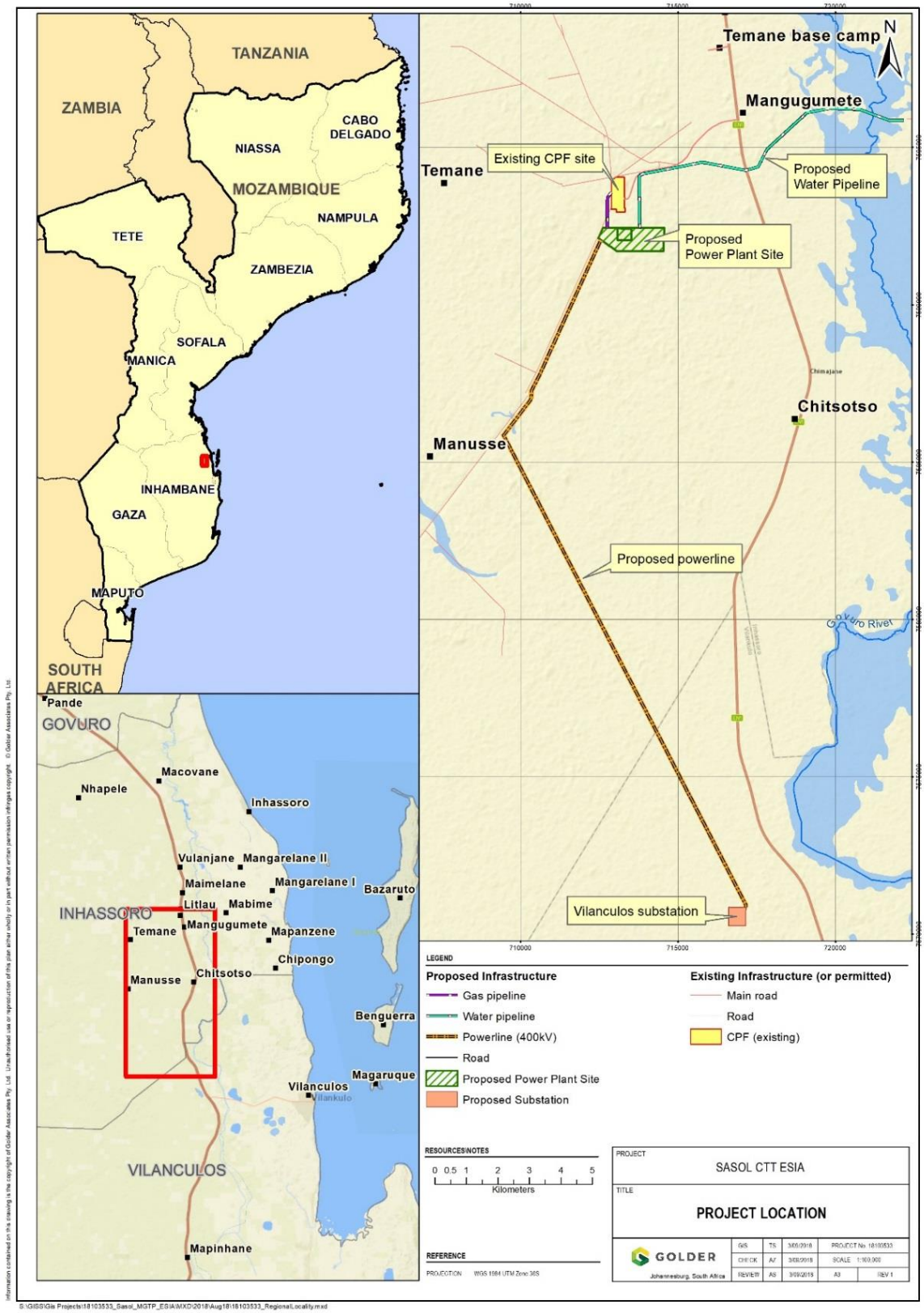

Figure 1: Project Location

2.0 DESCRIPTION OF THE KEY PROJECT COMPONENTS

The CTT project will produce electricity from natural gas in a power plant located 500m south of the CPF. The project will consist of the construction and operation of the following main components:

- Gas to Power Plant with generation capacity of 450MW;
- Gas pipeline (±2 km) that will feed the Power Plant with natural gas from the CPF;
- 400kV Electrical transmission line (± 25 km) with a servitude that will include a fire break (vegetation control) and a maintenance road to the Vilanculos substation. The transmission line will have a partial protection zone (PPZ) of 100m width. The transmission line servitude will fall inside the PPZ;
- Water supply pipeline to one or more borehole(s) located either on site or at boreholes located east of the Govuro River;
- Surfaced access road to the CTT site and gravel maintenance roads within the transmission line and pipeline servitudes;
- Temporary beach landing structures at Inhassoro for the purposes of delivery of equipment and infrastructure to build the power plant. This will include transhipment and barging activities to bring equipment to the beach landing site for approximately 1-2 days with up to 3-4 months between shipments over a period of approximately 8-15 months;
- Construction camp and contractor laydown areas adjacent to the CTT power plant site; and
- Temporary bridge structures across Govuro River and tributaries, as well possible new roads and/or road upgrades to allow equipment to be safely transported to site during construction.

Figure 2: Examples of gas to power plant sites (source: www.industcards.com and www.wartsila.com)

The final selection of technology that will form part of the power generation component of the CTT project has not been determined at this stage. The two power generation technology options that are currently being evaluated are:

- Combined Cycle Gas Turbine (CCGT); and
- Open Cycle Gas Engines (OCGE).

Please refer to Chapter 4 of the main ESIA document for further details on the technology option.

At this early stage in the project a provisional layout of infrastructure footprints, including the proposed linear alignments is indicated in Figure 1. A conceptual layout of the CTT plant site is shown below in Figure 3.

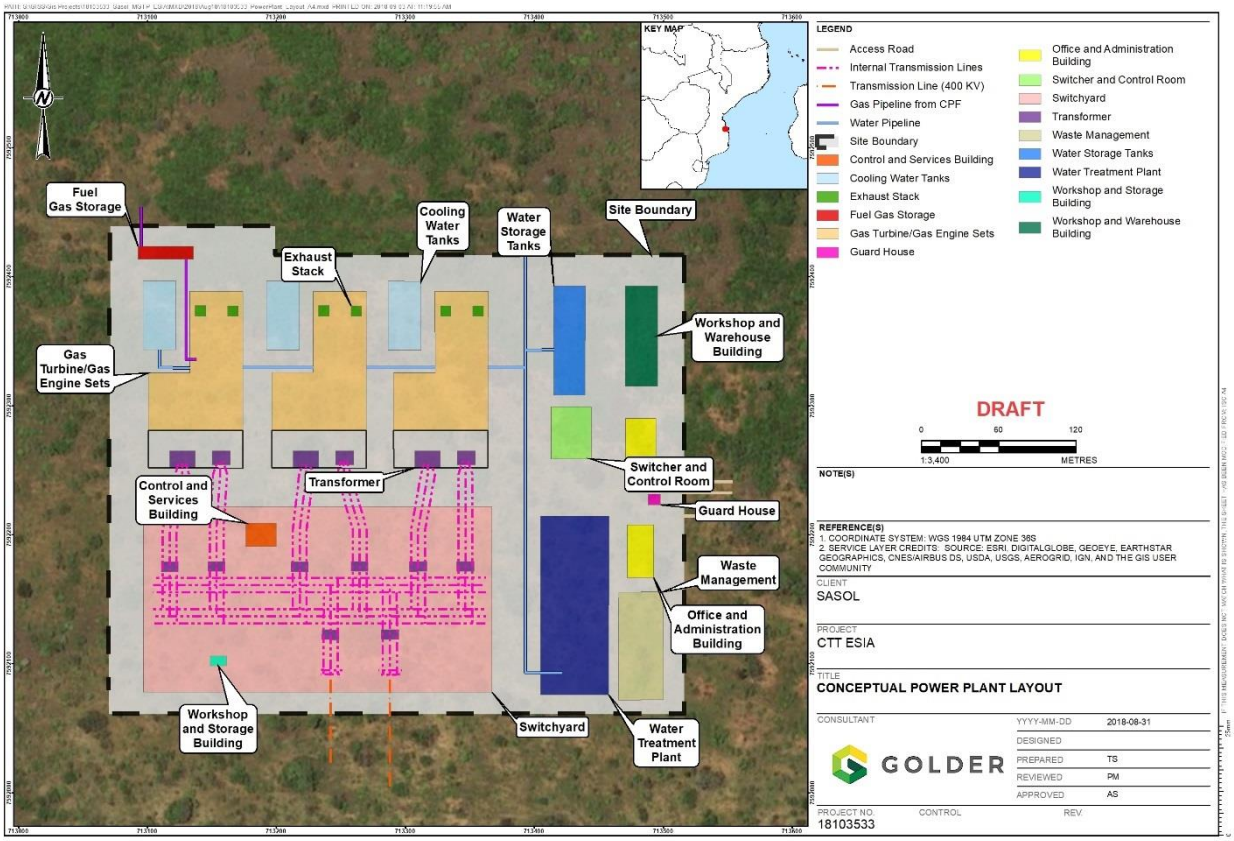

Figure 3: Conceptual layout of CTT plant site

2.1 Ancillary Infrastructure

The CTT project will also include the following infrastructure:

- Maintenance facilities, admin building and other buildings;
- Telecommunications and security;
- Waste (solid and effluent) treatment and/or handling and disposal by third party;
- Site preparation, civil works and infrastructure development for the complete plant;
- Construction camp (including housing/accommodation for construction workers); and
- Beach landing laydown area and logistics camp.

The heavy equipment and pre-fabricated components of the power plant will be brought in by ship and transferred by barge and landed on the beach near Inhassoro. The equipment and components will be brought to site by special heavy vehicles capable of handling abnormally heavy and large dimension loads. Figure 4, Figure 5 and Figure 6 show examples of the activities involved with a temporary beach landing site, offloading and transporting of large heavy equipment by road to site.

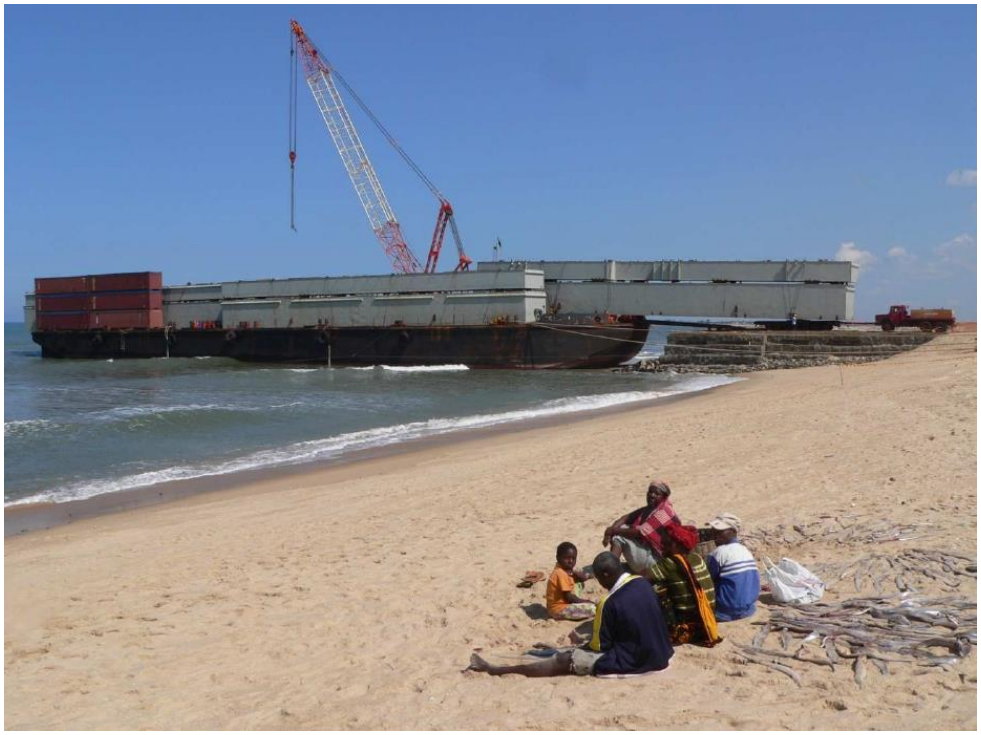

Figure 4: Typical beach landing site with barge offloading heavy equipment (source: Comarco)

Figure 5: Example of large equipment being offloaded from a barge. Note the levels of the ramp, the barge and the jetty (source: SUBTECH)

Figure 6: Heavy haulage truck with 16-axle hydraulic trailer transporting a 360 ton generator (source: ALE)

2.2 Water and electricity consumption

The type, origin and quantity of water and energy consumption are still to be determined based on the selected technology to construct and operate the CTT plant. At this stage it is known that water will be sourced from existing boreholes located on site or east of the Govuro River for either of the technology options below:

- Gas Engine: ± 12 m^3/day; or
- Gas Turbine (Dry-Cooling): ± 120 – 240 m^3/day.

2.3 Temporary Beach Landing Site and Transportation Route Alternative

As part of the CTT construction phase, it was considered that large heavy equipment and materials would need to be brought in by a ship which would remain anchored at sea off the coast of Inhassoro. Equipment and materials would be transferred to a barge capable of moving on the high tide into very shallow water adjacent to the beach to discharge its cargo onto a temporary off-loading jetty (typically containers filled with sand) near the town of Inhassoro. As the tide changes, the barge rests on the beach and off-loading of the equipment commences.

Currently, the SETA beach landing site is the preferred beach landing site from an environmental and social point of view assuming the use of one of the identified anchor sites, together with the road route option to be used in transporting equipment and materials along the R241 then the EN1 then via the existing CPF access road to the CTT site near the CPF. Figure 7 indicates the beach landing site. The alternative beach landing sites of Maritima and Briza Mar are still being evaluated as potential options.

Figure 7: SETA Beach landing site and route at Inhassoro

2.4 Anchorage Points

Two anchorage points for the ships that will transport large heavy equipment and components are indicated on existing historical nautical charts; both are located off the coast of Inhassoro within Bazaruto Archipelago National Park (BANP) (Figure 8). The first anchorage point is located approximately 20km east of SETA beach landing site (7km from Bazaruto Island and 13km from Santa Carolina Island) while the second one is nearer to the mainland shore, approximately 13km east of Briza Mar beach landing site (5-6km from Santa Carolina Island and 10km from Bazaruto Island).

As both previously identified anchorage sites are within the boundaries of the Bazaruto Archipelago National Park (BANP), an ongoing study seeks to identify alternative anchorage point(s) that would be located completely outside BANP, as well as being feasible from a technical, environmental, and social point of view. The anchorage point(s) and associated barge lane(s) to be used by this Project shall be fully outside BANP boundaries, unless alternative sites outside BANP either (i) are not at all available or clearly technically not feasible or (ii) would clearly have greater overall adverse environmental or social impacts than if they were within BANP.

Should the anchorage point(s) and/or barge route(s) have to be within the BANP for the above-mentioned reasons, a) the marine studies included within the ESIA will be updated and resubmitted to the World Bank for approval and b) the ESMP shall be updated to specify any further measures that may be necessary or appropriate to enhance the conservation and management of BANP and resubmitted to the World Bank for approval. Moreover, CTT would ensure that the locations of these facilities (i) have been formally approved by African Parks (legally responsible for BANP management) and ANAC (Mozambique's national conservation agency); (ii) are consistent with the Government-approved BANP Management Plan; and (iii) are legally permitted under Mozambican law—all in full compliance with IFC Performance Standard 6 (Paragraph 20) and the applicable Mozambican laws and regulations.

Technically it is feasible to moor the transhipment vessel at the identified anchoring locations, however they fall within the Bazaruto Archipelago National Park (BANP) and therefore an approval from the BANP would need to be obtained prior to utilizing these points, as well as consistency with PS 6, Mozambican legal requirements and any Management Plan of the BANP.

The vessel will not be anchored for extended periods of time and will most likely be anchored for 1-2 days at a time to offload the heavy equipment over a period of 8-15 months, although this will be defined once a technology option has been chosen as well as a preferred manufacturer of the various large and oversized power plant components. It should be noted that there will be a laydown area at the chosen beach landing site. This area will be used as a staging area to manage the large equipment and materials that will be offloaded from the barges. This is only expected to be used during daylight hours and for temporary storage of limited materials, equipment and vehicles (likely to be a mobile surface crane, two trailers and trucks).

Given the potential time between each shipment (up to 3-4 months), the equipment at the jetty will demobilize after each operation and need to be mobilized again for each operation.

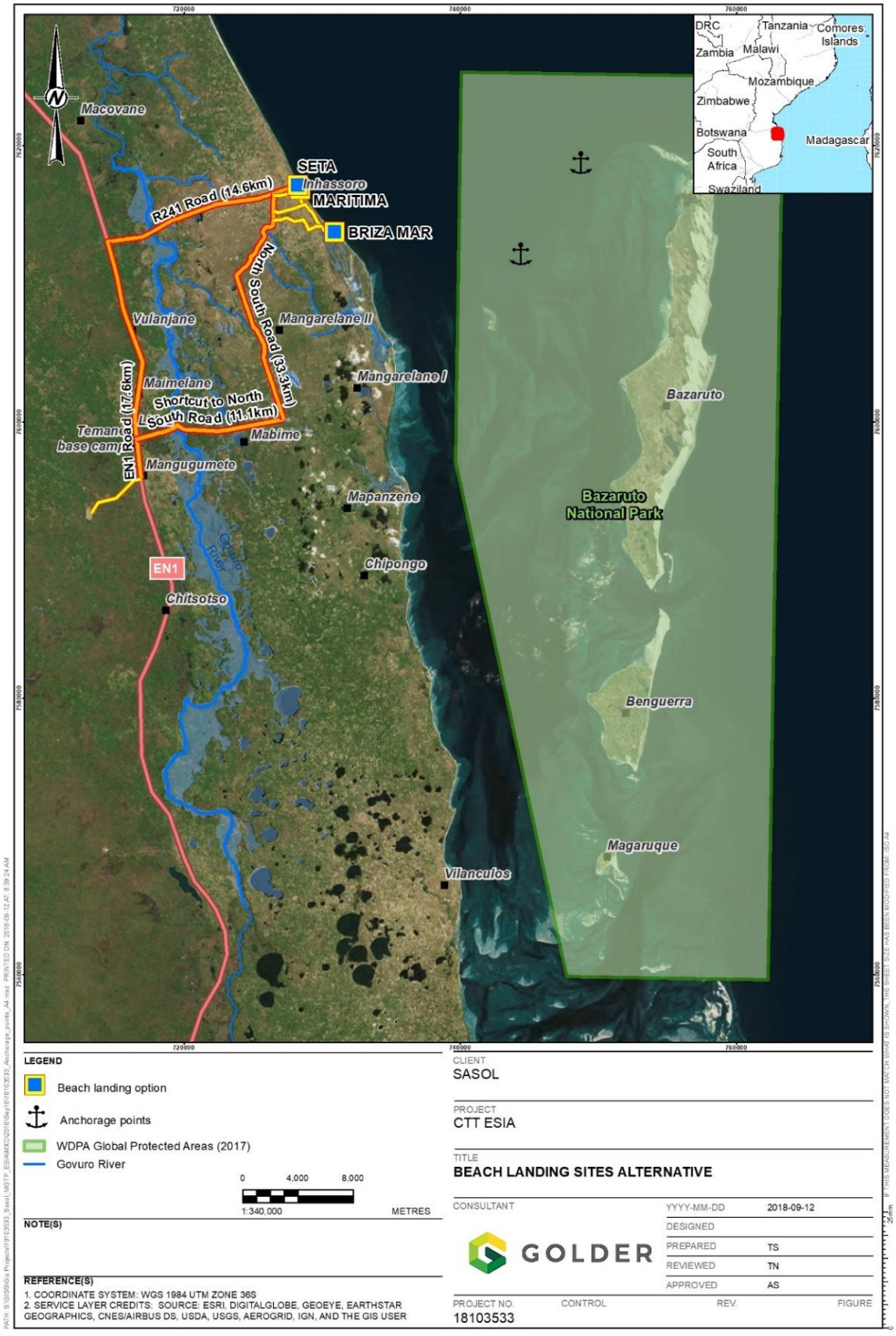

Figure 8: Previously used or identified Offshore Anchorage locations

3.0 LEGISLATION

A review of national and international law, policies, agreements and standards pertaining to marine and coastal biodiversity in Mozambique was conducted. These included Mozambican national law and policies, and international conventions and treaties to which Mozambique is a signatory.

The proposed project has been determined as 'Category A' in terms of Mozambique's environmental law (Decree No. 54/2015 of 31 December, which has been in force since April 2016). For 'Category A' projects, an Environmental and Social Impact Assessment (ESIA) must be prepared by independent consultants as a basis for whether or not environmental authorisation of the project is to be granted, and if so, under what conditions. The final decision maker is the Ministry of Land, Environment and Rural Development (Ministério da Terra, Ambiente e Desenvolvimento Rural (MITADER) through the National Directorate of Environmental Impact Assessment (DNAIA). MITADER consults with other relevant government departments prior to making a decision.

This document represents the Marine Ecology Impact Assessment undertaken to support the ESIA. This study is undertaken in terms of the national Mozambican Law for the Protection, Conservation and Sustainable Use of Biological Diversity (Law 16/2014, amended 2017) and Regulations for Protection of the Marine and Coastal Environment (Decree No. 45/2006) as well as the World Bank Group standards for conservation of biodiversity and ecosystem services (IFC 2012a, 2012b). The relevant legislation and policies are summarised in the subsections below, highlighting the relevant legislative and policy requirements that must be met to satisfy in-country biodiversity protection objectives, and achieve the desired biodiversity outcomes.

3.1 National Legislation and Policy

Mozambican legislation makes provision for the protection of the marine and coastal environment through the following instruments.

- **Regulation for Pollution Prevention and Protection of the Marine and Coastal Environment (Decree No. 45/2006):** provides for the prevention of marine pollution and environmental protection of marine and coastal areas to protect marine and fresh water ecosystems. The hunting of sea turtles, including the taking or destroying of their eggs is prohibited. Activities that disrupt ecosystems and habitats and normal development of sea turtles are also prohibited. Sanctions for illegal activity are prescribed, including disturbance of turtle nesting beaches.
- **Regulations for Recreational and Sports Fishing (Decree No. 51/99):** includes a list of protected marine species including the sea mammals (dugongs, whales and dolphins), sea turtles, and some species of fish, bivalves and gastropods. However, the list of marine protected species is currently applicable only to recreational and sports fishing, and does not account for capture of these species, either targeted or as by-catch, by both subsistence and commercial fisheries.
- **Decree No. 12/2002 approving the Regulation on Forestry and Wildlife:** The Forestry and Wildlife Regulation establishes the basic principles and norms for the protection, conservation and sustainable utilization of forest and wildlife resources under an integrated management framework for the economic and social development of the country. Chapter IV, articles 43 (5) and 44 (1a) fully protect the species listed in Annex II, which includes all five species of marine turtle found in Mozambique and sets fines for illegal hunting of marine turtles and dugongs. Furthermore, article 44 (1d) restricts the hunting of any other animal that may be declared as protected by a law or convention.
- **General Regulation of Maritime Fishing (Decree 43/2003):** Requires that the use of turtle excluder devices is mandatory for all trawler fishing boats aided by a motor.
- **Decree 5/2003 – Centre for Sustainable Development of Coastal Zones**: the mandate of the centre is to coordinate and promote studies, provide technical assistance, and develop capacity in

microenvironment coastal, marine and lacustrine management activities, and to formulate legislation that promotes the development of coastal zones.

- **Fisheries Law (Decree 22/2003):** this instrument regulates the fisheries sector; however, some aspects are not in conformity with international law, such as delimitation of fishing boundaries and continental shelfs, prohibition of over-night fishing, and the compulsory requirement for migration permits for foreign crews fishing in Mozambican waters (Perreira *et al.,* 2014).

- **Law for the Protection, Conservation and Sustainable Use of Biological Diversity (Law 16/2014, amended 2017)**: this law defines two categories of Conservation Area:

i) Total Conservation Areas which includes Integral National Reserves, National Parks, Cultural and Natural Monuments. Only indirect (non-consumptive)use of natural resources may be allowed in these areas; and

ii) Sustainable Use Conservation Areas which includes Special Reserves, Environmental Protection Areas, Official Game Reserves, Community Conservation Areas, Sanctuaries, Game Farms, and Municipal Ecological Parks. The primary aim of these areas is conservation, with integrated management which may permit sustainable utilisation/extraction of resources, subject to an approved management plan.

- **National Strategy and Action Plan of Biological Diversity of Mozambique (2015-2035):** National policy and plans for nature conservation in Mozambique are laid out in this Action Plan. Its objectives include the promotion of the sustainable use of marine and fisheries resources, improvement in the systems of enforcement and application of legislation on fauna conservation, and the promotion of sustainable development in areas adjacent to conservation protection areas, through use of effective management plans for development.

3.2 International Conventions and Policies

In addition to complying with national Mozambican legislation, the CTT project is also obliged to ensure that its operations comply with International Conventions to which the Republic of Mozambique is a signatory. Several conventions and agreements have been identified which relate to marine and coastal environments; these include:

- **Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region, 1985:** The convention commits its signatories to take all appropriate measures to prevent, reduce and combat marine pollution, establish Specially Protected Areas to protect and preserve rare or fragile marine ecosystems and species, conduct environmental impact assessments, and cooperate in scientific research, monitoring and data exchange with the Contracting Parties.

- **International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)**: The MARPOL convention sets out requirements for the management of ballast water, bilge water and other potential sources of ship-based pollution.

- **Convention on the Conservation of Migratory Species of Wild Animals, 1979:** The Convention on Migratory Species (CMS), also known as the Bonn Convention, aims to conserve terrestrial, aquatic and avian migratory species throughout their range. The CMS brings together the signatory States through which migratory animals pass, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.

- **Protocol for the Fisheries of the SADC, 2001:** commits member states to support national initiatives taken and international conventions for the sustainable use and protection of the living aquatic resources and aquatic environment of the region. In signing the Protocol, Member States agree to harmonise their domestic legislation with particular reference to fisheries and the management shared resources, to take

adequate measure to optimise fisheries law enforcement resources and thus protect aquaculture and the aquatic environment and safeguard the livelihood of fishing communities.

- **The Convention on Wetlands (Ramsar Convention) 1975:** the Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
- **Convention on Biological Diversity (CBD), 1992:** Under the convention, each contracting party is expected to develop national strategies, plans or programs for the conservation and sustainable use of Biological diversity, such as National Biodiversity Action Plans
- **Convention on International Trade in Endangered Species (CITES), 1973:** an international agreement between governments, to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Mozambique is a signatory since 1981.
  - CITES Appendix I lists species that are the most endangered among CITES-listed animals and plants and prohibits international trade in specimens of these species except when the purpose of the import is not commercial.
  - CITES Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled; international trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate.
  - CITES Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation; international trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates.

3.3 International Best Practise Guidance and Policies

The International Finance Corporation's (IFC) Performance Standards have become globally recognised as a benchmark for environmental and social risk management in the private sector. In addition to compliance with national Mozambican legislation, and international legislation to which Mozambique is a signatory, the Project must also achieve the financing requirements set out in the IFC's Performance Standards. At the project financing level, the management of biodiversity is addressed by Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC, 2012a). Performance Standard 6 (PS6) and the associated Guidance Note 6 (GN6) (IFC, 2012b) relates to:

- The protection and conservation of biodiversity;
- Maintenance of ecosystem services; and
- Sustainable management of living natural resources.

The requirements set out in PS6 have been guided by the Convention on Biological Diversity (see Section 3.2). PS6's main priority is that the Project should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented. However, when a project occurs in critical habitat (CH) supporting exceptional biodiversity value, a net gain in biodiversity value is required.

PS6 sets specific biodiversity protection and conservation standards relating to potential project impact. The specific requirements are separated according to the following categories:

- **Modified Habitat:** 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. PS6 relates to areas of modified habitat that have significant biodiversity value, and requires that impacts on such biodiversity must be minimised, and mitigation measures implemented as appropriate.

- **Natural Habitat:** viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. In such areas, the conservation outcome required by PS6 is no-net-loss of biodiversity value achieved using the "like-for-like" or better principle of biodiversity offsets, where feasible.
- **Critical Habitat:** areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. When a project occurs in critical habitat (CH) supporting exceptional biodiversity value, a net gain in biodiversity value is required by PS6. This is achievable through appropriate biodiversity offsets.
- **Legally Protected and Internationally Recognised Areas:** such areas often have high biodiversity value; when this is the case these areas are likely to qualify as Critical Habitat and as such the conservation outcome required by PS6 is also a net gain in biodiversity value, as well as obtaining the relevant legal permits, following standard governmental regulatory procedures, and engagement of affected communities and other stakeholders.
- **Invasive Alien Species:** the development project should not intentionally introduce any new alien species (unless carried out within the appropriate regulatory permits) and should not deliberate any alien species with a high risk of invasive behaviour under any circumstance. PS6 requires that any introduction of alien species be the subject of a risk assessment for potential invasive behaviour, and that the project should implement measures to avoid the potential for accidental or unintended introductions.
- **Management of Ecosystem Services:** where a project is likely to adversely impact ecosystem services (ES), an ecosystem service review to identify Priority ES is required. Priority ecosystem services are (i) those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities; and/or (ii) those services on which the project is directly dependent for its operations (e.g., water). If adverse impacts on Priority ES are unavoidable, these must be minimised and mitigation measures that aim to maintain the value and functionality of priority services implemented. With respect to impacts on Priority ES on which the project depends, impacts on ecosystem services should be minimised and measures that increase resource efficiency of their operations implemented.

3.3.1 Critical Habitat

As stated above, critical habitat (CH) consists of areas with high biodiversity value. Habitats supporting unique, irreplaceable and extremely vulnerable biodiversity features are likely to constitute CH and such features can be identified under baseline conditions at the ecological scales appropriate for their designation (PS 6, IFC 2012a). It is possible to identify critical habitat using the five primary criteria provided in Paragraph 16 of PS6. The criteria and the identification process are described in Table 1.

Table 1: Critical Habitat identification criteria

Criterion	Definition	Identification Process
1	Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species.	Species status to be searched on the IUCN Red List of Threatened Species for all observed and potential flora and fauna species in the Study Area. Any observed and potential CR or EN species to be screened and assessed against thresholds for Tier 1 and Tier 2 CH.

Criterion	Definition	Identification Process
2	Habitat of significant importance to endemic and/or restricted-range species	The global extent of occurrence for all observed and potential species to be defined. Extent of occurrence data can be obtained from the IUCN Red List of Threatened Species (IUCN 2018).
3	Habitat supporting globally significant concentrations of migratory species and/or congregatory species	Any observed and potential migratory or congregatory species to be screened and assessed against thresholds for Tier 1 and Tier 2 CH.
4	Highly threatened and/or unique ecosystems	Highly threatened or unique ecosystems are those (i) that are at risk of significantly decreasing in area or quality; (ii) with a small spatial extent; and/or (iii) containing unique assemblages of species including assemblages or concentrations of biome-restricted species (GN 90, IFC PS6, 2012b).
5	Areas associated with key evolutionary processes	Key evolutionary processes that underlie unique ecological properties, such as presence of sub-populations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern, given their distinct evolutionary history" (GN 95, IFC PS 6, 2012b).

Where species are present that trigger Criterion 1, 2 or 3, Critical Habitat can be further classified as Tier 1 or Tier 2. The qualitative categories for these thresholds are outlined in Table 2.

Table 2: Thresholds for Tiers 1 and 2 of Critical Habitat (GN32, GN89; IFC PS6 2012)

Criteria	Tier 1	Tier 2
1. Critically Endangered (CR)/Endangered (EN) Species	(a) Habitat required to sustain ≥10% of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. (b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	(c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/subspecies. (d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. (e) As appropriate, habitat containing nationally/regionally important

Criteria	Tier 1	Tier 2
		concentrations of an EN, CR or equivalent national/regional listing.
2. Endemic/Restricted Range Species	(a) Habitat known to sustain ≥ 95 % of the global population of an endemic or restricted-range species, where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).	(b) Habitat known to sustain ≥ 1 % but < 95 % of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.
3. Migratory/Congregatory Species	(a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(b) Habitat known to sustain, on a cyclical or otherwise regular basis ≥ 1 % but < 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. (c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 % population for both terrestrial and marine species. (e) Source sites that contribute ≥ 1 % of the global population of recruits.

Where insufficient data exists to address the thresholds for CH criteria, suitable field survey programmes must be conducted to gather sufficient data to properly ascertain whether CH is present.

4.0 APPROACH AND METHODOLOGY

4.1 Scope of study

Temporary beach landing sites and associated laydown areas will be required for handling and delivery of the large heavy equipment and infrastructure required to build the CTT Project. In addition, an anchorage point will be located in Bazaruto Bay, where heavy equipment will be transferred from a ship to the barges that transport the equipment to the chosen beach landing site. At this stage all three beach landing site options are still being evaluated and are assessed as part of this ESIA.

A baseline description of the coastal and marine environment in the vicinity of the temporary beach landing sites and anchorage points is necessary to inform the Environmental Impact Assessment process. Therefore, the objective of this study is to assess the impact of the temporary beach landing and associated activities (shipment

and barging) on marine ecology, particularly Dugongs and Turtles. The full scope of the study as set out in the Terms of Reference document for the Project (Golder, 2015) is outlined in Table 3.

Table 3: Scope of marine ecology study as defined in the ToR (Golder, 2015)

Objectives	Project Phase	Methodology
To assess the impact of the temporary beach landing and associated activities (shipment and barging) on marine ecology (specifically Dugongs and Turtles)	Construction	<u>Baseline</u> • Review existing literature available • Baseline data collection (secondary data) • Include additional desktop data on marine water quality, where available • Baseline reporting <u>Impact Assessment</u> • Assessment of the predicted increase of marine activities and beach landing activities during the temporary construction phase the project on marine fauna such as Dugongs and Turtles. • Marine fauna impact assessment report • Recommend mitigation measures (include commitments for collecting marine water quality data) in order to establish a baseline against which to monitor • Peer review by recognised expert

4.2 Study Area

The Study Area was based on the spatial extent of the footprint of the proposed beach landing sites and anchorage points, and an associated buffer zone within which potential direct and indirect effects to coastal and marine species and ecosystems could occur.

The Study Area therefore incorporates the footprints of the beach landing site options, the anchorage point locations, and a 1 km buffer surrounding the potential barge routes between the anchorage points and the landing sites, within which direct and indirect effects from the barging actvitiy and the development and operation of the landing sites was considered most likely. Since this area overlaps with the marine area enclosed by the Bazaruto Archipelago / Cabo São Sebastião and the mainland, and Bazaruto Archipelago National Park, these were also included in the Study Area to take into account any potential effects on marine species of concern; in particular, Dugong (*Dugong dugon*). The Study Area is shown in Figure 9.

Details of the Critical Habitat Area of Analysis (CHAA) are provided in Section 6.1.

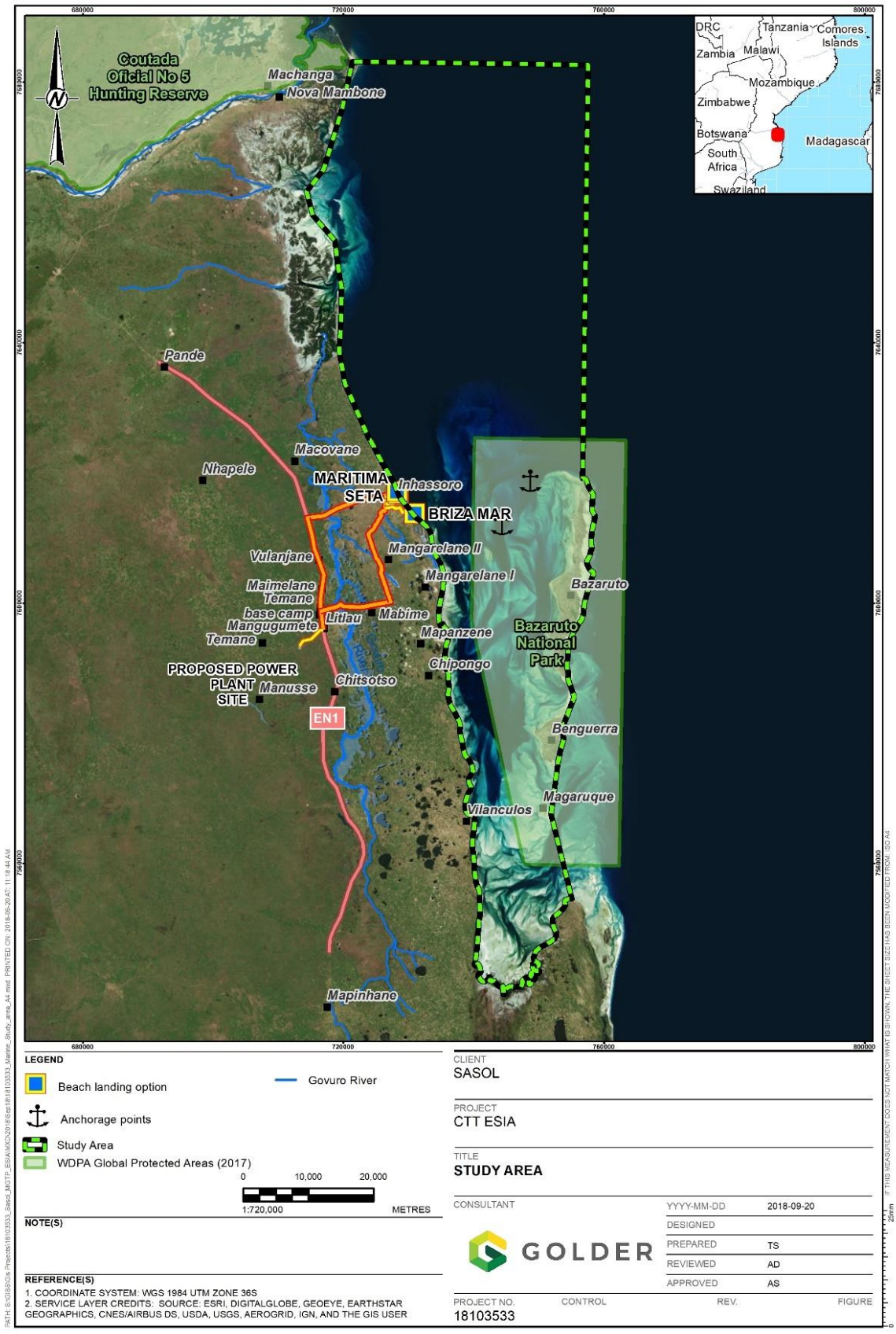

Figure 9: Marine Ecology Study Area

4.3 Desktop review of available information

The baseline of marine and coastal ecology was determined through a detailed review of existing baseline studies (e.g. Guissamulo, 2016; EWT, 2015; Findlay *et al.*, 2006; Guissamulo, 2006; Masquine & Torres, 2006) previously conducted on behalf of SASOL within the Study Area. Additional information relevant to the Study Area was sourced through online searches and interrogation of available databases such as the IUCN Red List, the Catalogue of Life, and Species Plus. Relevant information was then collated to aid in identifying any important marine and coastal biodiversity features that exist within the Study Area.

4.4 Impact Assessment Methodology and Rating Criteria

Potential impacts are assessed according to the direction, intensity (or severity), duration, extent and probability of occurrence of the impact. These criteria are discussed in more detail below:

Direction of an impact may be positive, neutral or negative with respect to the particular impact. A positive impact is one which is considered to represent an improvement on the baseline or introduces a positive change. A negative impact is an impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.

Intensity / Severity is a measure of the degree of change in a measurement or analysis (e.g. the concentration of a metal in water compared to the water quality guideline value for the metal), and is classified as none, negligible, low, moderate or high. The categorisation of the impact intensity may be based on a set of criteria (e.g. health risk levels, ecological concepts and/or professional judgment). The specialist study must attempt to quantify the intensity and outline the rationale used. Appropriate, widely-recognised standards are used as a measure of the level of impact.

Duration refers to the length of time over which an environmental impact may occur: i.e. transient (less than 1 year), short-term (1 to 5 years), medium term (6 to 15 years), long-term (greater than 15 years with impact ceasing after closure of the project) or permanent.

Scale/Geographic extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international. The reference is not only to physical extent but may include extent in a more abstract sense, such as an impact with regional policy implications which occurs at local level.

Probability of occurrence is a description of the probability of the impact actually occurring as improbable (less than 5% chance), low probability (5% to 40% chance), medium probability (40 % to 60 % chance), highly probable (most likely, 60% to 90% chance) or definite (impact will definitely occur).

Impact significance will be rated using the scoring system shown in Table 4 below. The significance of impacts is assessed for the three main phases of the project: i) construction ii) operations iii) decommissioning. While a somewhat subjective term, it is generally accepted that significance is a function of the magnitude of the impact and the likelihood (probability) of the impact occurring. Impact magnitude is a function of the extent, duration and severity of the impact, as shown in Table 4.

Table 4: Scoring system for evaluating impacts

Impact Magnitude			Impact Probability
Severity	Duration	Extent	
10 (Very high/don't know)	5 (Permanent)	5 (International)	5 (Definite/don't know)

8 (High)	4 (Long-term – longer than 15 years and impact ceases after closure of activity)	4 (National)	4 (Highly probable)
6 (Moderate)	3 (Medium-term- 6 to 15 years)	3 (Regional)	3 (Medium probability)
4 (Low)	2 (Short-term - 1 to 5 years)	2 (Local)	2 (Low probability)
2 (Minor)	1 (Transient – less than 1 year)	1 (Site)	1 (Improbable)
1 (None)			0 (None)

After ranking these criteria for each impact, a significance rating was calculated using the following formula:

SP (significance points) = (severity + duration + extent) x probability.

The maximum value is 100 significance points (SP). The potential environmental impacts were then rated as of High (SP >75), Moderate (SP 46 – 75), Low (SP ≤15 - 45) or Negligible (SP < 15) significance, both with and without mitigation measures in accordance with Table 5.

Table 5: Impact significance rating

Value	Significance	Comment
SP >75	Indicates high environmental significance	Where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. Impacts of high significance would typically influence the decision to proceed with the project.
SP 46 - 75	Indicates moderate environmental significance	Where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value. Such an impact is unlikely to have an influence on the decision. Impacts may justify significant modification of the project design or alternative mitigation.
SP 15 - 45	Indicates low environmental significance	Where an effect will be experienced, but the impact magnitude is small and is within accepted standards, and/or the receptor is of low sensitivity/value or the probability of impact is extremely low. Such an impact is unlikely to have an influence on the decision although impact should still be reduced as low as possible, particularly when approaching moderate significance.
SP < 15	Indicates negligible environmental significance	Where a resource or receptor will not be affected in any material way by a particular activity or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background levels. No mitigation is required.
+	Positive impact	Where positive consequences / effects are likely.

In addition to the above rating criteria, the terminology used in this assessment to describe impacts arising from the current project are outlined in Table 6 below. In order to fully examine the potential changes that the project might produce, the project area can be divided into Areas of Direct Influence (ADI) and Areas of Indirect Influence (AII).

- Direct impacts are defined as changes that are caused by activities related to the project and they occur at the same time and place where the activities are carried out i.e. within the ADI. This area aligns with the Study Area defined for the marine ecology assessment.
- Indirect impacts are those changes that are caused by project-related activities, but are felt later in time and outside the ADI. The secondary indirect impacts are those which are as a result of activities outside

of the ADI. The AII area aligns with the CHAA defined for the marine ecology assessment (See Section 6.1)

Table 6: Types of impact

Term for Impact Nature	Definition
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (i.e. between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (i.e., pollution of water placing a demand on additional water resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned activities) to affect the same resources and/or receptors as the Project.

5.0 MARINE AND COASTAL BASELINE

The Mozambican coastline is characterised by a wide diversity of habitats including sandy beaches, sand dunes, coral reefs, estuaries, bays, seagrass beds and mangrove forests, which in parts support pristine ecosystems, high biological diversity, high endemism, and endangered species (Pereira *et al.,* 2014). The following sections describe known ecosystems and fauna within the Study Area in terms of distribution, conservation status, and existing pressures/drivers of change.

5.1 Marine and Coastal Oceanography

Data on marine and coastal oceanography in the Study Area was provided by the proponent, consisting of text and figures extracted from relevant sections of the Sasol Offshore Block 16 & 19 Exploration ESIA conducted by ERM (2006) with additional studies commissioned in 2008. These data are reproduced without modification in the subsections that follow.

5.1.1 Bathymetry

Bazaruto Bay and the adjacent marine area to the north is a typical nearshore shallow water system with an average water depth of approximately 10 m. Two distinct basins can be identified in this bay, one located in the northern end, just north of Santa Carolina Island and another located in the middle section of the bay, in-between the Bazaruto and Benguerua Islands. The two basins are linked by a series of channels, which are regarded as flood- and ebb-tide deltas. These two basins and associated channels comprise the deeper areas of the bay with a maximum depth for southern basin of 24 m and 33 m for the northern basin. The remaining southern section of the bay is comprised of vast areas of tidal flats that often dry out during spring low tides.

The northern basin which is the deepest area of the bay is also the main connection to the open sea. Depth contours in this basin are irregular with numerous reefs occurring throughout the basin. The area north of the bay, exhibits a regular depth gradient up to depths of 50 m, despite the regular occurrence of reefs in the region. From the 50 m isobath, there is a sharp increase in water depth. The 1,000 m isobath is located very close to the coast, approximately 25 miles off the coast.

5.1.2 Spatial and temporal variability of physio-chemical regime of water masses

The physio-chemical characteristics of the water masses of Bazaruto Bay and the adjacent nearshore area north of the Bay, exhibit spatial and temporal variability. In the dry season (May to October), the bay is characterised by water of marine nature. Salinity in this period varies between 35 to 36 PSU and there is little

spatial gradient. In the rainy season, the bay is more estuarine, exhibiting greater salinity gradient and lower overall average salinity when compared to the dry season. In the rainy season, salinities levels varies between 35 and 33 PSU (Figure 10).

In the early rainy season (November to December), water with a very high salinity (37 to 40 PSU) occur in the nearshore area north of the bay, in the vicinity of the Govuro River mouth. This phenomenon is only temporary.

It is in the late rainy season that most spatial variability of salinity is observed. A stable salinity gradient is observed throughout the rainy season in the bay, with the lowest salinities being observed in the western side of the bay and the highest in the east (Figure 10). While the western side tends to be more estuarine showing larger temporal variability, the eastern side has more marine nature, varying little in its physic-chemical nature.

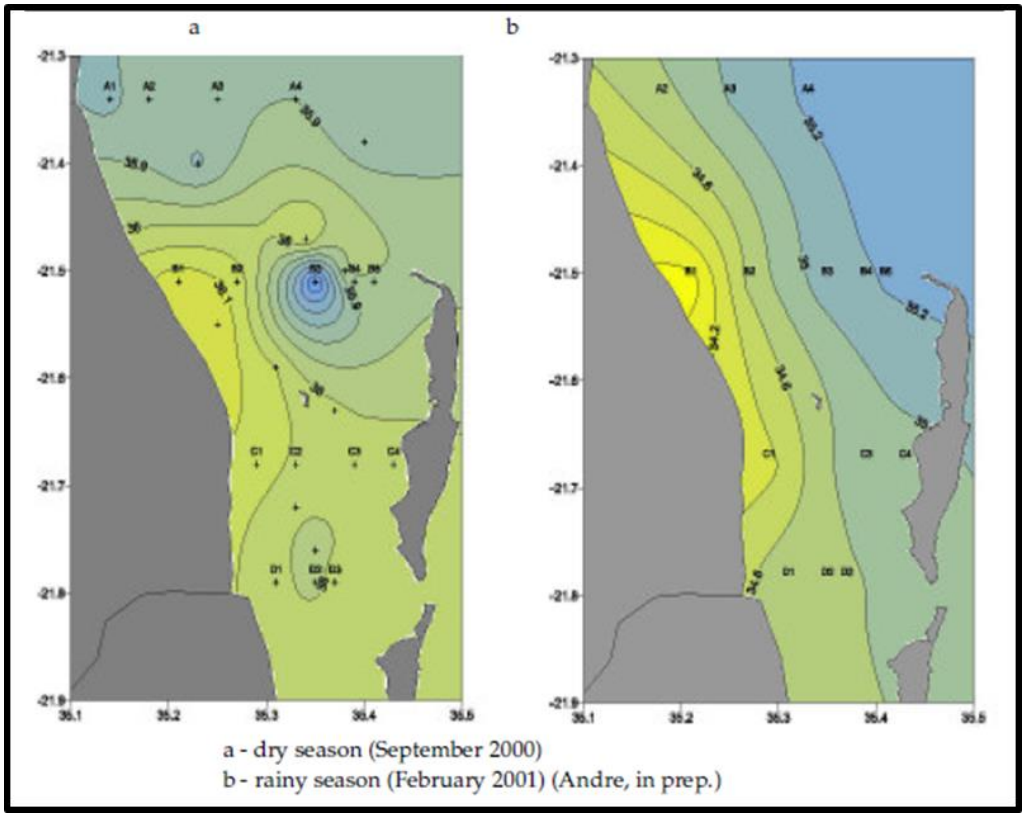

Figure 10: Spatial distribution of surface salinity in two distinct seasons (ERM, 2017)

5.1.3 Water Circulation

Distinct circulation patterns are recognised for the shelf, open ocean and Bazaruto Bay. The circulation of the open ocean adjacent to the Bazaruto Archipelago is governed by the Mozambique Channel circulation system which is comprised of a series of intermittent large-scale eddies drifting southward (see Figure 11). Surface currents associated with this circulation system are known to flow southward throughout the year, with flow speed varying with seasons. According to Admiralty (1995), this current is predominantly southwards and is strongest in summer (October to February), attaining speeds of up to 2 m during this period and 1.3 m at other times during the year.

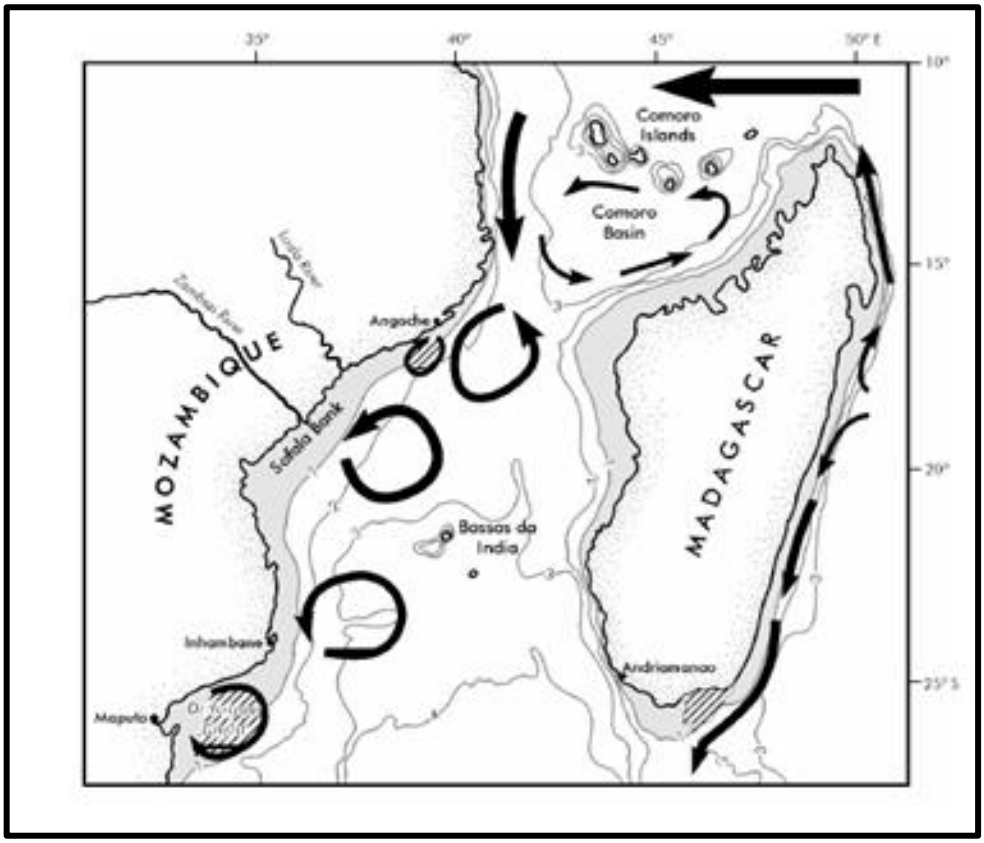

Figure 11: Bathymetry of the Mozambique Channel and the continental shelf off Madagascar in km (after Simpson 1974) with the major circulatory features indicated. Shaded areas are shallower than 1 km; hatched areas denote upwelling (after Lutjeharms, 2007)

The shelve circulation is considered to be a direct result of the Mozambique circulation (Lutjeharms, 2007). The average drift patterns at the sea surface, nevertheless, indicate a strong movement poleward along the eastern shelf of Mozambique (Saetre, 1985). This is also supported by recent salinity distribution map data for the region south of the Sofala bank, just north of Bazaruto, were salinity cells drifting southward are evident. (Figure 12).

However, for the inshore region of Bazaruto Archipelago, currents are known to be highly variable in both speed and direction and are wave-driven and consistent with the wave patterns of this region. In the bay, the main feature of circulation is the occurrence of strong tidal currents that drive water into the bay during the flood phase of the dies and move water out the bay during the ebb tide (Figure 13).

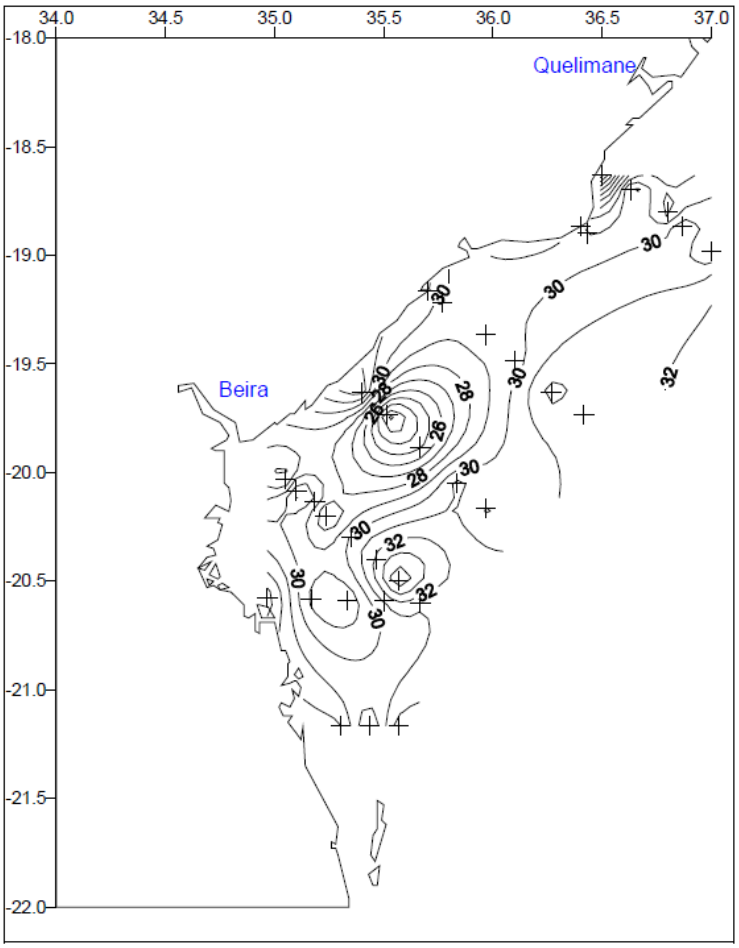

Figure 12: Spatial distribution of salinity in the Sofala Bank (PSU)

The offshore region is dominated by the Mozambique current comprising a number of large-scale eddies (Saetre and Jorge da Silva, 1984). The surface currents in the offshore region flow southwards throughout the year(>50% occurrence at an average speed of approximately 0.6 m) with slightly stronger southwards flows occurring in the November to April period compared to the May to October period (Saetre, 1985). Notes on the Admiralty predominantly southwards and is strongest ins summer (October to February), attaining speeds of up toe 2 m during this period and 1.3 m at other times during the year.

Within the archipelago the water temperature ranges from 23°C in winter to 28°C in summer and the salinity ranges from 35.4 PSU in winter to 34.7 PSU in summer (Dutton and Zolho, 1990).

The tides are semi-diurnal. The open littoral of the Bazaruto Archipelago experiences low and high tides some 40 minutes ahead of Durban while the tides on the inner bay (north-eastern Bazaruto) are lagged and coincide more or less with those at Durban (Dutton and Zolho, 1990). The mean spring tidal range is approximately 3 m during normal spring tides, increasing to approximately 4.4 m during equinoctial spring tides (measured at 4.39 m during the equinox of 9 March 1989). The tidal range at spring high tide produces strong tidal currents in the channels between the islands that have transported vast quantities of sand to form extensive flood- and ebb tide deltas. These strong tidal flows also maintain the deep channels on the landward side of the islands and transport sand across the tidal flats.

The offshore wave patterns are dominated by waves from a south-easterly sector. These observations are based on Voluntary Observing Ship swell observations in a block 21°30'-22°30'S; 35° – 36°E) and for the period

1968 to 1998. The highest waves are observed to come from the south during summer. The local wind-driven waves, like the local winds, are from the southeast sector.

Wave action is restricted to the seaward side of the islands and prevents the formation of extensive tidal flats in that area. The alignment of the small half-heart bays on the seaward side of the islands indicates a dominant littoral drift towards the north, consistent with both the offshore and local wind-driven wave climate. Sand transported northwards has been deposited at the northern end of Bazaruto Island to form extensive spit clearly visible on charts of the area. The back-barrier area is sheltered from direct wave action and this produces tranquil low wave conditions (Dutton and Zolho, 1990).

The islands are composed of mainly unconsolidated quartz sand with a minor carbonate component derived from the skeletons of marine organisms. The islands, composed of beach rock and sand dunes, are highly susceptible to movement caused by wind and wave action (Reina, 1998). The presence of beach rock around the island profoundly influences wave refraction patterns.

According to Mark Wood Consultants, (2001), the tidal range at spring highs, produces strong tidal currents in the channels between the islands that have transported vast quantities of sand to form extensive flood- and ebb tide deltas. These strong tidal flows also are known to maintain the deep channels on the landward side of the islands and transport sand across the tidal flats.

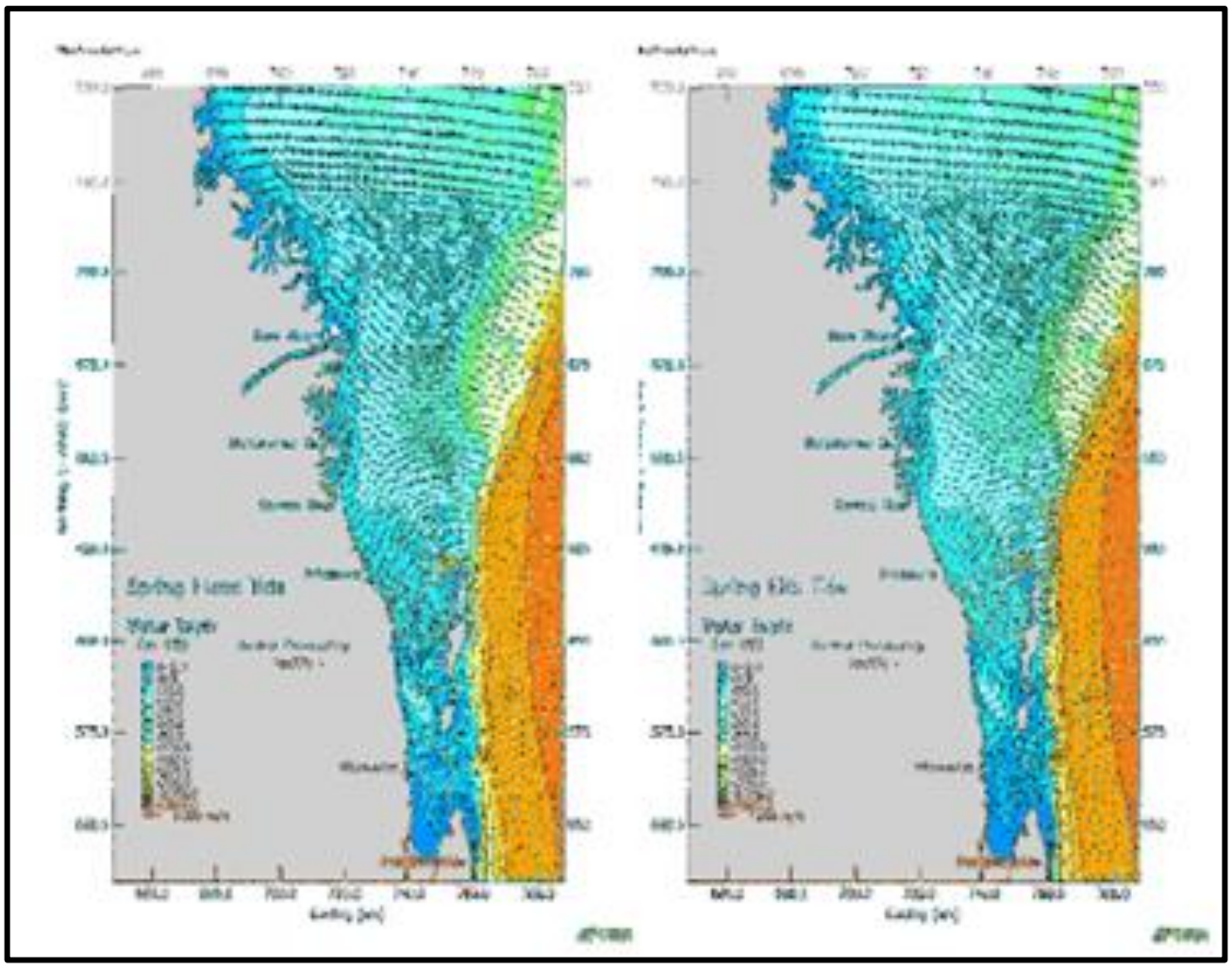

Figure 13: Modelled tidal currents of Bazaruto Bay and adjacent Shelf areas

5.1.4 Water Quality

Physicochemical surveys of water quality in Bazaruto Bay were carried out in November-December 2015 for the EIA process for the Sasol Pipeline and offshore Floating, Storage and Offloading unit (FSO) Project (ERM, 2016). Results of these surveys relevant to the current Study Area are presented in the following sections.

Water Column Characteristics

Offshore water within the Study Area was found to be well mixed, as expected for an open coastal region. Water temperatures averaged 26.6°C and an average salinity of 35.2 PSU throughout the water column was recorded. Turbidity values of < 0.6 NTU were recorded, which compare well to the turbidity values collected from the water samples at comparative depths (all < 1 NTU). These values are very low and represent clear water, also indicated by the high photosynthetic active radiation (PAR) values with depth. The 1 percent level of the incident light at the surface, which is the lowest light level required for photosynthesis to occur, reached the bottom of the water column, indicating a well-mixed, clear water column. The mean pH of all sites at the three depths was 8.14 which agrees with the accepted average pH of the global surface ocean of 8.1.

Heavy Metal Content

Heavy metal analysis was conducted on the water samples collected at three depths (surface, mid and bottom). Measured concentrations were compared to environmental quality targets (EQTs) recommended for coastal waters in the region (UNEP/CSIR 2009). Heavy metals were generally present in the offshore water column in low concentrations, with most not exceeding the recommended EQTs. Cadmium, chromium and mercury were below the detection level of the analyses (<1 µg/l) at all sites, and majority of the remaining metals were present at natural levels, as is expected for a well-mixed offshore region, with relatively little anthropogenic impact. The concentration of copper and lead were the only exceptions, where the EQTs were exceeded at selected depths at several sites. It was not possible to determine the source(s) of the observed elevated concentrations from the survey data.

Dissolved Organic Carbon

Dissolved organic carbon (DOC, a direct estimate of labile organic matter in the water column and thus a proxy for estimating BOD and COD) concentrations were generally found to be low in the area surrounding the proposed FSO location, with concentrations being below detection limits at majority of the sites.

Oil and Grease

In the absence of natural seeps, the concentrations of oil and grease can be considered gross indicators of hydrocarbon pollution in the water body. Typical sources of offshore oil and grease include spills and pollution from ships/tankers and spills from offshore platforms and pipelines. Concentrations in the collected water samples showed that levels varied both spatially and with depth. The concentrations range from < 3 mg/l (detection level of the analysis) to a maximum of 45 mg/l at the bottom depth of the FSO site. It was not possible to determine the source(s) of the observed elevated concentrations from the survey data.

Nutrients

Concentrations of total Kjeldahl nitrogen, nitrate, nitrite and phosphorus were found to be below the detection limit of the analyses used at all depths at all sites. The low values of these nutrients in the area could act as a limiting factor for the growth of phytoplankton.

Hydrocarbons and Aromatic Compounds

Both the total petroleum hydrocarbons and polyaromatic hydrocarbons were found to be below the detection levels of the analyses at all sites. This is expected for a well flushed area that is not close to any sources of anthropogenic contamination.

Low concentrations of naphthalene were detected in marine sediment samples. Concentrations at all measuring points were below the screening levels for significant human or ecological impact. Without a longer dataset the possible source is uncertain. Further research into activities in the upstream catchment would be necessary in order to establish a source.

5.2 Marine and Coastal Ecosystems

The Mozambican coastline can broadly be classified into three ecoregions from north to south, each supporting a variety of marine ecosystems; 1) the coral coast, 2) swamps and 3) parabolic coastal dunes (Spalding *et al.,* 2007). The Study Area is largely occupied by Bazaruto Bay, which is located within an area of overlap between the coral, swamp and parabolic coastal dune systems known as the Delagoa Bioregion (Figure 14) and includes aspects of each.

Bazaruto Bay is sheltered from high energy wave action by the Bazaruto Archipelago and Cabo São Sebastião, conditions which have supported the development of sandy tidal flats and associated seagrass meadows. The sea-ward side of the Bazaruto Archipelago is characterised by parabolic dune systems, consisting of steep and tall (up to 120 m) vegetated dunes, often backed by salt lakes and closed salt lagoons. Bazaruto Archipelago is a transitional ecosystem, where both tropical coral reef and submerged rocky reef occur offshore (Perreira *et al.,* 2014).

The specific ecosystems that are present within the Study Area are discussed in the sections that follow.

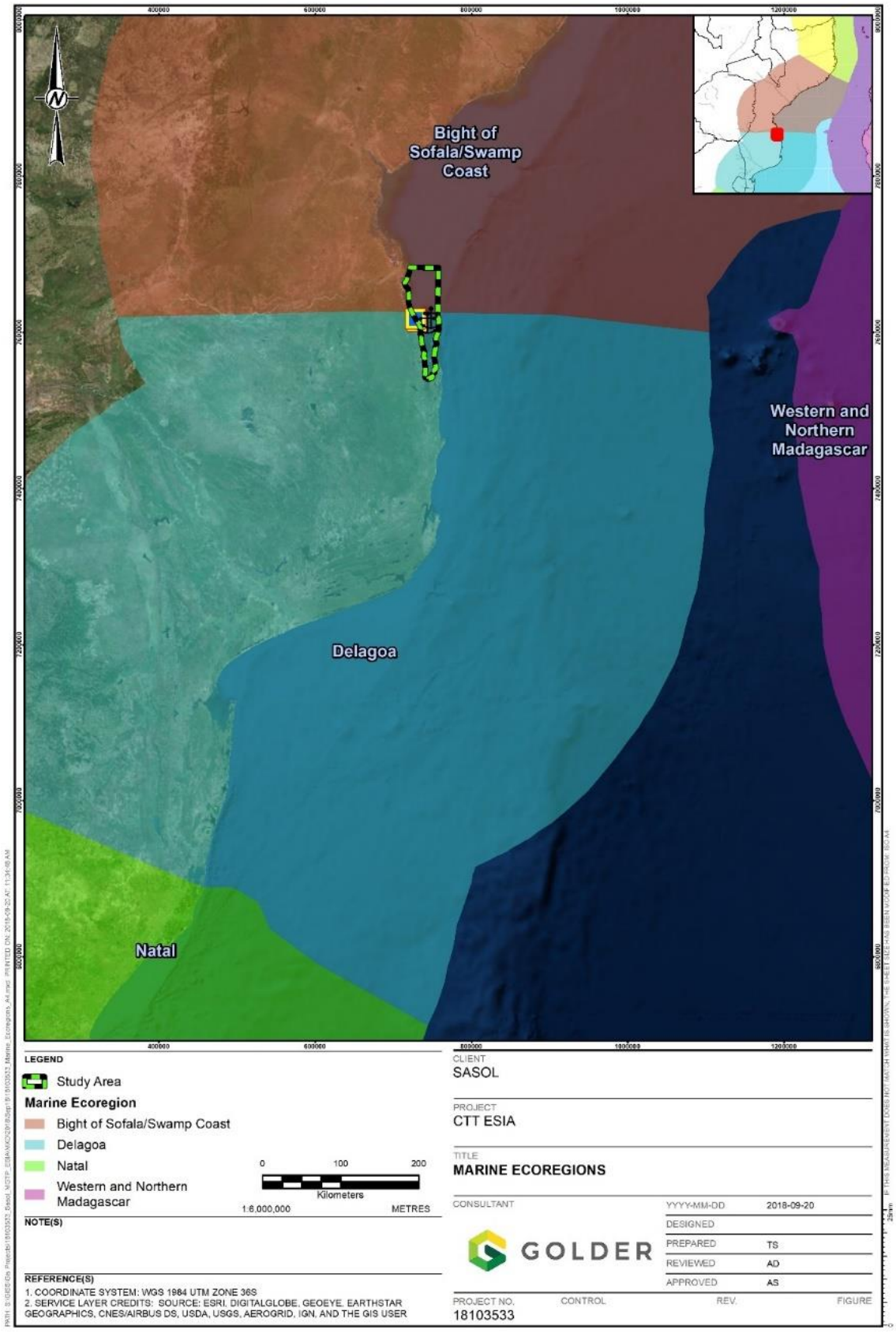

Figure 14: Marine ecoregions in the study area

5.2.1 Coral Reefs

Coral reef systems are distributed throughout the Study Area, the largest of which are located off the coast north of Inhassoro (Findlay *et al.,* 2006). The species diversity, extent and condition of the majority of these offshore and coastal reefs have not yet been studied; however Two-Mile reef off the south coast of Bazaruto Island has been monitored since 1999, as part of the CORDIO (Coral Reef Degradation in Indian Ocean) regional program to monitor coral condition and the impact of bleaching[1]. This reef is dominated by massive hard corals (mainly Porites and Faviids) followed by branching/tabular corals (Acropora) (Pereira *et al*., 2008). The condition of Two-Mile reef has been previously assessed as good (Findlay *et al*., 2006), despite pressures including increased populations of coral-feeding crown-of-thorns starfish (*Acanthaster planci*), and illegal fishing practises. The most recent available monitoring results indicate that 16.7% of this reef was affected by bleaching which occurred during a widespread bleaching event in early 2005 (Pereira *et al.,* 2008). No recent results to indicate whether the reef has recovered or further deteriorated since then were available at the time of writing.

5.2.2 Seagrass Beds

In Bazaruto Bay, seagrass beds associated with the sand tidal flats typically occur in shallow and subsidiary waters of less than 5 m depth (Bandeira *et al.,* 2008). Within the Study Area, an extensive seagrass bed is located off the shoreline where beach landing sites Maritima and Seta are located (Guissamulo, 2006) (Figure 15). Additional dense seagrass cover occurs 10-20 km north of Inhassoro, in an area approximately 10 km wide. Seagrass beds of much smaller extents are present in the near shore environment south from Inhassoro to Vilanculos, and along the western shore of Bazaruto Island. The most common seagrass species in the Study Area are *Halodule uninevis*, *Halophyla ovalis* and *Thalassondendron ciliatum* (Guissamulo, 2006).

The importance of seagrass beds in the Bazaruto Bay area is related to their importance as a food source for the populations of green turtle (*Chelonia mydas*) and dugong (*Dugong dugon*) that are resident in the area (Perreira *et al.,* 2014). The seagrass meadows of the tidal flats in Bazaruto Bay are known to support the largest remaining populations of dugong in the Western Indian Ocean (Findlay *et al.,* 2011; Perreira *et al*., 2014). In addition, seagrass meadows act as a shelter and nursing areas for several juvenile fish species and have importance as fishing grounds for the subsistence (artisanal) beach seine fisheries within the Study Area. Erosion of river systems that discharge into Bazaruto Bay as a result of damming and agricultural intensification are anticipated to increase sediment loading of waters, which could affect seagrass beds through smothering (Pereira *et al.* 2014).

[1] When corals are stressed by changes in conditions such as temperature, light, or nutrients, they expel the symbiotic algae living in their tissues, causing them to turn completely white (National Oceanic and Atmospheric Administration, 2015).

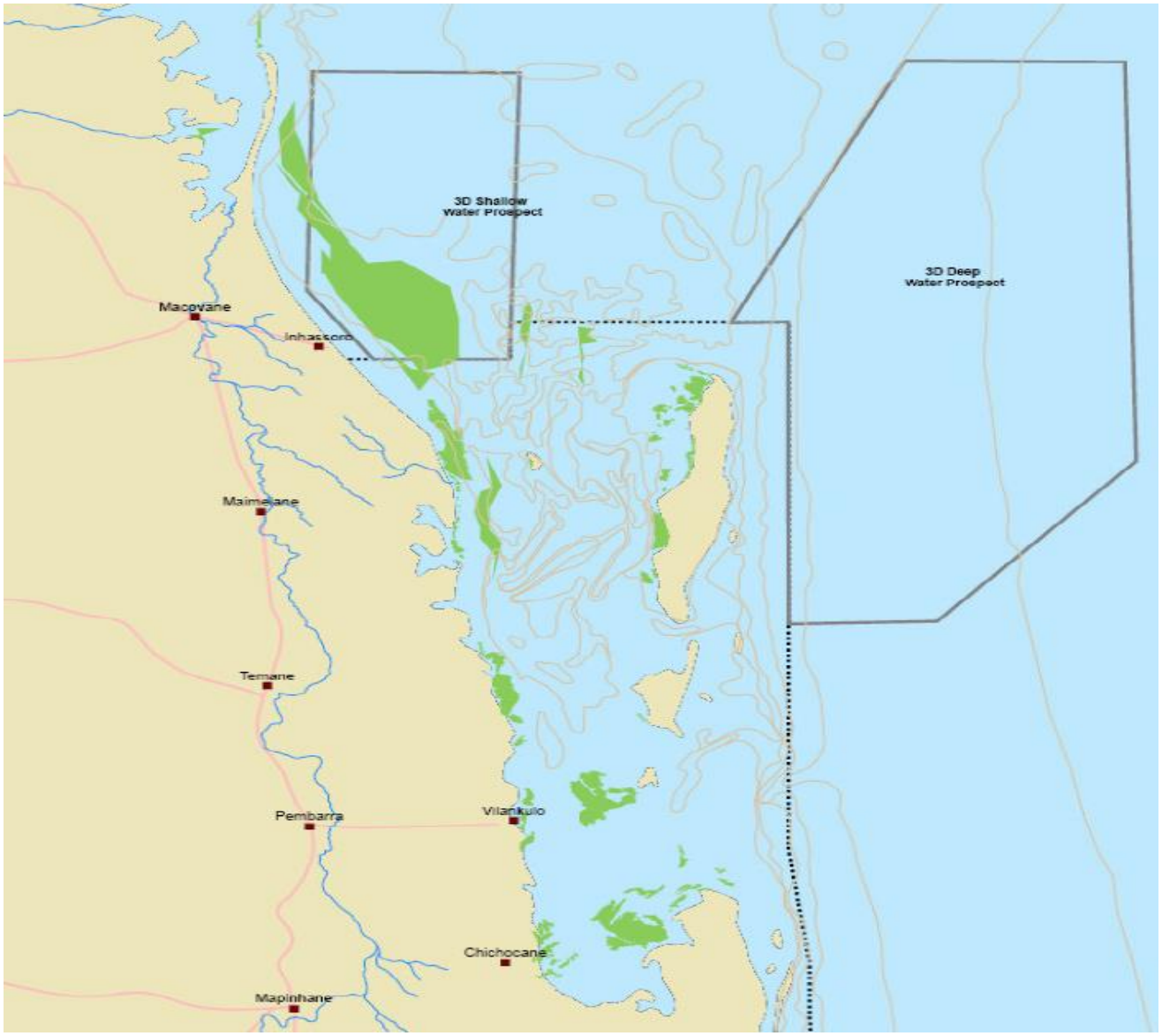

Figure 15: Seagrass beds (green areas) within Bazaruto Bay (Guissamulo, 2006)

5.2.3 Mangroves

Mozambique contains the second highest area of mangrove forest within the Western Indian Ocean (Spalding *et al*., 2007). Mangroves play an important role in the retention of marine sediment and stabilisation of coastlines (Perreira *et al.,* 2014). The sediments and sheltered waters of mangrove forests support a huge variety of invertebrates, phytoplankton, zooplankton, juvenile fish and shrimps (Perreira *et al.*, 2014) and therefore are crucial in support of higher-trophic level species such as birds and commercial fish species. They are particularly important during juvenile growth stages of commercial prawns that are harvested in open waters, as they provide a nutrient-rich environment and shelter from tides and predation for juvenile fish and marine invertebrates. Other ecosystem services provided by mangrove forests in Mozambique include supply of construction material and firewood.

Current pressures on Mozambican mangrove systems include clearance for agricultural purposes and salt extraction, harvest of accessible mangrove forests for firewood/charcoal production, accidental oil spills (Perreira *et al.,* 2014), and upstream dams (e.g. Cahora-Bassa dam) which reduce the flow of freshwater and associated nutrients to mangrove systems, resulting in their shrinkage (Bandeira *et al.,*2012).

Within the Study Area, mangroves are associated with river and stream mouths and concentrated in the Mangarelane area of the mainland, approximately 20 km south of the proposed beach landing sites (Findlay *et al.,* 2006). Five species occur within the Study Area, including red mangrove (*Rhizophora mucronata*), see Figure 16 below, black mangrove (*Bruguiera gymnorrhiza*), Indian mangrove (*Ceriops tagal*), white mangrove (*Avicennia marina*), and *Sonneratia alba* (Findlay *et al.,* 2006).

Figure 16: Crab species in red mangrove, Mangarelane area (Golder Associates, 2015)

5.2.4 Primary Dunes and Sandy Beaches

Sandy beaches occur along most of the coast of the mainland between Cabo São Sebastião and Bartolomeu Dias Point, and make up most of the east and west coasts of the islands of Bazaruto Archipelago (Findlay *et al.,* 2006). Sandy beaches are extensive within Bazaruto Bay, within which the Study Area lies. These beaches sometimes extend to form sand/mud banks and are backed by sparsely vegetated dunes. The dunes are subject to strong erosion pressure, both natural (wind/rain/sand accretion) and anthropogenic (unplanned development on dunes) in nature (Findlay *et al.,* 2006). Sandy beaches and dunes in this area have an important role as nesting habitat for marine turtles (Perreira *et al*., 2014).

5.3 Marine and Coastal Fauna

The Bazaruto Archipelago and its coastal waters is a marine protected area (MPA) and National Park, which supports the most viable dugong population in East Africa (UNEP, 2014) as well as turtles, dolphins and marlin. The proposed beach landing points are located north and south of Inhassoro town on the mainland coast, outside the National Park. The currently proposed anchorage points are located approximately 10-18 km offshore, within Bazaruto Archipelago National Park.

A description of the marine fauna expected to occur in the study area is provided in the following sections, using baseline studies previously completed for Sasol's seismic exploration area within which the Study Area lies, and available published and unpublished information.

5.3.1 Plankton

There are few data available for phytoplankton and zooplankton within the Study Area. In Mozambique the most phytoplankton-productive waters are found near the coast, due to the influence of river discharges and upwelling, while the warmer offshore waters support a lower plankton biomass (Perreira *et al*., 2014). The Inhassoro area experiences high nutrient loading due to outflows from the Save River where the sediment inputs cause elevated turbidity, thereby influencing primary production along the coast (Findlay *et al*., 2006). Therefore, the Study Area is likely to support productive planktonic communities due to the presence of river/estuarine systems.

The Delagoa marine ecoregion, within which the Study Area is located, is a transitional zone between the oligotrophic warm waters of the subtropics, and the more productive waters of the sub-Antarctic zone (Spalding *et al*., 2007). This mixing of waters results in an area of planktonic upwelling that is an important feeding ground for some migratory animals such as whales, whale shark (*Rhincodon typus*) and sea birds (Perreira *et al.,* 2014).

5.3.2 Invertebrates

There is limited available information on marine invertebrates of Mozambique, particularly species that are not harvested for commercial reasons. Most available information is focussed on molluscan fauna, many of which are harvested for food purposes or for their shells.

The invertebrate species discussed in the following sections have not yet been assessed by the IUCN Red List (IUCN, 2014); therefore, their conservation status is currently unknown.

Molluscs

Over 500 species of mollusc are known from the Bazaruto Archipelago alone (Everett *et al.,* 2008) six of which are endemic (Perreira *et al.,* 2014).

Some species of marine mollusc on the Mozambique coast have important 'ecosystem engineer' roles. For example, giant triton (*Charonia tritonis*) is one of the few predators of crown-of-thorns starfish (*Acanthaster planci*). Giant triton is heavily exploited for sale as a souvenir; large-scale removal of giant triton can allow crown-of-thorns starfish to proliferate, which can result in coral reef collapse (Perreira *et al*., 2014). Other species such as sea slugs are thought to be very diverse but greatly understudied, with a recent study (Tibiriçá, 2013) contributing over 100 new records for Mozambique as well as a number of undescribed species.

Relevant coastal habitats within the Study Area that provide habitat for molluscan species include beaches, rocky intertidal areas and mangrove forests:

- Sandy beaches in the Bazaruto archipelago are inhabited by various gastropods capable of trapping water inside their shells to prevent dessication during low tide, such as the periwinkle species *Nodilittorina natalensis* and *Littoraria glabrata*, and the nerite (*Nerita plicata*) (Everett *et al.,* 2008).
- In rocky intertidal areas, species present include black rock oyster (*Crassostrea cuccullata*), grazing snail (*Planaxis sulcatus*), mussel (*Parviperna nucleus*), whelk (*Thais savignyi*), limpet (*Cellana capensis*) and the predatory black mulberry shell (*Morula granulata*) (Everett *et al*., 2008).
- Mangrove forest provides specialised habitat for several molluscan species, including mangrove creeper (*Cerithidea decollata*), mangrove periwinkle (*Littoraria scabra, Littoraria intermedia*), a creeping snail (*Terebralia palustris*), and oysters (*Crassostrea forskhalii*).

Six endemic species of gastropod (*Conus pennaceus, Epitonium pteroen, E. repandior, Fusiaphera eva, Thracia anchoralis, Limatula vermicola*) are known from the Bazaruto Archipelago (BirdLife International, 2018).

Crustaceans

Mangroves are particularly important as a nursery for juvenile stages of penaid prawn, including the Indian white prawn (*Fenneropenaeus indicus*) and brown prawn (*Metapenaeus monoceros*), prior to their migration to deep open waters. These species are crucial to the Mozambican prawn fishing industry, accounting for 90% of the total catch (Findlay *et al*., 2006). Their conservation status has not yet been assessed by the IUCN Red List (IUCN, 2018). Nursery habitat (mangroves) for these species is present within the Study Area.

Cephalopods

Although these are typically offshore species of deep waters, some cephalopod species may occur within the Study Area.

Deep channels near shore inside Bazaruto Archipelago provide habitat for some (normally deep-water dwelling) juvenile squid species including diamondback squid (*Thysanouteuthis rhombus*) and Indian squid (*Loligo duvauceli*), which are thought to be attracted to seagrass beds for feeding opportunities and shelter (Findlay *et al*., 2006). The cuttlefish *Sepia pharaonis* appears to be common in shallow waters, as it dominates the catches of the beach seine fishery in the coast of Vilankulo and Inhassoro district (Findlay *et al.,* 2006). The presence of these species in the Study Area was confirmed during the Golder site visit; squid and cuttlefish were brought ashore at Inhassoro from Bazaruto Bay by fishermen (Figure 17).

Figure 17: Squid and cuttlefish caught in Bazaruto Bay (Golder Associates Africa, February 2015).

5.3.3 Seahorses

There are at least 30 species of pipefish recorded in Mozambique, however it is likely that this number is underestimated (Perreira *et al*., 2014). Seahorses and pipefish are subject to overexploitation for souvenirs, traditional medicinal purposes, and the aquarium market (Perreira *et al*. 2014; Project Seahorse, 2003). CITES lists five species of seahorse in Mozambican waters as protected (Table 7).

Table 7: CITES-listed seahorse species in Mozambican waters

Scientific name	Common Name	Conservation Status (IUCN, 2018)
Hippocampus borboniensis,	Réunion seahorse	DD
Hippocampus camelopardalis	Giraffe seahorse	DD

Scientific name	Common Name	Conservation Status (IUCN, 2018)
Hippocampus fuscus	Sea pony	DD
Hippocampus histrix	Spiny seahorse	VU
Hippocampus kuda	Spotted seahorse	VU

All of these species are associated with seagrass habitats (Aylesworth, 2014; Project Seahorse, 2003a, 2003b, 2003c; Wiswedel, 2012), therefore they could potentially occur within the Study Area. The entire seahorse genus *Hippocampus* spp. was listed in Appendix II of CITES in November 2002 (Project Seahorse, 2003).

5.3.4 Fish (excluding Sharks and Rays)

Fish diversity and population composition will vary according to habitat type within the Study Area. Fish species expected to be present within the Study Area largely consist of species associated with seagrass beds and shallow waters, as well as some juvenile stages of deep water and pelagic fishes.

Shallow-water coastal species expected to occur within the Study Area are listed in Table 8.

Table 8: Shallow-water coastal species expected in the Study Area (Findlay *et al.,* 2006)

Scientific name	Conservation Status (IUCN, 2018)
Aeoliscus punctulatus	DD
Amblygaster sirm	LC
Carangoides ferdau	LC
Cheilopogon cyanopterus	LC
Chirocentrus dorab	LC
Fistularia commersonii	LC
Hemiramphus far	NE
Strongylura leiura	NE
Tylosurus crocodiles crocodiles	NE

Juvenile stages of deep water pelagic species that may also occur include Indian scad (*Decapterus russelli* – LC*), Scomberoides tol, Selar crumenophthalmus, Carangoides dinema,* kawakawa *(Euthynnus affinis* – LC), *Rastreliger kanagurta* and *Herklotsichthys quadrimaculatus* (Findlay *et al*., 2006). Other species likely to be present include the mangrove and estuarine fish species flathead mullet (*Mugil cephalus* - LC), yellowtail barracuda (*Sphyraena flavicauda* - NE), and bonefish (*Albula vulpes* - NT) (Findlay *et al*., 2006). The diversity of fish species taken by the local capture fishery is illustrated in Figure 18.

Figure 18: Capture fisheries observed during site visit (Golder Associates Africa, 2015)

5.3.5 Sharks and Rays

Sharks and rays recorded in Bazaruto National Park include black tip reef shark (*Carcharhinus melanopterus* – NA), white tip reef shark (*Triaenodon obesus* – NA), blackfin shark (*Carcharhinus limbatus* – NA), dusky shark (*Carcharhinus obscurus* - VU), Zambezi shark (*Carcharhinus leucas* - NA), Java shark (*Carcharhinus amboinensis* - DD), blue stingray (*Dasyatis chrysonota* - LC), and whale shark (*Rhincodon typus* - VU) (Everett *et al*., 2008). The conservation status of several of these is unknown (not assessed - NA) as they have not yet been assessed by the IUCN Red List of Threatened Species (IUCN, 2014). The oceanographic characteristics of the Inhambane area create favourable conditions for aggregations of resident and transient reef manta ray (*Manta alfredi* – VU), giant manta ray (*Manta birostris* - VU) and whale sharks (*Rhincodon typus* - EN) (Perreira *et al.,* 2014).

Little information exists on the presence or distribution of sharks and rays within the Study Area. Aerial surveys conducted in 2001 (Mackie, 2001) recorded no whale sharks between the Save River estuary and Bazaruto (within which the Study Area lies), possibly because the survey was conducted over shallow water of <10 m depth (Mackie, 2001); by comparison, sightings of whale shark were made in the open sea between Pomene and Bazaruto Island (Findlay *et al*., 2006). The species is known to occur in both coastal and pelagic waters (Pierce & Norman, 2016) and therefore could occur within the Study Area.

Dusky shark (*C. obscurus*) has a patchy distribution in tropical and warm temperate seas, being highly migratory (Musick *et al*., 2009). Population decline in several areas of its range are attributed to entanglement in shark-protection beach nets, fisheries bycatch, and targeted fishing - its fins are highly prized for the shark fin trade (Musick *et al*., 2009). Although recorded in Bazaruto National Park (Everett *et al.*, 2008), no information on frequency of occurrence or distribution is available.

Blue stingray (*D. chrysonota*) is often found in shallow bays and sheltered sandy beaches in summer, moving offshore to deeper waters of up to about 100 m depth in winter (Smale, 2009); it is likely to be present within the Study Area.

5.3.6 Avifauna

Bazaruto Archipelago is a designated Important Bird Area (IBA) (BirdLife International, 2015). A total of more than 180 bird species have been recorded for Bazaruto Archipelago, which is an important stopover for different species of migrating birds, particularly Palaearctic waders which are attracted by the extensive sand flats on the leeward shores of the islands (CSIR, 2001).

The number of waterbirds present during the austral summer regularly exceeds 20,000 (BirdLife International, 2015). The largest congregations in southern Africa of bar-tailed godwit (*Limosa lapponica)* and crab-plover (*Dromas ardeola)* have been observed within the IBA. Flocks of American flamingo (*Phoenicopterus ruber*), which arrive from breeding grounds in Botswana and disperse along the east coast of Africa, are present in the archipelago during mid-winter (BirdLife International, 2015). Rare birds observed in the marshes of San Sebastião include long-toed lapwing (*Vanellus crassirostris*) and rufous-bellied heron (*Butorides rufiventris*) (BirdLife International, 2015); however, these are not listed as threatened (i.e. Critically Endangered, Endangered, or Vulnerable) by the IUCN Red List of Threatened Species (IUCN, 2014).

5.3.7 Cetaceans

The combination of shallow, plankton-rich waters in Bazaruto Bay, and nearby oceanic conditions, provides highly suitable conditions for cetaceans (whales and dolphins) in the greater Bazaruto area (Everett *et al.,* 2008). At least three species of whale and six species of dolphin occur in the area, and thus may occur in the Study Area.

Whale species include southern right whale (*Eubalaena australis*), humpback whale (*Megaptera novaeangliae*) and minke whale (*Balaenoptera acutorostrata*). These typically occur on the seaward side of Bazaruto Archipelago, the shallow waters of the leeward side not being deep enough for them. Minke whale and southern right whale are resident in the area, whilst humpback whales migrate along the coasts of Natal, southern Madagascar and Mozambique, passing Bazaruto Archipelago between September and November on their annual migration to Madagascar (CSIR, 2001).

Four species of dolphins are resident in coastal waters of the area; Indian Ocean Humpback Dolphin (*Sousa plumbea* - EN), Indo-Pacific bottlenose dolphin (*Tursiops aduncus* - DD), spinner dolphin (*Stenella longirostris* - DD) and spotted dolphin (*Stenella attenuata* - LC) (Perreira *et al*., 2014). Other species that are present in the Study Area (Findlay et al., 2006) include common dolphin (*Delphinus delphis* - LC), and bottlenose dolphin (*Tursiops truncatus* - LC). All of these species may occur within the Study Area.

5.3.8 Dugong

Dugong (*Dugong dugon*), is listed as Vulnerable on the IUCN Red List of Threatened Species (Marsh, 2008) because of population declines across its entire range. The declines have arisen from threats including gill netting (which entangles them as bycatch), overexploitation through subsistence hunting, and agricultural pollution resulting in sedimentation of seagrass beds and consequent habitat loss (IUCN, 2008). They are also listed on Appendix I of the Convention on International Trade in Endangered Species (CITES) which prohibits trade of this species or its parts. The dugong population of Bazaruto Bay is the largest population of dugongs in the Western Indian Ocean (IUCN, 2008).

Dugong presence and movements are closely linked to the presence and extent of seagrass beds, which form its primary food source (Guissamulo, 2006). Dugongs have been estimated to spend 72% of their time within 3 m from the sea surface (Chilvers et al., 2004). In Bazaruto Bay, seagrass beds associated with the sand tidal flats cover approximately 88 km^2 in shallow and subsidiary waters less than 5 m (Bandeira et al., 2008); it is

thus assumed that dugong in Bazaruto Bay spend the majority of the time that they are present in waters of depths less than 5 m. Surveys offshore of Bazaruto Island have showed that dugongs move extensively to the offshore shallow areas during low tide to escape the risk of stranding; this information has prompted the proposal of an area north of Bazaruto National Park as an additional dugong protection area (WWF & UNEP 2004).

2006 Baseline Survey

An aerial field survey of dugong in Sasol's offshore exploration blocks 16 & 19, within which the Study Area lies, was previously undertaken in March/April 2006 (Guissamulo, 2006). The survey gathered primary data on dugong numbers/movements in the area to the north of Bazaruto National Park, and the extent of sea grass beds to the north of Bazaruto. Dugong presence within the Study Area based on the data gathered in Guissamulo's study is shown in Figure 19. Dugong was observed singly, in pairs and less frequently in aggregations, at distances varying from 500 m to 10 km from shore. Most sightings were concentrated between Bazaruto Bay and Vilanculos, with 54 of a total 79 dugong recorded in this area (Guissamulo, 2006).

Overall, during Guissamulo's survey, dugong were most common in the area north of the Santa Carolina Island and west of the northern tip of the Bazaruo Island, an area which lies between the proposed anchoring points and the beach landing site options (Figure 19). Dugong were observed to sometimes form large aggregations, for reasons speculated to be either for social behaviours, or due to presence of deeper water during low tide conditions when access to seagrass feeding areas was restricted. These aggregations were observed both within Bazaruto Bay, and up to 10 km offshore (Guissamulo, 2006).

2015 Supplementary Data

Additional shapefile data provided by the Endangered Wildlife Trust (EWT, 2015) who are currently studying dugong presence and patterns of distribution in the Bazaruto Bay area, shows the areas where sightings of dugong have been concentrated during their survey work (Figure 20, Figure 21). The figures illustrate the areas (isopleths) within which 100%, 95% and 90% of adult dugong sightings (Figure 20) and calf sightings (Figure 21) have been observed by EWT during 2012-2014; these areas may be considered as being of greater importance for dugong conservation within the Study Area.

2016 Baseline Survey

An aerial survey of dugong in Bazaruto Bay was carried out in April 2016 for the EIA process for the Sasol Pipeline and offshore Floating, Storage and Offloading unit (FSO) Project (Guissamulo, 2016), which updated the distribution and abundance estimates made previously (Guissamulo, 2006), and characterised the Study Area's importance for dugongs. Observed group sizes ranged from solitary individuals to groups of 11 individuals, 20% of which included calves (Guissamulo, 2016). Groups with calves were observed at four key locations, notably in the north eastern area of Bazaruto Bay between Bazaruto Bay and north of Santa Carolina Island, which lies within the Study Area.

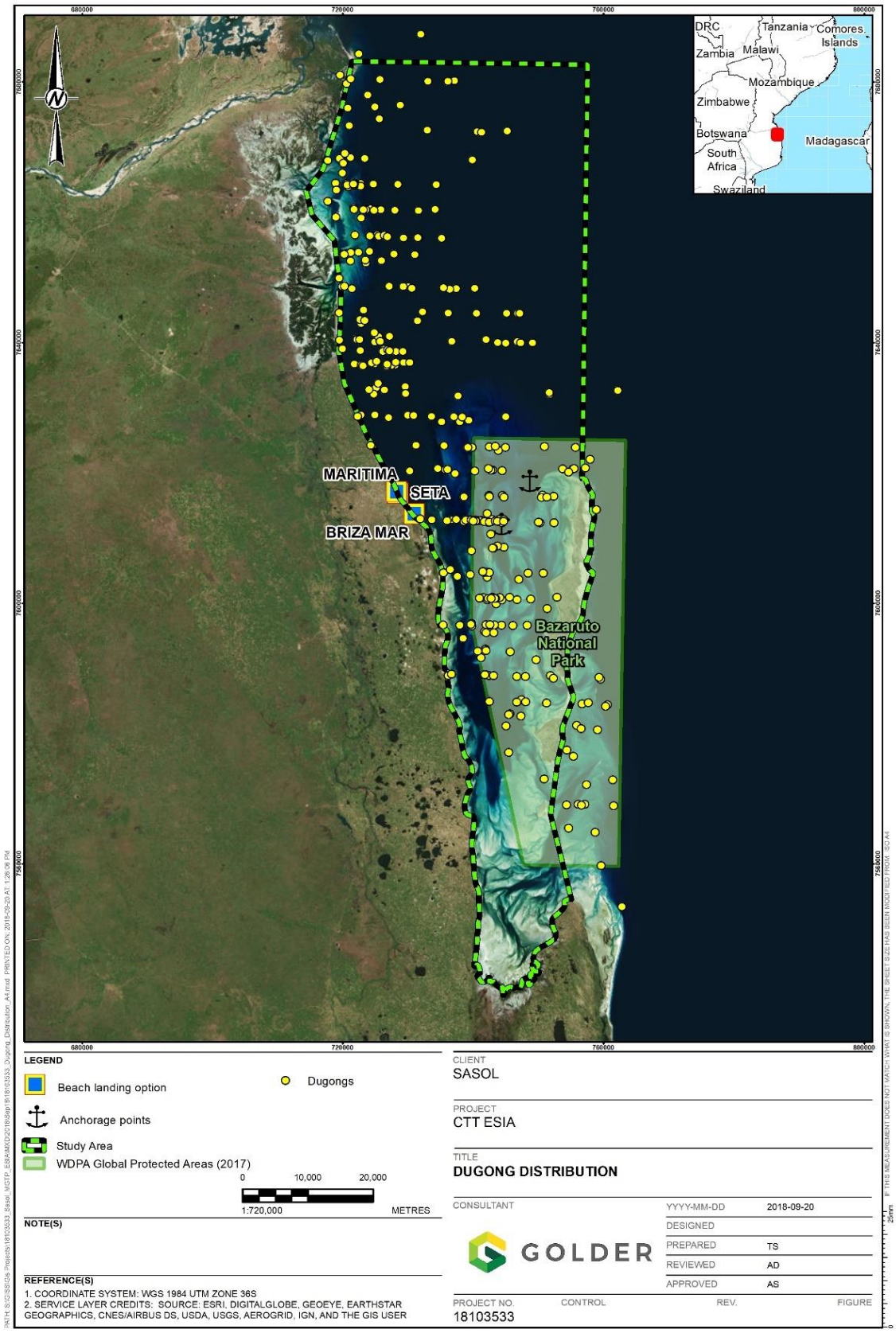

Figure 19: Dugong distribution in relation to the Study Area (Guissamulo, 2006)

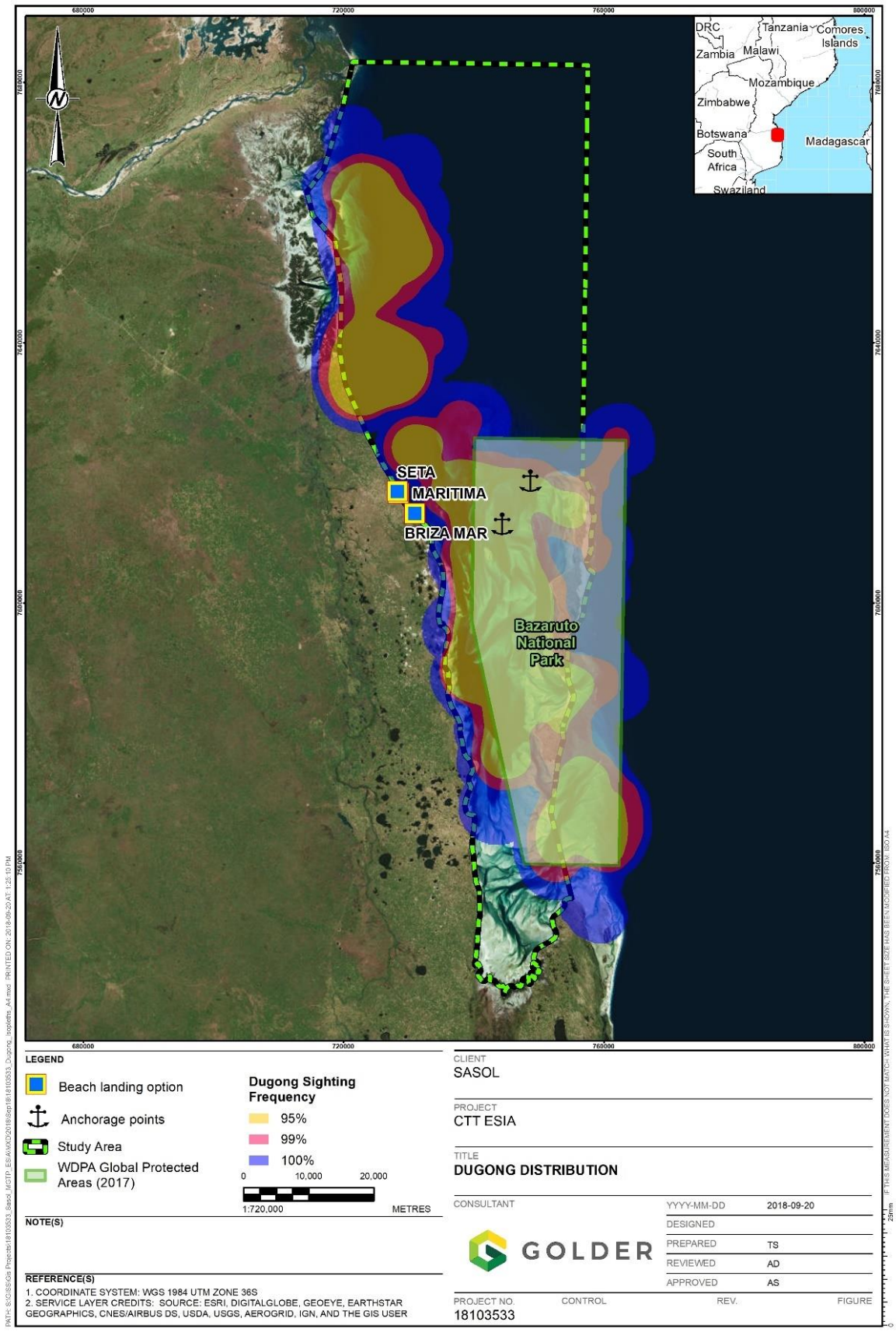

Figure 20: Adult dugong distribution 2012-2014 (EWT, 2015)

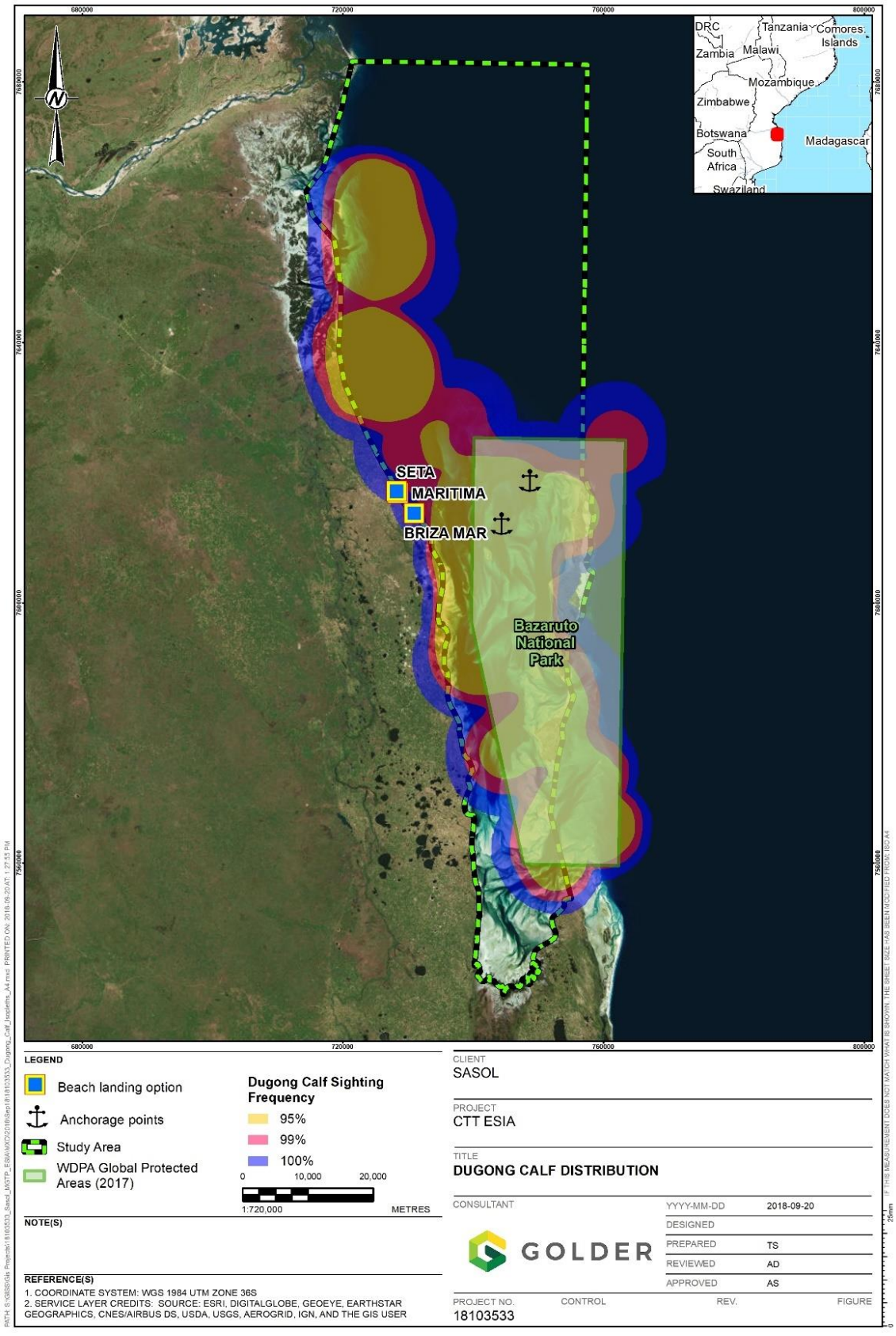

Figure 21: Breeding dugong distribution 2012-2014 (EWT, 2015)

5.3.9 Sea Turtles

Five species of marine turtles occur in Mozambique, the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochleys coriacea*), hawksbill (*Eretmochelys imbricata*), and olive ridley (*Lepidochelys olivacea*). Observations of the olive ridley turtle are largely confined to the northern region; the other four have been observed along the entire Mozambican coast (Perreira *et al.,* 2014).

Loggerhead and leatherback turtle nests have been recorded on the eastern coast of Bazaruto Island, and at the sandy beaches of the mainland coastline north of Inhassoro, especially in areas of small dunes and weak erosion (Findlay *et al*., 2006). The distribution and number of nests along the coastline within the Study Area is unknown; however suitable habitat may be present 10-15 km south of Inharasso where dune systems are evident. Loggerhead turtle is listed as Endangered (Marine Turtle Specialist Group 1996) and leatherback turtle is listed as Vulnerable (Wallace *et al.,* 2013) by the IUCN Red list of threatened species.

While the hunting of marine reptiles is prohibited by law, butchered adult green turtles were found on the foreshore at the mouth of the Nhangonzo coastal stream (Avis *et al*. 2015).

5.3.10 Seals

Two seal species (crab eater seal *Lobodon carcinophaga*, cape fur seal *Arctocephalus pusillus*) have been recorded in Mozambican waters; however, these are incidental records - Mozambican coastal waters are outside their normal distribution ranges (southern coast of South Africa and Antarctic respectively (Findlay *et al.*, 2006). Seals are therefore not expected to occur in significant numbers within the Study Area.

5.4 Protected Areas and Species

Several marine and coastal ecosystems and species are protected by Mozambican law, or as a result of obligations on the Mozambican government as signatories to various international conventions (ref. Section 4.0). Protected areas and species that are present within the Study Area are summarised in the following paragraphs.

5.4.1 Protected Areas

5.4.1.1 Nationally Designated Areas

Bazaruto Archipelago National Park

As mentioned throughout this report, Bazaruto Archipelago National Park lies within the Study Area. Designated in 1971, it was the first official National Park of Mozambique, and initially comprised the three southernmost islands Bangue, Magaruque and Benguerua, together with a contiguous sea area extending 5 kilometres to the West and to the 100 m line of bathymetry to the East (WWF, 2010). The protected area was then extended in 2002, to include the remaining islands of the archipelago (i.e. Bazaruto and Santa Carolina), and was renamed as the Bazaruto Archipelago National Park, with a total area of 1,430 km^2 (WWF, 2010; Perreira *et al*., 2014).

The Nhamabue area at the Govuro River Estuary to the north of Inhassoro and Save River holds about 60 percent of the dugong population of the entire greater Bazaruto Archipelago and has been proposed as a sanctuary which could be managed as part of the Bazaruto Archipelago National Park (Guissamulo, 2016).

Bazaruto Archipelago Important Bird Area

Bazaruto Archipelago Important Bird Area (IBA) consists of the islands of Bazaruto, Santa Carolina, Benguerra and Margaruque, and also the San Sebastião peninsula on the mainland – overlapping in part with the National Park. The most important habitat for birds is the extensive intertidal flats which connect the islands, as the site is designated as an IBA due to its importance as wintering ground for large numbers of non-breeding migratory waders from the Palearctic (BirdLife International, 2015).

5.4.1.2 Protected Habitats

Primary dunes and sandy beaches are prominent habitats, especially from Bazaruto southwards, where these play an important role as nesting habitat for marine turtles. The Forestry and Wildlife Regulations offer total protection to all five species of marine turtles, which extends to their nesting sites. If nesting sites occur within the Study Area, these beach areas will be subject to the requirements of the Forestry and Wildlife Regulations.

In addition, the Regulation for the prevention of marine pollution further protects beach systems where turtles are present, describing beaches as "fundamental habitats for the normal development of marine turtles". It requires that infrastructure development apply for special licenses, prohibits driving on the beach and makes provisions for heavy fines for violations.

5.4.2 Nationally Protected Species

Several nationally-protected faunal species occur within the Study Area, which will be closely considered during the assessment of potential project impacts:

- All turtle species are protected under national legislation so that the killing of marine turtles and possession of their eggs is an offence (Forest and Wildlife Regulations [Decree 12/2002 of 6 June 2002]). This regulation prescribes a fine of MT 25,000 (approximately US$ 1,000) for the illegal hunting of marine turtles;
- All cetacean species are protected under national legislation (Forest and Wildlife Regulations [Decree 12/2002 of 6 June 2002]); and
- Dugong is protected under national legislation (Forest and Wildlife Regulations [Decree 12/2002 of 6 June 2002]).

5.4.3 Marine Species of Conservation Concern

Two marine mammal species of concern are found in the coastal waters of the Study Area; Dugong, and Indian Ocean Humpback Dolphin.

The dugong population in the area (the Bazaruto Archipelago region), is considered the largest and last viable population in the Western Indian Ocean region, from Cabo de São Sebastião in the south to the Save River mouth in the north (Findlay et al. 2011; Allen 2013; Samoilys et al. 2015). Most recent population estimates, which should be considered cautiously as different methodologies were used at varying levels of detail, vary between 359, 463 and 852 dugongs for the Greater Bazaruto Area (Findlay et al, 2011; Provancha & Stolen, 2008; Guissamulo et al., 2016, respectively). Dugongs use the entire inshore waters depending on the availability of forage and disturbance. Their distribution is closely related to the location of the seagrass meadows between 1 and 5 m deep that they utilise for grazing (Guissamulo, 2006). Pressures from anthropogenic disturbances, causing reductions in available seagrass beds for foraging, is the main cause for classifying the East African dugong population as endangered on the IUCN Red List (Allen, 2013).

The Indian Ocean Humpback Dolphin (*S. plumbea*) is resident in the coastal waters of the Study Area. It occurs in shallow waters typically less than 25 m in depth; correspondingly, most of the population occurs within 500 m to 2 km of the coastline (Plon et al., 2016). The use by Indian Ocean Humpback Dolphins of this habitat elevates the exposure of the animals to a variety of threats, including organic and chemical pollution from land-based runoff causing food web and water quality changes, noise pollution, boat disturbance, climate change, and mortality via entanglement in fishing gear; the latter of which is considered to be the greatest threat to this species' survival (Braulik et al., 2017; Plon et al., 2016).

Bull shark (*Carcharhinus leucas*), which is classified as Near Threatened, and smalltooth sawfin (*Pristis microdon*), which is Critically Endangered (CR), are expected to occur within the Study Area (Golder, 2017). Whale shark (*R. typus*), which is Endangered (EN), could also occur.

In addition, all five Western Indian Ocean (WIO) marine turtle species have been reported to occur in or near the Study Area (Costa et al., 2007). These species utilise the seagrass beds and coral reefs in the region for foraging, and the beaches, particularly on the east coast of Bazaruto Island, for nesting (Hughes 1971; Costa et al. 2007; Videira et al. 2008; Pereira and Videira 2009). Five species nest on the beaches of Bazaruto Archipelago and São Sebastião Peninsula (Olive Ridley awaits further confirmation) during the October-March period. Some of these species may nest on the sandy beaches of the Study Area, with special reference to the Nhamábuè area (north of Inhassoro) where beaches are considered suitable for nesting. It is likely that loggerhead turtles nest in this beach (ERM & IMPACTO, 2016), but Marshall et al. (2015) consider the area a suitable nesting ground for green and leatherback turtles as well.

Marine turtles are the only threatened reptiles reported to occur in the estuarine and coastal habitats of the Study Area. These are briefly discussed in Table 6-10. All five species of marine turtles are protected from hunting by the Forest and Wildlife Law (Decree 12/2002 of 6 June) and its eggs and habitats by the Regulation on Pollution Prevention and Protection of the Marine and Coastal Environment (Decree 45/2006 of 30 November). Apart from these, one other threatened species (Zambezi Soft-shelled Terrapin - *Cycloderma frenatum*) may be present in the Study Area, confined to the Save River and the Govuro River estuaries (Golder, 2015a). This species is mostly found in northern Mozambique, with the Save River marking the southern extent of its range. Hence, these six species are the main reptile species of conservation concern for the estuarine and coastal area (Table 9).

Table 9: Reptile species of conservation concern associated with estuarine and coastal habitats in Study Area

Species	Common name	Conservation status (IUCN, 2016)	Likelihood in Study Area	Notes
Chelonia mydas	Green turtle	Endangered	Confirmed	Recorded on the seagrasses north of Inhassoro, an important foraging ground (ERM & IMPACTO, 2016). May also nest in the Study Area.
Eretmochelys imbricata	Hawksbill turtle	Critically Endangered	High	Observed near the Study Area (ex. Santa Carolina Island). May also occur on shallow waters of Study Area.
Lepidochelys olivacea	Olive Ridley turtle	Vulnerable	Moderate	Observed in Bazaruto Archipelago and São Sebastião Peninsula). May occasionally visit the Study Area.
Caretta	Loggerhead turtle	Vulnerable *Near-threatened (South West Indian Ocean subpopulation)	Confirmed	Observed in Bazaruto Archipelago and São Sebastião Peninsula). May also nest in the Study Area.
Dermochelys coriacea	Leatherback turtle	Vulnerable *Critically Endangered	Moderate	Recorded near the Study Area ERM & IMPACTO (2016). May

Species	Common name	Conservation status (IUCN, 2016)	Likelihood in Study Area	Notes
		(Southwest Indian Ocean subpopulation);		occasionally visit the Study Area and possibly nest here.
Cycloderma frenatum	Zambezi Soft-shelled Terrapin	Endangered	Low	Mainly found in northern Mozambique as far south as the Save River and may occur in the Save and Govuro River estuaries.

5.5 Baseline Conclusion

The Study Area is characterised by a diversity of habitats including sandy beaches, sand dunes, coral reefs, estuaries, bays, seagrass beds and mangrove forests, which support a rich marine and coastal flora and fauna, some of which are of significant conservation concern.

Of note is the presence of dugong within the Study Area; the dugong population of the Bazaruto Archipelago is the largest population in the Western Indian Ocean and thus is of significant conservation importance. Other species of conservation concern that occur within the Study Area include Indo-Pacific bottlenose dolphin and spinner dolphin, both of which are Data Deficient; and the Endangered loggerhead turtle and Vulnerable leatherback turtle, seahorses, whale shark, reef manta ray and giant manta ray; all of which are of international conservation concern.

The nautical anchorage points previously used or identified for mooring of the transhipment vessel are located within Bazaruto Archipelago National Park, in waters of approximately 15-20 m depth. These existing nautical anchorage points lie within the area of Bazaruto Bay within which sightings of dugong have been concentrated; however, water depths at this location are probably sufficient to avoid any significant disturbance of seabed and coral reef habitat, or collision risks for dugong. Impacts on seagrass beds at the anchorage points are unlikely given that seagrass beds typically occur in shallow and subsidiary waters of less than 5 m depth in Bazaruto Bay. The final anchorage points have not yet been selected and will be determined based in part on ongoing acceptable environmental studies.

Dugong presence and movements are closely linked to the presence and extent of seagrass beds. Within the Study Area, the most extensive bed of seagrass is located off the shoreline where the beach landing options Maritima and Seta are located (Guissamulo, 2006). At low tide, dugong move from these areas into deeper waters to avoid stranding on the tidal flats where the seagrass occurs. Barges loaded with heavy equipment will sail to the beach landing sites on the high tide; at low tide the barge will reach the beach landing site and be off-loaded. Barges sailing on the high tide may present a collision risk to dugong; in addition, barge movements in shallow waters at the beach landing sites could disturb the seabed and any nearby seagrass beds. Timing of barge sailing schedules to take place during high tides only, and selection of appropriate barge sailing routes to avoid important seagrass bed locations, will be critical in minimising the potential for any impacts on species and habitats of conservation concern, and protected areas.

6.0 CRITICAL HABITAT

6.1 Critical Habitat Area of Analysis

A Critical Habitat Area of Analysis (CHAA) that encompassed both the beach landing sites and anchorage points was identified, being an ecologically relevant area surrounding and including the anticipated extent of project influence on coastal and marine biodiversity. The CHAA was used as the geographical extent to screen biodiversity features to be assessed for CH and is roughly equivalent to the Study Area that was defined for the current baseline description (Section 4.2). CH was only identified and mapped at the CHAA scale as potential direct and indirect project effects are expected to be limited to this spatial extent. The CHAA for the current assessment is shown on Figure 22.

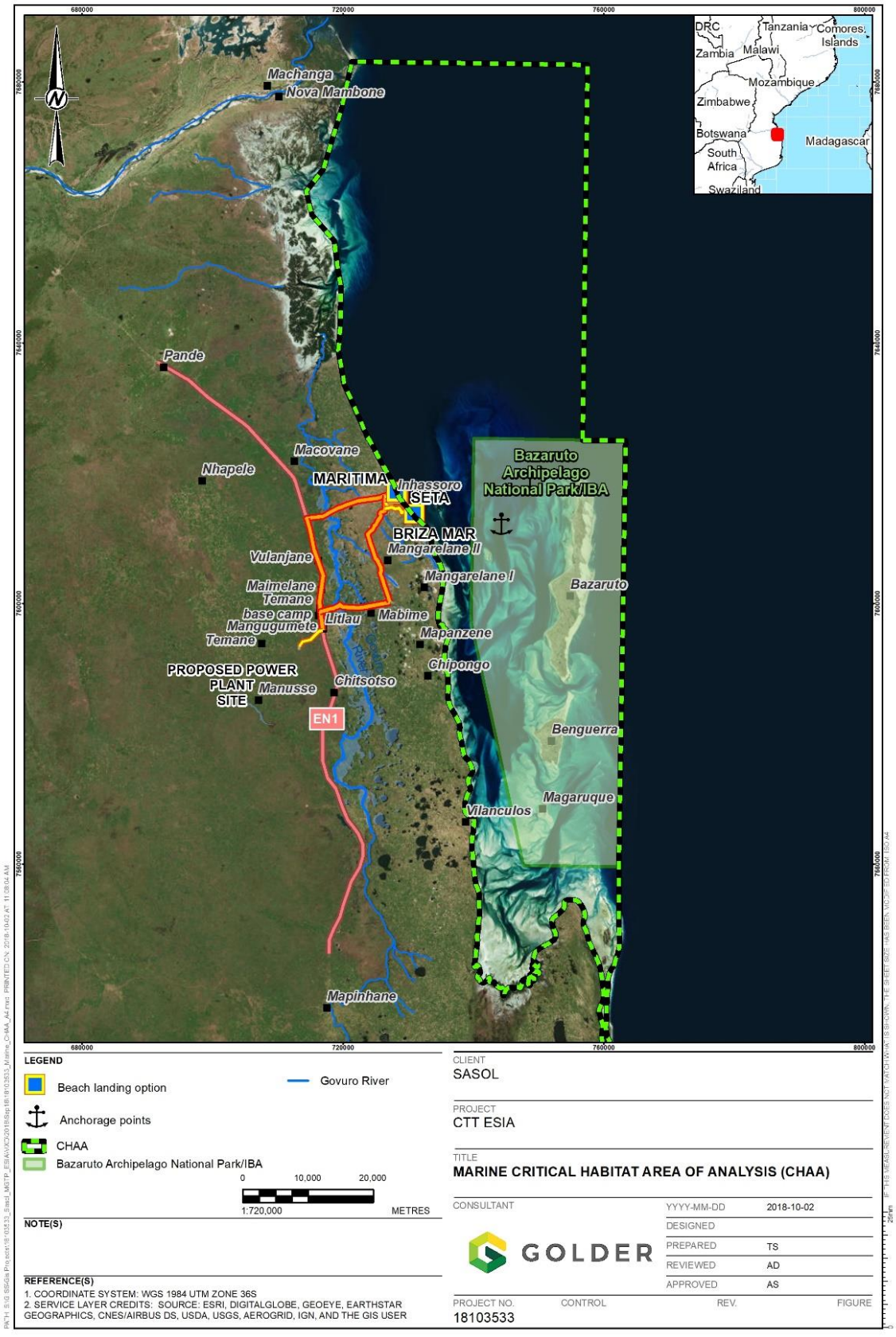

Figure 22: Marine Critical Habitat Area of Analysis (CHAA)

6.2 Species Triggers of CH

A list of 1,974 marine and coastal species with potential to occur within the Study Area was derived from the IUCN Red List for Mozambique (IUCN, 2018), with the following habitat filters applied:

- Marine Neritic
- Marine Deep Benthic
- Marine Coastal/Supratidal
- Marine Oceanic
- Marine Intertidal
- Artificial/Aquatic & Marine

In order to refine the list to include only species of conservation concern with potential to trigger Critical Habitat criteria, species that were categorised as CR or EN on the IUCN Red List (Criterion 1), known endemic species (Criterion 2) and/or species listed on Appendix I or II of the Convention on Migratory Species (Criterion 3) were shortlisted. 112 marine and coastal faunal species with potential to trigger Critical Habitat designation on the basis of Criterion 1-3 were identified (Appendix A) and are discussed in greater detail according to trigger criteria overleaf.

6.2.1 Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species

Twenty-eight CR and EN species potentially occur in the marine and coastal habitats of the Study Area. Although none of these are expected to occur in concentrations sufficient to trigger Tier 1 Critical Habitat designation, the regular occurrence of individuals of beach-nesting turtles (Green Turtle, Hawksbill Turtle), and Indian Ocean Humpback Dolphin (*Sousa plumbea* - EN) which is resident in the coastal waters of the Study Area triggers Tier 2 CH criteria in the CHAA (Figure 23). *Regular* occurrence of individuals of the fish species listed in Table 8 within the CHAA cannot be confirmed based on the available baseline data.

Table 10: Critically Endangered and Endangered Species confirmed/with potential to occur in the CHAA

Class	Common name	*Scientific name*	IUCN	CMS	CITES
ACTINOPTERYGII	Giant Wrasse	*Cheilinus undulatus*	EN		II
ACTINOPTERYGII	Dusky Grouper	*Epinephelus marginatus*	EN		
HOLOTHUROIDEA	Golden Sandfish	*Holothuria lessoni*	EN		
HOLOTHUROIDEA	Black Teatfish	*Holothuria nobilis*	EN		
HOLOTHUROIDEA	Golden Sandfish, Sandfish	*Holothuria scabra*	EN		
ACTINOPTERYGII	Kariba Tilapia, Mozzie	*Oreochromis mortimeri*	CR		
ACTINOPTERYGII	Sibayi Goby	*Silhouettea sibayi*	EN		
HOLOTHUROIDEA	Prickly Redfish	*Thelenota ananas*	EN		
CHONDRICHTHYES	Ornate Eagle Ray	*Aetomylaeus vespertilio*	EN		
CHONDRICHTHYES	Honeycomb Izak	*Holohalaelurus favus*	EN		
CHONDRICHTHYES	Whitespotted Izak	*Holohalaelurus punctatus*	EN		
CHONDRICHTHYES	Largetooth Sawfish	*Pristis pristis*	CR		I
CHONDRICHTHYES	Whale Shark	*Rhincodon typus*	EN	I/II	II
CHONDRICHTHYES	Great Hammerhead	*Sphyrna mokarran*	EN		
CHONDRICHTHYES	Zebra Shark	*Stegostoma fasciatum*	EN		
REPTILIA	Green Turtle	*Chelonia mydas*	EN	I/II	I
REPTILIA	Hawksbill Turtle	*Eretmochelys imbricata*	CR	I/II	I
AVES	Basra Reed-warbler	*Acrocephalus griseldis*	EN	I/II	
AVES	Madagascar Pond-heron	*Ardeola idae*	EN		
AVES	Grey Crowned-crane	*Balearica regulorum*	EN		II
AVES	Cape Gannet	*Morus capensis*	EN		
AVES	Cape Cormorant	*Phalacrocorax capensis*	EN		
AVES	African Penguin	*Spheniscus demersus*	EN	II	II

Class	Common name	*Scientific name*	IUCN	CMS	CITES
AVES	Indian Yellow-nosed Albatross	*Thalassarche carteri*	EN		
AVES	Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	EN		
MAMMALIA	Blue Whale	*Balaenoptera musculus*	EN	I	I
MAMMALIA	Fin Whale	*Balaenoptera physalus*	EN	I/II	I
MAMMALIA	Indian Ocean Humpback Dolphin	*Sousa plumbea*	EN		I

6.2.2 Criterion 2: Endemic and/or restricted-range species

Six endemic gastropods from the Bazaruto Archipelago are known to occur within the CHAA (BirdLife International, 2018). The presence of these endemic species triggers Tier 1 CH under Criterion 2, as the Bazaruto Archipelago supports >95% of the global population of these species, and can be considered a discrete management unit (DMU) for these species (Figure 24).

Table 11: Endemic species occurring within the CHAA

Class	Common name	*Scientific name*	IUCN	CMS	CITES
GASTROPODA	Feathered Cone	*Conus pennaceus*	LC	-	-
GASTROPODA	-	*Epitonium pteroen*	NE	-	-
GASTROPODA	-	*Epitonium repandior*	NE	-	-
GASTROPODA	-	*Fusiaphera eva*	NE	-	-
GASTROPODA	-	*Limulata vermicola*	NE	-	-
GASTROPODA	-	*Thracia anchoralis*	NE	-	-

6.2.3 Criterion 3: Migratory and/or congregatory species

Eighty-three migratory/congregatory faunal species could potentially occur in the CHAA (Table 12), including six shark/ray species, three sea turtles, 63 bird species, and 11 mammals (cetaceans). None are expected to occur in concentrations sufficient to trigger Tier 1 Critical Habitat designation (≥95% of the global population) under Criterion 3 in the CHAA.

Tier 2 Critical Habitat under Criterion 3 is triggered by congregations of migratory bird species associated with Bazaruto Archipelago IBA in the CHAA (Figure 24). Bazaruto Archipelago IBA, which lies within the CHAA, and can be considered a DMU for relevant migratory/congregatory bird species, constitutes Tier 2 Critical Habitat on the basis of BirdLife International's Criterion A4[2] for congregations of the following species; Grey Plover *Pluvialis squatarola*, Lesser Sandplover *Charadrius mongolus*, Sanderling *Calidris alba*, Little Tern *Sternula albifrons*, Common Tern *Sterna hirundo*, and Lesser Crested Tern *Thalasseus bengalensis* (BirdLife International, 2018).

Although the seagrass beds of the CHAA support significant numbers of Dugong *(D. dugon*) for both grazing and breeding purposes, the numbers recorded to date (359, 463 and 852 dugongs for the Greater Bazaruto Area (Findlay et al., 2011; Provancha & Stolen, 2008; Guissamulo et al., 2016, respectively)) do not trigger global population qualitative criteria for Tier 2 Critical Habitat under Criterion 3, i.e. ≥ 1% but < 95% of the global population. Since the dugong population of the Bazaruto Archipelago has been identified as the only viable population along East African Coast, it could potentially trigger Tier 2 Critical Habitat on the basis of being a

[2] BirdLife International Criterion A4, Congregations: The site is known or thought to hold congregations of ≥1% of the global population of one or more species on a regular or predictable basis. This criterion can be applied to seasonal (breeding, wintering or migratory) congregations of any waterbird, seabird or terrestrial bird species. Sites can qualify whether thresholds are exceeded simultaneously or cumulatively, within a limited period.

species with a large but clumped distribution, if the Bazaruto subpopulation constituted ≥ 5% of the global population; however, this is considered unlikely given that the maximum count of the Bazaruto subpopulation is 852 dugong, and the global population has been estimated in the tens of thousands, though largely concentrated off the coast of Northern Australia, Papua New Guinea, Qatar and the United Arabian Emirates (Marsh & Sobtzick, 2015).

Table 12: Migratory/congregatory species potentially occurring within the CHAA

Class	Common name	*Scientific name*	IUCN	CMS	CITES
CHONDRICHTHYES	Pelagic Thresher	*Alopias pelagicus*	VU	II	II
CHONDRICHTHYES	Common Thresher Shark	*Alopias vulpinus*	VU	II	-
CHONDRICHTHYES	Silky Shark	*Carcharhinus falciformis*	VU	II	II
CHONDRICHTHYES	Great White Shark	*Carcharodon carcharias*	VU	I/II	II
CHONDRICHTHYES	Shortfin Mako	*Isurus oxyrinchus*	VU	II	-
CHONDRICHTHYES	Longhorned Pygmy Devil Ray	*Mobula eregoodootenkee*	NT	I/II	II
REPTILIA	Loggerhead Turtle	*Caretta caretta*	VU	I/II	I
REPTILIA	Leatherback	*Dermochelys coriacea*	VU	I/II	I
REPTILIA	Olive Ridley	*Lepidochelys olivacea*	VU	I/II	I
AVES	Sedge Warbler	*Acrocephalus schoenobaenus*	LC	II	-
AVES	Cape Teal	*Anas capensis*	LC	II	-
AVES	Red-billed Teal	*Anas erythrorhyncha*	LC	II	-
AVES	African Black Duck	*Anas sparsa*	LC	II	-
AVES	Yellow-billed Duck	*Anas undulata*	LC	II	-
AVES	Rufous-bellied Heron	*Ardeola rufiventris*	LC	II	-
AVES	Ruddy Turnstone	*Arenaria interpres*	LC	II	-
AVES	Sanderling	*Calidris alba*	LC	II	-
AVES	Curlew Sandpiper	*Calidris ferruginea*	NT	II	-
AVES	Little Stint	*Calidris minuta*	LC	II	-
AVES	Caspian Plover	*Charadrius asiaticus*	LC	II	-
AVES	Common Ringed Plover	*Charadrius hiaticula*	LC	II	-
AVES	Greater Sandplover	*Charadrius leschenaultii*	LC	II	-
AVES	White-fronted Plover	*Charadrius marginatus*	LC	II	-
AVES	Lesser Sandplover	*Charadrius mongolus*	LC	II	-
AVES	Chestnut-banded Plover	*Charadrius pallidus*	NT	II	-
AVES	Kittlitz's Plover	*Charadrius pecuarius*	LC	II	-
AVES	African Three-banded Plover	*Charadrius tricollaris*	LC	II	-
AVES	White-winged Tern	*Chlidonias leucopterus*	LC	II	-
AVES	Western Marsh-harrier	*Circus aeruginosus*	LC	II	II
AVES	White-faced Whistling-duck	*Dendrocygna viduata*	LC	II	-
AVES	Wandering Albatross	*Diomedea exulans*	VU	II	-
AVES	Crab-plover	*Dromas ardeola*	LC	II	-
AVES	Peregrine Falcon	*Falco peregrinus*	LC	II	I
AVES	African Snipe	*Gallinago nigripennis*	LC	II	-
AVES	Rock Pratincole	*Glareola nuchalis*	LC	II	-
AVES	Collared Pratincole	*Glareola pratincola*	LC	II	-
AVES	African Fish-eagle	*Haliaeetus vocifer*	LC	II	II

Class	Common name	*Scientific name*	IUCN	CMS	CITES
AVES	Black-winged Stilt	*Himantopus himantopus*	LC	II	-
AVES	Caspian Tern	*Hydroprogne caspia*	LC	II	-
AVES	Common Little Bittern	*Ixobrychus minutus*	LC	II	-
AVES	Dwarf Bittern	*Ixobrychus sturmii*	LC	II	-
AVES	Sooty Gull, Hemprich's Gull	*Larus hemprichii*	LC	II	-
AVES	Bat Hawk	*Macheiramphus alcinus*	LC	II	II
AVES	Southern Giant Petrel	*Macronectes giganteus*	LC	II	-
AVES	Black Kite	*Milvus migrans*	LC	II	II
AVES	Yellow-billed Stork	*Mycteria ibis*	LC	II	-
AVES	Southern Pochard	*Netta erythrophthalma*	LC	II	-
AVES	Eurasian Curlew, Curlew	*Numenius arquata*	NT	II	-
AVES	Whimbrel	*Numenius phaeopus*	LC	II	-
AVES	Osprey	*Pandion haliaetus*	LC	II	II
AVES	Great White Pelican	*Pelecanus onocrotalus*	LC	I/II	-
AVES	Red Phalarope	*Phalaropus fulicarius*	LC	II	-
AVES	Lesser Flamingo	*Phoeniconaias minor*	NT	II	II
AVES	African Spoonbill	*Platalea alba*	LC	II	-
AVES	Spur-winged Goose	*Plectropterus gambensis*	LC	II	-
AVES	Glossy Ibis	*Plegadis falcinellus*	LC	II	-
AVES	Grey Plover	*Pluvialis squatarola*	LC	II	-
AVES	Spotted Crake	*Porzana porzana*	LC	II	-
AVES	White-chinned Petrel	*Procellaria aequinoctialis*	VU	II	-
AVES	Pied Avocet	*Recurvirostra avosetta*	LC	II	-
AVES	African Skimmer	*Rynchops flavirostris*	NT	II	-
AVES	African Comb Duck	*Sarkidiornis melanotos*	LC	II	II
AVES	Little Tern	*Sternula albifrons*	LC	II	-
AVES	Lesser Crested Tern	*Thalasseus bengalensis*	LC	II	-
AVES	Greater Crested Tern	*Thalasseus bergii*	LC	II	-
AVES	Wood Sandpiper	*Tringa glareola*	LC	II	-
AVES	Common Greenshank	*Tringa nebularia*	LC	II	-
AVES	Green Sandpiper	*Tringa ochropus*	LC	II	-
AVES	Marsh Sandpiper	*Tringa stagnatilis*	LC	II	-
AVES	Common Redshank	*Tringa totanus*	LC	II	-
AVES	White-headed Lapwing	*Vanellus albiceps*	LC	II	-
AVES	Wattled Lapwing	*Vanellus senegallus*	LC	II	-
MAMMALIA	Bryde's Whale	*Balaenoptera edeni*	LC	II	I
MAMMALIA	Dugong	*Dugong dugon*	VU	II	I
MAMMALIA	Southern Right Whale	*Eubalaena australis*	LC	I	I
MAMMALIA	Humpback Whale	*Megaptera novaeangliae*	LC	I	I
MAMMALIA	Killer Whale	*Orcinus orca*	DD	II	II
MAMMALIA	Sperm Whale	*Physeter macrocephalus*	VU	I/II	I
MAMMALIA	Pantropical Spotted Dolphin	*Stenella attenuata*	LC	II	II
MAMMALIA	Striped Dolphin	*Stenella coeruleoalba*	LC	II	II
MAMMALIA	Spinner Dolphin	*Stenella longirostris*	DD	II	II

Class	Common name	*Scientific name*	IUCN	CMS	CITES
MAMMALIA	Indo-Pacific Bottlenose Dolphin	*Tursiops aduncus*	DD	II	II
MAMMALIA	Common Bottlenose Dolphin	*Tursiops truncatus*	LC	I/II	II

6.3 Ecosystem Triggers of CH

Ecosystem triggers of CH within the CHAA are illustrated on Figure 24.

6.3.1 Criterion 4: Highly threatened and/or unique ecosystems

Both Bazaruto Archipelago IBA and Bazaruto Archipelago National Park qualify as CH under Criterion 4 on the basis of constituting internationally and nationally recognised area of high biodiversity value that have been determined to be of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognised academic institutions and/or other relevant qualified organisations (including internationally-recognised NGOs such as BirdLife International) (IFC, 2012b).

Seagrass beds within the CHAA could also qualify on the basis of their support of unique assemblages of species, as well as potentially being at risk of significantly decreasing in area or quality (IFC, 2012b).

6.3.2 Criterion 5: Key evolutionary processes

The islands of the Bazaruto Archipelago support at least six species of endemic marine gastropod that are phylogenetically distinct (see Section 6.2.2), as well as two terrestrial lizard species that are endemic to Magaruque and Benguera (*Scelotes duttoni*, *Lygosoma lanceolatum*) (BirdLife International, 2018). These islands could therefore trigger CH under Criterion 5.

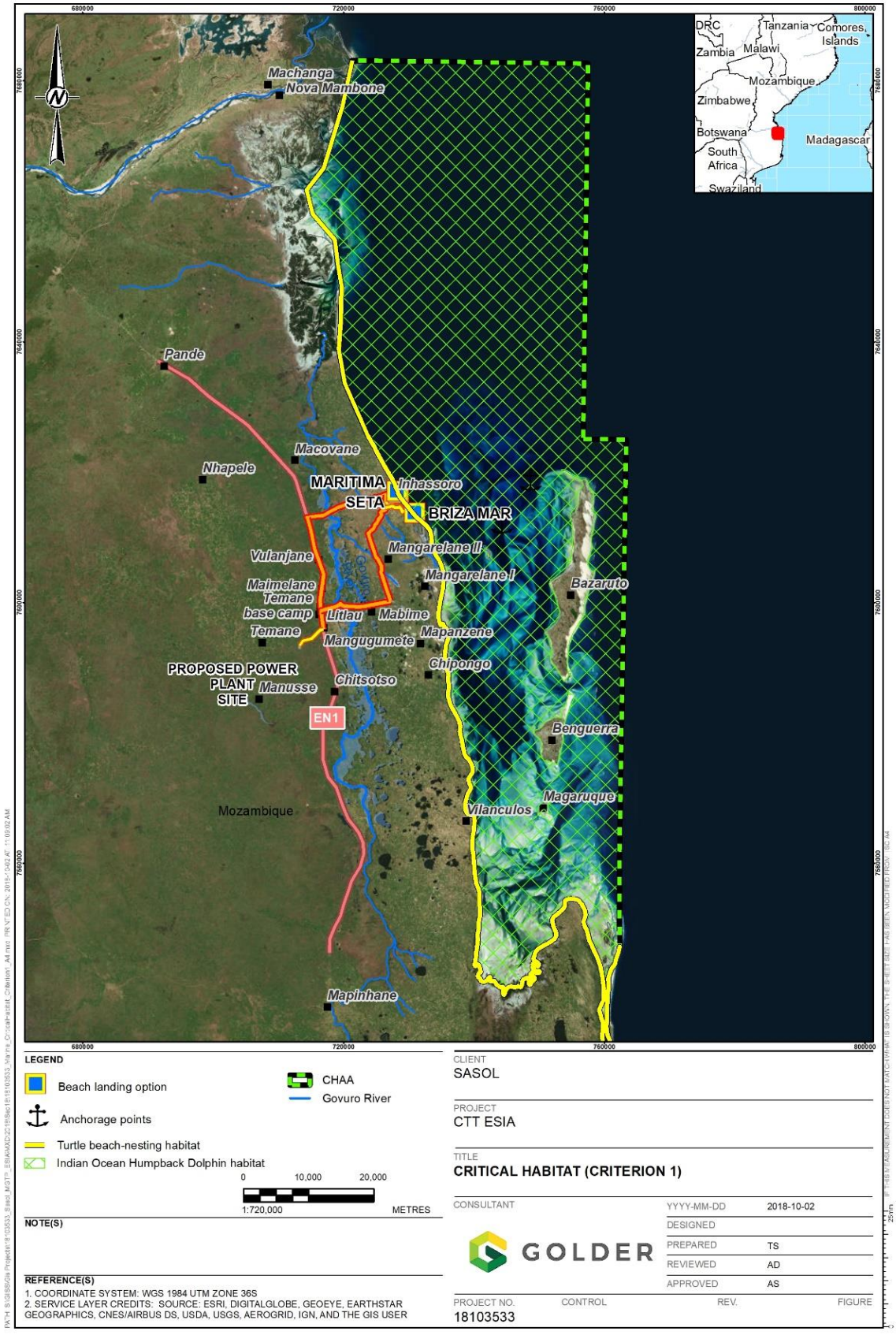

Figure 23: Critical Habitat (Criterion 1)

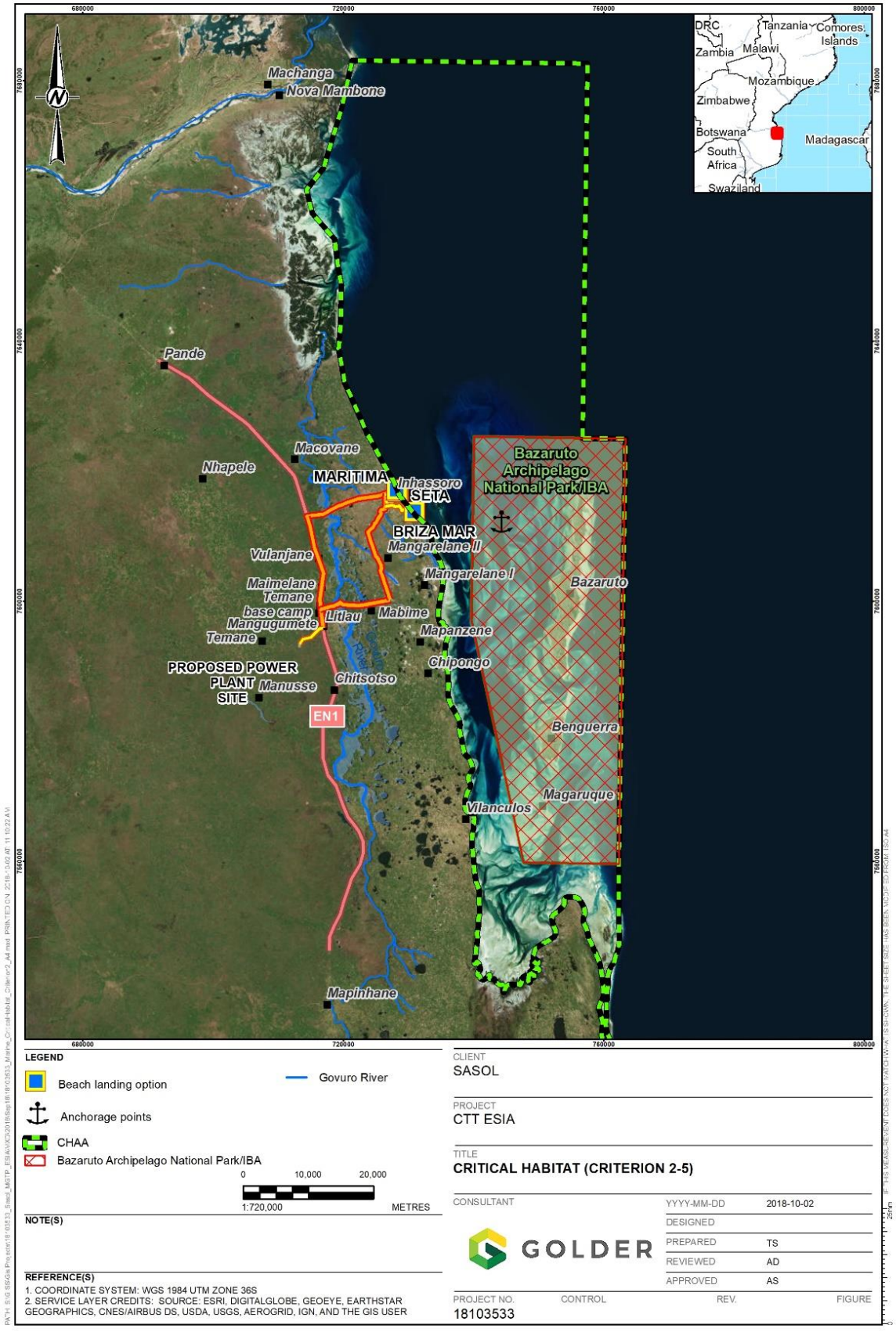

Figure 24: Critical Habitat (Criteria 2-5)

7.0 IMPACT ASSESSMENT

7.1 Receptors for Impact Assessment

Receptors for Impact Assessment were selected based on their capacity to trigger Critical Habitat (species and ecosystems); ecosystems that constitute 'natural' habitat as defined by IFC (2012b); protected ecosystems and nationally-protected species were also included. All selected receptors for impact assessment are summarised in Table 13.

Table 13: Marine ecology receptors for impact assessment

Project Component	Receptors	Reasoning
Temporary beach landing	Beach-nesting turtles	Nationally-protected, CH triggering
	Primary dunes and sandy beaches	CH for beach-nesting turtles (Green Turtle, Hawksbill Turtle)
	Seagrass beds	Natural habitat
	Dugong	Nationally-protected
Anchorage points	Endemic gastropods from the Bazaruto Archipelago	CH triggering
	Migratory bird species associated with Bazaruto Archipelago	CH triggering
	Bazaruto Archipelago National Park/IBA	Protected Area, CH triggering
	Coral reef	Natural habitat
Barge movements	Indian Ocean Humpback Dolphin	Nationally-protected, CH triggering
	Dugong	Nationally-protected
	Seagrass beds	Natural habitat

7.2 Identified impacts – Temporary Beach Landing Sites

It should be noted that the temporary beach landing site and associated transhipment and barging activities will all take place during the CTT project construction phase. The impacts below are however, separated into the site-specific construction, operational and decommissioning impacts for each of the beach landing sites, anchorage points and barging activities, as relevant.

7.2.1 Construction impacts

The construction of the preferred temporary beach landing site will involve the construction of a new jetty from the beach into the water (see Figure 7, Figure 8,Figure 9), which will either be 14 m wide x 100 m long (1400 m^2), or 20m wide x 80m long (1600 m^2). The chosen beach landing site will also require some road upgrades from the beach landing site along the chosen route to the CTT site. Although the proposed sites are currently or have in the past, been used for beach access, the upgrade of the access roads will result in additional disturbance and loss of primary dune habitat; in addition, the construction of the jetty will result in the loss of a

minimum of 1400-1600 m^2 of sandy beach habitat. In the context of the extent of this habitat in the CHAA, the potential impact could be of moderate intensity, with the loss being medium-term, persisting until such a time as the beach landing sites have been removed (after 12-15 months) and natural dune formation and sedimentation processes have been resumed. Impacts would be restricted to the extent of the temporary landing sites, and the impact is considered definite. Prior to mitigation, the significance of the impact of loss of natural primary dune and sandy beach habitat will be moderate. The application of the required mitigation measures reduces the intensity of the impact to low, as well as the probability of the impact occurring, resulting in a residual impact of low significance.

Since the proposed sites are already being regularly used for beach access for boats, it is unlikely that these areas are important turtle nest sites due to existing levels of disturbance. Therefore, the likelihood of direct impacts of loss of nest sites, or mortality or injury of nesting turtles or incubating eggs as a result of construction activities (e.g. site clearance, earthworks) is considered low. Should the impact occur, it could be of medium intensity, since loss of individuals of CR or EN beach-nesting turtles (Green Turtle, Hawksbill Turtles), could represent a moderate proportion of the overall population of these species in the CHAA. The duration of the impact would be long-term and would need to be considered at an at least national extent, since the affected species are nationally protected, as well as being of global conservation concern. The application of the required mitigation measures may reduce the intensity of the impact, and the probability of its occurrence, resulting in a residual impact of still low significance, but with a lower score.

The hunting of turtles for meat has been noted in the CHAA (see Section 5.3.9). There is a potential that construction workers or influx of people attracted to the construction sites (e.g. people seeking employment or opportunities) could increase hunting pressure on beach-nesting turtles within the CHAA. In many cases, once job/opportunity seekers have arrived and settled, they may stay for indefinite periods of time. Should the impact occur, it could be of high intensity, since loss of individuals of CR or EN beach-nesting turtles (Green Turtle, Hawksbill Turtles) through hunting could affect a high proportion of the overall population of these species in the CHAA. The duration of the impact would be permanent, as opportunity-seekers may remain at/near the sites beyond their operational lifetime and would need to be considered at an at least national extent, since the affected species are nationally protected, as well as being of global conservation concern. The probability of the impact occurring as predicted is considered high, resulting in an impact of moderate significance prior to mitigation. The application of the required mitigation measures (particularly appropriate population influx management and education programmes) could reduce the intensity of hunting pressure as well as the probability of the predicted impacts for nesting turtles; however, the effectiveness of these measures would need to be monitored into the future. The residual impact therefore remains of moderate significance, pending confirmation that influx management and education programmes have been successful in reducing hunting pressure on beach-nesting turtles within the CHAA.

The accidental capture of Dugong as bycatch in nets has been reported by fishers in the Study Area (Guissamulo, 2016). There is a potential that construction workers or people attracted to the construction sites (e.g. people seeking employment or opportunities) could increase fishing pressure in the Study Area, and thus the likelihood of Dugong becoming captured as bycatch. The potential impact could be of high intensity, affecting a high proportion of the overall population of Dugong in the CHAA. The duration of the impact would be permanent, as opportunity-seekers may remain at/near the sites beyond their operational lifetime and would need to be considered at the national extent, since Dugong are nationally protected. The probability of the impact occurring as predicted is considered high, resulting in an impact of moderate significance prior to mitigation. The application of the required mitigation measures (particularly appropriate population influx management) could reduce the probability of the predicted impacts occurring, however the intensity of the potential impact remains high, as subsistence/commercial fishing and thus accidental dugong bycatch is likely to continue in the Study Area, despite the project's best efforts.

Required mitigation measures

- New areas of primary dune and beach habitat disturbance and associated vegetation clearance should be minimised wherever possible. Areas proposed for vegetation clearance should be clearly marked and no heavy vehicles should travel beyond the marked works zone.
- Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks.
- Ecological clerk of works (ECOW) to be appointed for duration of construction works.
- The Proponent must enforce a complete ban on wildlife harvesting (hunting/trapping/fishing) for all project personnel.
- The development of worker and community education programmes by the Proponent and Contractor(s), which focus on the value of conservation of species such as sea turtles and dugong, and the generation of tourism potential, can contribute to the alleviation of hunting pressure on affected fauna species and reduce local people's reliance on consumption of bush meat.
- An Influx Management Plan for the Project should be implemented to manage access control, prevent unplanned growth in housing development and promote regional economic development, at the same time reducing pressure on ecosystems of concern and associated species for provision of natural resources.

Table 14: Temporary beach landing sites – construction impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Intensity	Duration	Geographic Extent	Probability	Significance	Intensity	Duration	Geographic Extent	Probability	Significance
Loss of natural habitat (primary dunes and sandy beaches)	6	3	1	5	**Moderate 50**	4	3	1	3	**Low 24**
Direct injury/mortality of nesting turtles/eggs	6	4	5	2	**Low 30**	4	4	5	1	**Low 13**
Indirect injury/mortality of nesting turtles/eggs	8	5	5	4	**Moderate 72**	8	5	5	3	**Moderate 54**
Indirect injury/mortality of Dugong	8	5	4	4	**Moderate 68**	8	5	4	3	**Moderate 51**

7.2.2 Operational impacts

The operation of the temporary beach landing sites will involve barging of large project components to shore, from where they will be transported via road to a laydown area, and then to the CTT site itself. It is anticipated that a maximum of 2 components could be shipped in a week to the site, thus Option 1 (Gas Turbines) would take 20 weeks and Option 2 (Gas Engines) would take 15 weeks (Chapter 2.0, Project Description), suggesting that the temporary beach landing sites will be operated on at least 7-10 occasions, over the course of a minimum of 20 weeks (5 months), with the actual duration likely to be extended due to the waiting period of up to 3-4

months between some of the shipments. It is likely that the total duration could be between 8-15 months with long periods of no activity.

The operation of the temporary beach landing sites could cause alteration of local hydrodynamics due to the presence of the jetty, influencing sediment transport, erosion and accretion on Primary dune and sandy beach habitat. The intensity of the potential impact could be moderate, and the duration short-time, persisting for the duration of the use of the temporary landing sites. Impacts are likely to affect local sediment transport dynamics, potentially causing sand erosion on the up-shore side of the jetty, and accretion down-shore of the jetty. The application of the required mitigation measures can reduce the intensity of potential impacts as well as the probability of them occurring in the first place, reducing the residual impact to one of low significance.

During operation, deterioration of water quality and benthic sediment as a result of contamination with hydrocarbon fuels, oils and/or lubricants from barges and heavy equipment is probable. The intensity of the potential impact could be moderate, and the duration short-time, persisting for the duration of the use of the temporary landing sites. Impacts are likely to affect local water and sediment quality. The application of the required mitigation measures can reduce the intensity of potential impacts as well as the probability of them occurring in the first place, reducing the residual impact to one of low significance.

Discharge of ballast water could result in the introduction and/or spread of invasive marine algae (e.g. *Acanthophora spicifera, Gracilaria salicornia*), which have the potential to substantially alter natural sandy beach or seagrass habitats. The intensity of the potential impact could be high, causing changes to a high proportion of affected ecosystems of concern (sandy beaches, seagrass beds) within the CHAA. The duration of the impact would be permanent and would extend regionally; there is a high likelihood that this impact could occur within the CHAA without appropriate management and mitigation. The application of the required mitigation measures can reduce the probability of the impact occurring in the first place; however, the intensity and likely extent of potential impacts remain the same, resulting in a residual impact of still moderate significance.

Required mitigation measures

- Monitor erosion and accretion of sands on either side of the jetty and employ appropriately designed engineering measures to prevent any significant impacts on sandy beach habitat upshore and downshore of the jetty where necessary. Designs for engineered measures should be approved by the permitting authority, prior to construction.
- Restore beach landform to its original setting, following removal of the temporary beach landing jetty.
- Routes for transfer of heavy equipment should be clearly marked and no heavy vehicles should travel beyond the marked works zone.
- Prohibit access to personnel outside of the defined access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks.
- Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised. Daily maintenance and monitoring checks of vessels should be conducted. The use of biofuel for barges is recommended.
- Frequent monitoring of marine water and sediment quality should be implemented for the duration of transhipment and barging activities, focussing on the anchorage point, landing site and the designated barging route between them.
- Strict controls on ballast water management for both barges and transhipment vessels must be enforced by The Proponent, in line with the relevant MARPOL standards (see Section 3.2). High risk ballast water (that coming from ports and coastal waters outside of Bazaruto Bay) should not be discharged by barges

and/or transhipment vessels, under any circumstances. Tank-to-tank transfer of ballast water should be enforced for all barges and transhipment vessels associated with the Project, and should be documented and monitored by The Proponent at all times.

- Monitoring for the introduction and/or spread of invasive marine algal and faunal species should be conducted on a regular basis for the duration of barging and transhipment activity.

Table 15: Temporary beach landing sites – operational impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	intensity	Duration	Geographic Extent	Probability	Significance	intensity	Duration	Geographic Extent	Probability	Significance
Alteration of hydrodynamics - Loss/ disturbance of natural habitat (primary dunes and sandy beaches)	6	2	2	5	**Moderate 50**	4	3	1	3	**Low 24**
Compaction from access roads – permanent loss/disturbance of natural habitat (primary dunes and sandy beaches)	4	2	1	5	**Low 35**	4	2	1	3	**Low 24**
Water and benthic contamination from petroleum, oils and lubricants (primary dunes and sandy beaches, seagrass beds)	6	2	2	5	**Moderate 50**	4	2	2	2	**Low 16**
Ballast discharge – spread of invasive species - Loss/ disturbance of natural habitat (primary dunes and sandy beaches, seagrass beds)	8	5	3	4	**Moderate 64**	8	5	3	3	**Moderate 48**

7.2.3 Decommissioning impacts

The decommissioning of the temporary beach landing sites will involve the removal of the jetty structure, leaving a minimum footprint of 1400-1600 m^2 in the sandy beach habitat zone. Over time, natural hydrodynamic patterns

will re-establish and ultimately, the affected area is expected to be restored to a sandy beach habitat, while recognising that the habitat is unlikely to be restored to its exact baseline condition. Disturbances arising during decommissioning will be transient and local, with the significance of predicted impacts expected to be low. The significance of predicted impacts can be further reduced through the application of the required mitigation measures.

The removal of the jetty infrastructure and associated heavy vehicle works is likely to cause some transient water quality and benthic contamination with sediment, and potentially petroleum, oils and lubricants. Following completion of decommissioning, the intensity of the impact is expected to be low, and site based only, resulting in a residual impact of low significance.

Required mitigation measures

- The extent of sandy beach habitat disturbance should be minimised wherever possible. Areas proposed for works should be clearly marked and no heavy vehicles should travel beyond the marked works zone.
- Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks.
- Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. Daily maintenance and monitoring checks of vessels should be conducted.

Table 16: Temporary beach landing sites – decommissioning impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	intensity	Duration	Geographic Extent	Probability	Significance	intensity	Duration	Geographic Extent	Probability	Significance
Alteration of hydrodynamics - Loss/ disturbance of natural habitat (primary dunes and sandy beaches)	4	1	2	5	**Low 35**	4	1	1	3	Low 18
Water and benthic contamination from petroleum, oils and lubricants (primary dunes and sandy beaches, seagrass beds)	6	1	2	5	**Moderate 45**	4	1	1	3	**Low 18**

7.3 Identified impacts – Anchorage Points

Two previously used or identified anchorage points for the ships that will transport large heavy equipment and components are indicated on nautical charts; both are located off the coast of Inhassoro within Bazaruto Archipelago National Park (BANP) (Figure 8). The first anchorage point is located approximately 20km east of SETA beach landing site (7km from Bazaruto Island and 13km from Santa Carolina Island) while the second

one is nearer to the mainland shore, approximately 13km east of Briza Mar beach landing site (5-6km from Santa Carolina Island and 10km from Bazaruto Island).

The anchorage locations have depths of around 15 to 20 m (Subtech, 2014), making them technically feasible for mooring of the transhipment vessel. It is understood that the vessel will not be anchored for extended periods of time and will most likely be anchored for a week or two at a time to offload the heavy equipment, although this will be defined once a technology option has been chosen as well as a preferred manufacturer of the various large and oversized power plant components.

As both previously identified anchorage sites are within the boundaries of the Bazaruto Archipelago National Park (BANP), an ongoing study seeks to identify alternative anchorage point(s) that would be located completely outside BANP, as well as being feasible from a technical, environmental, and social point of view. The anchorage point(s) and associated barge lane(s) to be used by this Project shall be fully outside BANP boundaries, unless alternative sites outside BANP either (i) are not at all available or clearly technically not feasible or (ii) would clearly have greater overall adverse environmental or social impacts than if they were within BANP. Ultimate selection of anchorage points therefore is subject to the World Bank's no-objection.

Should the anchorage point(s) and/or barge route(s) have to be within the BANP for the above-mentioned reasons, a) the marine studies included within the ESIA will be updated and resubmitted to the World Bank for approval and b) the ESMP shall be updated to specify any further measures that may be necessary or appropriate to enhance the conservation and management of BANP and resubmitted to the World Bank for approval. Moreover, CTT would ensure that the locations of these facilities (i) have been formally approved by African Parks (legally responsible for BANP management) and ANAC (Mozambique's national conservation agency); (ii) are consistent with the Government-approved BANP Management Plan; and (iii) are legally permitted under Mozambican law—all in full compliance with IFC Performance Standard 6 (Paragraph 20) and the applicable Mozambican laws and regulations.

7.3.1 Construction impacts

The construction of the anchorage point will involve placement of the anchoring system on the seabed. Depending on the system being used, some excavation for the anchor may be necessary. In any case, some habitat loss and degradation in the footprint and immediate surrounds of the anchorage point is predicted.

The proposed anchorage locations have depths of around 15 to 20 m, therefore seagrass bed habitat is unlikely to be affected as it typically occurs in shallow and subsidiary waters of less than 5 m depth (see Section 5.2.2). However, coral reef systems off the coast of Bazaruto may be affected, and further surveys will be undertaken prior to anchorage points being selected in order to confirm that sensitive habitat such as corals are avoided.

The intensity of the potential impact of loss of coral reef habitat is expected to be low, since the current anchor points are not considered to be above coral reefs, though a potential impact would have a duration that is long-term, as restoration of hard coral reef habitat is likely to be difficult – although some coral may establish on the structures once usage has ceased. Prior to mitigation, an impact of moderate significance on natural coral reef habitat is predicted. The successful implementation of the required mitigation measures may limit the intensity and confine the extent of the impact to the site only, resulting in a low residual impact.

The potential loss/disturbance of the coral reef/seabed habitat during anchorage placement will result in the loss of habitat for endemic gastropod species receptors; however, the low intensity of effects on the overall population of these species, and limited extent ensure that the impact would be of low significance. There is little to be done to mitigate the loss of habitat, however as the seabed patterns re-establish and some coral species begin to re-colonise the affected areas, the duration and extent of the impact of loss will be reduced, further minimising the significance of the residual impact.

The placement of the anchorage points within Bazaruto Archipelago National Park/IBA and resultant effects on seabed habitat and associated species is also considered a low intensity impact; however, the impacts must be considered at the national/international scale, resulting in an overall impact of high significance prior to mitigation. Mitigation of the impact focuses solely on the relocation of the proposed anchorage points to suitable sites outside of the National Park boundary which would change the geographic extent of effects to site-based, minimise the probability of impacts to BANP/IBA, and reduce the residual impact to one of negligible significance. Anchorage points located outside the BANP are currently being investigated.

Required mitigation measures

- The extent of seabed disturbance should be minimised wherever possible. Areas proposed for works should be clearly marked and no excavation or disturbances should occur beyond the marked works zone.
- Site-specific surveys for coral reef and endemic gastropods should be conducted in advance of placement of the anchorage points to confirm anchor will not be on coral reefs or seagrass beds.
- Anchorage points should be located outside of the boundary of the Bazaruto Archipelago National Park/IBA as well as popular recreational sites (dive/snorkelling sites), and a buffer of at least 250 m should be maintained between the outer extent of the boundary and the anchorage points/navigation routes of the transhipment/barging vessels.

Table 17: Anchorage points – construction impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Intensity	Duration	Geographic Extent	Probability	Significance	Intensity	Duration	Geographic Extent	Probability	Significance
Loss/ disturbance of natural habitat (coral reef)	4	4	2	5	Moderate 50	2	4	1	5	Low 35
Loss of habitat for endemic gastropods	4	4	2	4	Low 40	2	2	1	4	Low 20
Placement within Bazaruto NP/IBA	4	4	5	5	High 65	4	4	1	1	Negligible 9

7.3.2 Operational impacts

The activities at the anchorage points will involve mooring of the transhipment vessel. It is understood that the vessel will not be anchored for extended periods of time and will most likely be anchored for 1-2 days at a time to offload the heavy equipment with up to 3-4 months between shipments over a period of 8-15 months. The presence of the transhipment vessel could give rise to impacts including contamination of the local marine water and sediment quality with hydrocarbon fuels, oils and/or lubricants, and disturbance of migratory/congregatory seabird species associated with Bazaruto Archipelago IBA.

The intensity of the potential impact of marine water and sediment contamination could be moderate, and the duration short-term, persisting for the lifetime of the use of the anchorage points. Impacts are likely to affect local water and sediment quality, which would have knock-on effects on underlying natural habitats such as coral reefs. The application of the required mitigation measures can reduce the severity of potential impacts as well as the probability of them occurring in the first place, reducing the residual impact to one of low significance.

Disturbance of migratory/congregatory seabird species associated with Bazaruto Archipelago IBA is likely to be of low intensity, and transient – only occurring when the transhipment vessel is moored at the anchorage point. The geographic extent of the impact is considered at the global scale due to possible effects on species for which the IBA is designated; the transient nature of the disturbances results in an overall impact of moderate significance prior to mitigation. Again, focussing the mitigation measures on the relocation of the proposed anchorage points to suitable sites outside of the National Park boundary and away from popular recreational sites, would change the geographic extent of effects to site-based, minimise the probability of impacts to bird species associated with Bazaruto Archipelago IBA, and reduce the residual impact to one of negligible significance.

Required mitigation measures

- Strict controls should be put in place to ensure that leakages of hydrocarbon fuels, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. Daily maintenance and monitoring checks of vessels should be conducted.
- Anchorage points should be located outside of the boundary of the Bazaruto Archipelago National Park/IBA and away from popular recreational sites, and a buffer of at least 250 m should be maintained between the outer extent of the boundary and the anchorage points/navigation routes of the transhipment/barging vessels.
- Ensure that all vessels and machinery are in sound mechanical order, do not have any oil leaks and are fitted with appropriate mufflers to minimise nuisance affecting migratory/congregatory seabird species. Other measures include restrictions in operating hours for heavy machinery and vessels.

Table 18: Anchorage points - operational impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Water and benthic contamination from petroleum, oils and lubricants (coral reefs, seagrass beds)	6	2	2	5	**Moderate 50**	4	2	2	2	**Low 16**
Disturbance of migratory/ congregatory seabird species	4	1	5	5	**Moderate 50**	4	1	1	2	**Negligible 12**

7.3.3 Decommissioning impacts

At decommissioning, it is expected that the anchorage points will remain in situ on the seabed, and no further usage will be made. No impacts on species or ecosystem receptors are anticipated.

7.4 Identified impacts – Barge Movements

Large heavy equipment and components required for the construction of the power plant will be transferred from the transhipment vessel onto a barge capable of moving on the high tide into very shallow water adjacent to the

beach to offload its cargo onto the temporary jetty at the beach landing site. As the tide subsides, the barge rests on the sand and the equipment will be off-loaded.

A maximum of 2 components could be shipped in a week to the site, thus Option 1 (Gas Turbines) would take 20 weeks and Option 2 (Gas Engines) would take 15 weeks (Chapter 2.0, Project Description), suggesting that barging will be required on at least 7-10 occasions, over the course of a minimum of 20 weeks (5 months), with the actual duration likely to be extended due to the waiting period of up to 3-4 months between some of the shipments. The actual number of barging movements may also be greater than 7-10 movements, depending on the size of the load that the barges can transport. It is likely that the total duration could be between 12-15 months with long periods of no activity.

7.4.1 Construction impacts

No construction phase impacts are anticipated, other than those already addressed for the temporary beach landing sites and anchorage points.

7.4.2 Operational impacts

The movements of the barges from the anchorage points to the beach landing points will cross Dugong habitat north of Bazaruto Archipelago National Park, with the potential to separate some of the largest feeding grounds of the north from other feeding grounds and/or preferred breeding habitats of the south as a result of acoustic and/or physical disturbances, creating barriers to movement for this species. The intensity of the potential impact on Dugong movements could be high and are considered at the national scale given the level of protection assigned to this species in Mozambique; but the impacts will be transient, only occurring at disjunct times of barge movements. The probability of the impact occurring is assessed as being moderate, resulting in an impact of moderate significance prior to mitigation. The application of the required mitigation measures, specifically the presence of a Certified Marine Mammal Observer on all barge movements, reduces the intensity of the potential impact for both species, resulting in a residual impact of low significance.

Barge strikes are possible, as Dugong are very slow moving (average 10 kmph, typically 5-8 kmph, short bursts of up to 20 kmph) and are typically concentrated in shallow waters (< 5 m depth) where seagrass beds occur. Barge strikes could also affect the *Endangered* Indian Ocean Humpback Dolphin, which is resident in the coastal waters of the Study Area. The intensity of the potential impact is high, and effects would be long-term, lasting until such a time as Dugong/Indian Ocean Humpback Dolphin recovered from the loss of the affected individuals. The potential effect is assessed at the national scale for nationally-protected Dugong, and at the international scale for the globally *Endangered* Indian Ocean Humpback Dolphin. Prior to mitigation measures being implemented, there is a very high probability of barge strike for Dugong, and a moderate probability of barge strike for Indian Ocean Humpback Dolphin which is a faster-swimming, more agile species. Impacts on Dugong and Indian Ocean Humpback Dolphin prior to mitigation are High and Moderate respectively. The strict application of the required mitigation measures, specifically strict speed restrictions of 5km/h such that the boats would be traveling slower than the speeds of the mammals, as well as the presence of a Certified Marine Mammal Observer on all barge movements, reduces the intensity of the potential impact for both species, resulting in residual impacts of low significance.

The barge movements may cause seabed scour in areas of shallower water, which could affect seagrass beds which are the preferred foraging habitat for Dugong. In the context of the extent of this habitat in the CHAA, the potential impact could be of moderate intensity, with the loss being medium-term, persisting until such a time as the barge movements cease (after approximately 12-15 months) and seagrass beds recover. Impacts would be local sites and are considered definite. Prior to mitigation, the significance of the impact of loss of natural primary dune and sandy beach habitat will be moderate. The application of the required mitigation measures reduces the intensity of the impact to low, as well as the probability of the impact occurring, resulting in a residual impact of low significance.

Impacts of Large Vessels

Similar to the impacts of barge movements in the Bazaruto Bay area, the transhipment vessel will also need to adhere to a number of mitigation measures in order to limit potential impacts on the marine environment when entering the Bazaruto Bay area.

Required Mitigation Measures

- Strict speed restrictions must be enforced on barges and the transhipment vessel vessels to protect Dugongs (and Indian Ocean Humpback Dolphin) from vessel strikes in Bazaruto Bay. The maximum allowable speed should be < 5 kmph to allow Dugong to move out of the way of oncoming vessels, minimising the risk of collision.
- A Certified Marine Mammal Observer (MMO) must be employed by the Proponent or the Contractor responsible for such activities to observe and monitor all barge and transhipment movements. The MMO will have authority to influence the speed and direction of vessel movements where any potential risks to marine mammals are identified.
- The presence of an MMO on both the barge and transhipment vessels being utilised by the Project is compulsory.
- Barges and the transhipment vessel must be routed via specific vessel lanes/channels that avoid potentially important areas of seagrass habitat. . These routes needed to be clearly marked with buoys (no Styrofoam to be used). Further site-specific seagrass mapping surveys are likely to be required to inform route selection.
- Strict controls on ballast water management for both barges and transhipment vessels must be enforced by The Proponent, in line with the relevant MARPOL standards. High risk ballast water (that coming from ports and coastal waters outside of Bazaruto Bay) should not be discharged within the CHAA under any circumstances. Tank-to-tank transfer of ballast water should be enforced for all barges and transhipment vessels associated with the Project and should always be documented and monitored.

Table 19: Barge and transhipment vessel movements - operational impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Intensity	Duration	Geographic Extent	Probability	Significance	intensity	Duration	Geographic Extent	Probability	Significance
Barrier to movement (Dugong)	8	1	4	3	Moderate 52	4	1	4	3	Low 27
Barge collisions causing injury/mortality (Dugong)	8	4	4	5	High 80	4	4	4	2	Low 24
Barge collisions causing injury/mortality (Indian Ocean	8	4	5	3	Moderate 51	4	4	5	2	Low 26

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Intensity	Duration	Geographic Extent	Probability	Significance	intensity	Duration	Geographic Extent	Probability	Significance
Humpback Dolphin)										
Loss/ disturbance of natural habitat (seagrass beds)	4	4	2	5	**Moderate 50**	2	4	1	5	**Low 35**

7.4.3 Decommissioning phase impacts

No decommissioning phase impacts are anticipated.

7.5 Cumulative Impacts

The construction and operation of the temporary beach landing sites, anchorage points and associated barging movements will add to cumulative impacts on species and ecosystems of concern in the CHAA. As can be seen from the impact assessment and the significant residual impacts highlighted above, the main direct project effect will be the possible creation of a transient barrier to movement of individuals of Dugong between southern and northern feeding grounds within the CHAA, as a result of increased vessel traffic between the anchorage point and beach landing sites, and the associated noise and potential vessel strike effects.

However, the potential contribution of the Project to indirect/induced effects, i.e. population influx and increased fishing pressure in Bazaruto Bay, may be much more significant for Dugong populations due to increased rates of accidental bycatch. Although mortality rates have been estimated at two to four individuals a year in the Greater Bazaruto Archipelago (Findlay et al., 2011), the values are likely under-estimated, and the actual rate is likely to be greater. Greater intensity of beach seine netting by the increased population could also result in increased degradation of seagrass habitat, reducing available foraging habitat for dugong (Provancha and Stolen, 2008).

Although residual impacts of low significance for collision risk to Dugong and Indian Ocean Humpback Dolphin are predicted following implementation of the required mitigation measures, they may still contribute to the cumulative effects of increased boat traffic in Bazaruto Bay that is being generated by the growth of tourism in the area (Murie et al., 2016); the presence of the barges and anchored transhipment vessel also contribute to increased acoustic disturbance in the Bay and subsequent deterioration of the quality of habitat for both of these species.

Similarly, low level residual impacts on marine water and sediment quality at the temporary landing sites and anchorage points in the form of small hydrocarbon fuel and lubricating oil leaks will contribute to the overall increased marine pollution loading in the CHAA arising from fishing vessels as well as tourism and recreational vessels (Murie et al., 2016).

The construction of the temporary beach landing sites will add to the increased erosion and deposition of sand on nearby seagrass beds, which is already evident as a result of intensifying land development in the Vilanculos/Inhassoro region for tourism and residential purposes, albeit at a very localised and transient scale.

Application of the recommended Project mitigation measures may reduce the level of contribution of the Project to overall cumulative impacts; however since some significant residual effects are predicted, despite mitigation

(population influx exacerbating fishing pressure and accidental bycatch, barge movements presenting a barrier to movement in the CHAA and increased mortality risk), the Project is therefore likely to contribute to the existing cumulative impacts in the CHAA, on Dugong in particular.

8.0 ENVIRONMENTAL ACTION PLAN – TEMPORARY BEACH LANDING SITES

Table 20: Environmental Action Plan – Temporary Beach Landing Sites

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
Construction Phase				
Primary dunes and sandy beaches Nesting turtles	Loss of natural habitat (primary dunes and sandy beaches)	Land take during construction	■ New areas of primary dune and beach habitat disturbance and associated vegetation clearance should be minimised wherever possible. Areas proposed for vegetation clearance should be clearly marked and no heavy vehicles should travel beyond the marked works zone. ■ Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks. ■ Ecological clerk of works (ECOW) to be appointed for duration of construction works.	The Proponent to instruct construction crew regarding buffer area and produce construction method statement The Proponent to employ ECOW for duration of construction works
	Direct injury/mortality of nesting turtles/eggs	Site clearance in advance of construction		
	Indirect injury/mortality of nesting turtles/eggs	Population influx	■ The Proponent must enforce a complete ban on wildlife harvesting (hunting/trapping/fishing) for all project personnel, including any such activities by any person within the mining lease area.	The Proponent environmental manager
	Indirect injury/mortality of Dugong	Population influx		

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
			■ The development of worker and community education programmes by the proponent, which focus on the value of conservation of species such as sea turtles and dugong, and the generation of tourism potential, can contribute to the alleviation of hunting pressure on affected fauna species and reduce local people's reliance on consumption of bush meat. ■ An Influx Management Plan for the Project should be implemented to manage access control, prevent unplanned growth in housing development and promote regional economic development, at the same time reducing pressure on ecosystems of concern and associated species for provision of natural resources.	
Operational Phase				
Primary dunes and sandy beaches	Alteration of hydrodynamics - Loss/ disturbance of natural habitat	Presence of the jetty	■ Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. Daily maintenance and monitoring checks of vessels should be conducted.	The Proponent environmental manager

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
			■ Frequent monitoring of marine water and sediment quality should be implemented for the duration of transhipment and barging activities, focussing on the anchorage point, landing site and the designated barging route between them.	
Primary dunes and sandy beaches	Compaction from access roads – permanent loss/ disturbance of natural habitat	Transfer of heavy equipment	■ Routes for transfer of heavy equipment should be clearly marked and no heavy vehicles should travel beyond the marked works zone. ■ Prohibit access to personnel outside of the defined access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks.	The Proponent environmental manager
Primary dunes and sandy beaches Seagrass beds	Water and benthic contamination from petroleum, oils and lubricants	Barge Transhipment vessel	■ Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. ■ Daily maintenance and monitoring checks of vessels should be conducted. ■ Frequent monitoring of marine water and sediment quality should be implemented	The Proponent environmental manager

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
			for the duration of transhipment and barging activities, focussing on the anchorage point, landing site and the designated barging route between them	
Primary dunes and sandy beaches Seagrass beds	Ballast discharge – spread of invasive species - Loss/ disturbance of natural habitat	Barge Transhipment vessel	■ Strict controls on ballast water management for both barges and transhipment vessels must be enforced by The Proponent. ■ High risk ballast water (that coming from ports and coastal waters outside of Bazaruto Bay) should not be discharged within the CHAA under any circumstances. ■ Tank-to-tank transfer of ballast water should be enforced for all barges and transhipment vessels associated with the Project, and should be documented and monitored by The Proponent at all times. ■ Monitoring for the introduction and/or spread of invasive marine algal and faunal species should be conducted on a regular basis for the duration of barging and transhipment activity	The Proponent environmental manager Independent ecologist to be contracted to conduct and document invasive marine species monitoring surveys

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
Decommissioning Phase				
Primary dunes and sandy beaches	Alteration of hydrodynamics - Loss/ disturbance of natural habitat	Dismantling of jetty	■ The extent of sandy beach habitat disturbance should be minimised wherever possible. Areas proposed for works should be clearly marked and no heavy vehicles should travel beyond the marked works zone. ■ Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks.	The Proponent to instruct decommissioning crew regarding buffer area and produce work method statement The Proponent to employ ECOW for duration of decommissioning works
Primary dunes and sandy beaches Seagrass beds	Water and benthic contamination		■ Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. Daily maintenance and monitoring checks of vessels should be conducted	The Proponent Environment Manager

9.0 ENVIRONMENTAL ACTION PLAN – ANCHORAGE POINTS

Table 21: Environmental Action Plan – Anchorage Points

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
Construction Phase				
Coral reef	Loss/ disturbance of natural habitat	Anchorage point	■ Baseline marine water and sediment quality data to be gathered prior to construction, as a benchmark for monitoring that will be conducted throughout the operation of the anchorage points (see Section 10.0 below). ■ The extent of seabed disturbance should be minimised wherever possible. Areas proposed for works should be clearly marked and no excavation or disturbances should occur beyond the marked works zone. ■ Site-specific surveys for coral reef and endemic gastropods should be conducted in advance of placement of the anchorage points to select locations which would cause least potential harm to coral reef and/or endemic gastropod populations, as well as other benthic organisms.	The Proponent environmental manager Independent ecologist to be contracted to conduct and species-specific surveys and guide relocation of anchorage points
Endemic gastropods	Loss of habitat	Anchorage point		
Bazaruto Archipelago NP/IBA	Placement within Bazaruto Archipelago NP/IBA	Anchorage point	■ Anchorage points should be located outside of the boundary of the Bazaruto Archipelago National Park/IBA with a target buffer of at least 250 m should be maintained between the outer extent of the boundary and the anchorage points/navigation routes of the transhipment/barging vessels.	The Proponent to define anchorage point outside of national park/IBA and update marine studies for approval by the World Bank.

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
				The Proponent to instruct transhipment vessel crew regarding buffer area
Operational Phase				
Coral reef Seagrass beds	Water and benthic contamination from petroleum, oils and lubricants	Transhipment vessels	■ Strict controls should be put in place to ensure that leakages of petrol, oils and/or lubricants from barges, transhipment vessels and heavy equipment are minimised/eliminated. Daily maintenance and monitoring checks of vessels should be conducted.	The Proponent Environment Manager
Migratory/ congregatory seabird species	Disturbance of migratory/ congregatory seabird species	Transhipment vessels	■ Anchorage points should be located outside of the boundary of the Bazaruto Archipelago National Park/IBA, with a target buffer of at least 250 m should be maintained between the outer extent of the boundary and the anchorage points/navigation routes of the transhipment/barging vessels. ■ Ensure that all vessels and machinery are in sound mechanical order, do not have any oil leaks and are fitted with appropriate mufflers to minimise nuisance affecting migratory/congregatory seabird species. Other measures include restrictions in operating hours for heavy machinery and vessels	The Proponent to define anchorage point outside of national park/IBA The Proponent to instruct transhipment vessel crew regarding buffer area

10.0 ENVIRONMENTAL ACTION PLAN – BARGE MOVEMENTS

Table 22: Environmental Action Plan – Barge Movements

Aspect	Potential Impact	Impact Source	Detailed Actions	Responsibility
Operational Phase				
Dugong	*Barrier to movement*	Barge movements	■ Strict speed restrictions must be enforced on barge vessels in Bazaruto Bay. The maximum allowable speed should be < 5 kmph ■ A Certified Marine Mammal Observer (MMO) must be employed by THE PROPONENT to observe and monitor all barge and transhipment movements. The MMO will have authority to influence the speed and direction of vessel movements where any potential risks to marine mammals are identified.	The Proponent to instruct transhipment vessel and barge crews regarding speed limits The Proponent to employ certified MMO for duration of operations
Dugong Indian Ocean Humpback Dolphin	*Barge collisions causing injury/mortality*	Barge movements		
Seagrass beds	*Loss/ disturbance of natural habitat*	Barge movements	■ Barges must be routed via specific vessel lanes/channels that avoid potentially important areas of seagrass habitat.	The Proponent to instruct transhipment vessel and barge crews regarding defined routes

11.0 MONITORING PROGRAMME – MARINE ECOSYSTEMS AND SPECIES

Table 23: Monitoring programme – Marine ecosystems and species

Objective	Detailed Actions	Monitoring Location	Frequency	Responsibility
Construction Phase				
Minimise impacts on primary dune and sandy beach habitat	ECOW	Construction site	Daily monitoring during construction	The Proponent to employ ECOW for duration of construction works
Establish baseline for marine water and sediment quality monitoring	Baseline data gathering for benchmarking of future monitoring - to be conducted prior to construction of anchorage points and beach landing sites, and the designated barging route between them	Within the area of influence of anchorage points and beach landing sites (to be defined by specialist)	Prior to construction	The Proponent to employ independent specialist to establish the baseline
Operational Phase				
Maintain acceptable marine water and sediment quality, prevent contamination	Frequent monitoring focussing on the anchorage point, landing site and the designated barging route between them	Anchorage point, landing site and the designated barging route	Monthly marine water and sediment quality monitoring for operational lifetime	The Proponent Environmental manager
Prevent collisions with Dugong or Indian Humpback Dolphin	Certified Marine Mammal Observer (MMO) to observe and monitor all barge and transhipment movements. The MMO will have authority to influence the speed and direction of vessel movements where any potential	Anchorage point, landing site and the designated barging route	MMO should be present on all barge movements	The Proponent to employ Certified Marine Mammal Observer (MMO)

Objective	Detailed Actions	Monitoring Location	Frequency	Responsibility
	risks to marine mammals are identified			
Decommissioning Phase				
Minimise impacts on primary dune and sandy beach habitat	ECOW	Beach landing site	Daily monitoring during decommissioning works	The Proponent to employ ECOW for duration of decommissioning works

12.0 CONCLUSIONS

The project will potentially affect marine biodiversity in three main ways; loss and disturbance of marine and coastal ecosystems of concern; loss and disturbance of fauna species of conservation concern, and creation of barriers to movement and collision risk for fauna species of concern.

The construction of the temporary landing sites will cause minor land cover changes through vegetation clearance, and changes in local hydrodynamics, the effects of which will impact primary dune and sandy beach habitat. The main direct Project effect will be the possible creation of a transient barrier to movement of individuals of Dugong between southern and northern feeding grounds within the CHAA, as a result of increased vessel traffic between the anchorage point and beach landing sites, and the associated noise and potential vessel strike effects. However, the potential contribution of the Project to indirect/induced effects, i.e. population influx and increased fishing pressure in Bazaruto Bay, may be much more significant for Dugong populations due to increased rates of accidental bycatch.

It is therefore crucial that the mitigation hierarchy is followed and all efforts to avoid impacts on biodiversity within the project's area of influence are made; in particular, seeking to identify anchorage points outside of Bazaruto Archipelago National Park. Where avoidance of impacts is impossible, application of the recommended mitigation measures is critical in reducing the significance of predicted project impacts.

Appropriate vessel maintenance and management is essential for the prevention of pollution of the marine environment with hydrocarbon fuels, oils and/or lubricants from barges and heavy equipment; of potentially greater importance is the application of strict controls on ballast water management to prevent introductions and/or spread of marine invasive species. The implementation of a Population Influx Management Plan and community and worker education programmes by the Proponent to reduce or prevent turtle hunting and accidental mortality of Dugong as bycatch in the CHAA are important measures in reducing project impact on marine fauna species of conservation concern. The retention of a target 250 m buffer zone around Bazaruto Archipelago National Park/IBA is sought to preserving the ecological integrity of the protected area and preventing any project-related disturbance in the reserve.

Provided that the recommended mitigation measures are incorporated into the Project's environmental management plan, and are enacted and reported upon to the relevant authority throughout the lifetime of the project, the significance of most predicted impacts on biodiversity can be reduced to environmentally acceptable levels. However, the potential impacts on Dugong as a result of population influx throughout the lifetime of the Project and associated increase risk of accidental bycatch in fishing gear may be difficult to mitigate, and further

measures to address this predicted residual impact may be required, that is, the development of a biodiversity action plan that investigates the feasibility/necessity of additional conservation measures at the municipal/government level and potential biodiversity offsets or expansion of reserves, to ensure no net loss of Dugong in the Study Area as a result of the induced and cumulative effects of the Project.

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Signature Page

Golder Associados Moçambique Limitada

Aisling Dower
Ecologist

Warren Aken
Ecology Lead

NUIT 400196265
Directors: G Michau, RGM Heath

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APPENDIX A

Critical Habitat Screening Results – Potential Species Triggers

The results of the screening exercise to identify species that could trigger Critical Habitat Critera 1, 2 and 3 within the Study Area are presented in Table x.

Table 24: Critical Habitat Species Screening Results

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
GASTROPODA	Feathered Cone	*Conus pennaceus*	LC			2
GASTROPODA		*Epitonium pteroen*	NE			2
GASTROPODA		*Epitonium repandior*	NE			2
GASTROPODA		*Fusiaphera eva*	NE			2
GASTROPODA		*Limulata vermicola*	NE			2
GASTROPODA		*Thracia anchoralis*	NE			2
ACTINOPTERYGII	Giant Wrasse	*Cheilinus undulatus*	EN		II	1
ACTINOPTERYGII	Dusky Grouper	*Epinephelus marginatus*	EN			1
HOLOTHUROIDEA	Golden Sandfish	*Holothuria lessoni*	EN			1
HOLOTHUROIDEA	Black Teatfish	*Holothuria nobilis*	EN			1
HOLOTHUROIDEA	Golden Sandfish	*Holothuria scabra*	EN			1
ACTINOPTERYGII	Kariba Tilapia	*Oreochromis mortimeri*	CR			1
ACTINOPTERYGII	Sibayi Goby	*Silhouettea sibayi*	EN			1
HOLOTHUROIDEA	Prickly Redfish	*Thelenota ananas*	EN			1
CHONDRICHTHYES	Ornate Eagle Ray	*Aetomylaeus vespertilio*	EN			1

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
CHONDRICHTHYES	Honeycomb Izak	*Holohalaelurus favus*	EN			1
CHONDRICHTHYES	Whitespotted Izak	*Holohalaelurus punctatus*	EN			1
CHONDRICHTHYES	Largetooth Sawfish	*Pristis pristis*	CR		I	1
CHONDRICHTHYES	Whale Shark	*Rhincodon typus*	EN	I/II	II	1
CHONDRICHTHYES	Great Hammerhead	*Sphyrna mokarran*	EN			1
CHONDRICHTHYES	Zebra Shark	*Stegostoma fasciatum*	EN			1
CHONDRICHTHYES	Pelagic Thresher	*Alopias pelagicus*	VU	II	II	3
CHONDRICHTHYES	Common Thresher Shark	*Alopias vulpinus*	VU	II		3
CHONDRICHTHYES	Silky Shark	*Carcharhinus falciformis*	VU	II	II	3
CHONDRICHTHYES	Great White Shark	*Carcharodon carcharias*	VU	I/II	II	3
CHONDRICHTHYES	Shortfin Mako	*Isurus oxyrinchus*	VU	II		3
CHONDRICHTHYES	Longhorned Pygmy Devil Ray	*Mobula eregoodootenkee*	NT	I/II	II	3
REPTILIA	Green Turtle	*Chelonia mydas*	EN	I/II	I	1
REPTILIA	Hawksbill Turtle	*Eretmochelys imbricata*	CR	I/II	I	1
REPTILIA	Loggerhead Turtle	*Caretta caretta*	VU	I/II	I	3
REPTILIA	Leatherback	*Dermochelys coriacea*	VU	I/II	I	3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
REPTILIA	Olive Ridley	*Lepidochelys olivacea*	VU	I/II	I	3
AVES	Basra Reed-warbler	*Acrocephalus griseldis*	EN	I/II		1
AVES	Madagascar Pond-heron	*Ardeola idae*	EN			1
AVES	Grey Crowned-crane	*Balearica regulorum*	EN		II	1
AVES	Cape Gannet	*Morus capensis*	EN			1
AVES	Cape Cormorant	*Phalacrocorax capensis*	EN			1
AVES	African Penguin	*Spheniscus demersus*	EN	II	II	1
AVES	Indian Yellow-nosed Albatross	*Thalassarche carteri*	EN			1
AVES	Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	EN			1
AVES	Sedge Warbler	*Acrocephalus schoenobaenus*	LC	II		3
AVES	Cape Teal	*Anas capensis*	LC	II		3
AVES	Red-billed Teal	*Anas erythrorhyncha*	LC	II		3
AVES	African Black Duck	*Anas sparsa*	LC	II		3
AVES	Yellow-billed Duck	*Anas undulata*	LC	II		3
AVES	Rufous-bellied Heron	*Ardeola rufiventris*	LC	II		3
AVES	Ruddy Turnstone	*Arenaria interpres*	LC	II		3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
AVES	Sanderling	*Calidris alba*	LC	II		3
AVES	Curlew Sandpiper	*Calidris ferruginea*	NT	II		3
AVES	Little Stint	*Calidris minuta*	LC	II		3
AVES	Caspian Plover	*Charadrius asiaticus*	LC	II		3
AVES	Common Ringed Plover	*Charadrius hiaticula*	LC	II		3
AVES	Greater Sandplover	*Charadrius leschenaultii*	LC	II		3
AVES	White-fronted Plover	*Charadrius marginatus*	LC	II		3
AVES	Lesser Sandplover	*Charadrius mongolus*	LC	II		3
AVES	Chestnut-banded Plover	*Charadrius pallidus*	NT	II		3
AVES	Kittlitz's Plover	*Charadrius pecuarius*	LC	II		3
AVES	African Three-banded Plover	*Charadrius tricollaris*	LC	II		3
AVES	White-winged Tern	*Chlidonias leucopterus*	LC	II		3
AVES	Western Marsh-harrier	*Circus aeruginosus*	LC	II	II	3
AVES	White-faced Whistling-duck	*Dendrocygna viduata*	LC	II		3
AVES	Wandering Albatross	*Diomedea exulans*	VU	II		3
AVES	Crab-plover	*Dromas ardeola*	LC	II		3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
AVES	Peregrine Falcon	*Falco peregrinus*	LC	II	I	3
AVES	African Snipe	*Gallinago nigripennis*	LC	II		3
AVES	Rock Pratincole	*Glareola nuchalis*	LC	II		3
AVES	Collared Pratincole	*Glareola pratincola*	LC	II		3
AVES	African Fish-eagle	*Haliaeetus vocifer*	LC	II	II	3
AVES	Black-winged Stilt	*Himantopus himantopus*	LC	II		3
AVES	Caspian Tern	*Hydroprogne caspia*	LC	II		3
AVES	Common Little Bittern	*Ixobrychus minutus*	LC	II		3
AVES	Dwarf Bittern	*Ixobrychus sturmii*	LC	II		3
AVES	Sooty Gull, Hemprich's Gull	*Larus hemprichii*	LC	II		3
AVES	Bat Hawk	*Macheiramphus alcinus*	LC	II	II	3
AVES	Southern Giant Petrel	*Macronectes giganteus*	LC	II		3
AVES	Black Kite	*Milvus migrans*	LC	II	II	3
AVES	Yellow-billed Stork	*Mycteria ibis*	LC	II		3
AVES	Southern Pochard	*Netta erythrophthalma*	LC	II		3
AVES	Eurasian Curlew, Curlew	*Numenius arquata*	NT	II		3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
AVES	Whimbrel	*Numenius phaeopus*	LC	II		3
AVES	Osprey	*Pandion haliaetus*	LC	II	II	3
AVES	Great White Pelican	*Pelecanus onocrotalus*	LC	I/II		3
AVES	Red Phalarope	*Phalaropus fulicarius*	LC	II		3
AVES	Lesser Flamingo	*Phoeniconaias minor*	NT	II	II	3
AVES	African Spoonbill	*Platalea alba*	LC	II		3
AVES	Spur-winged Goose	*Plectropterus gambensis*	LC	II		3
AVES	Glossy Ibis	*Plegadis falcinellus*	LC	II		3
AVES	Grey Plover	*Pluvialis squatarola*	LC	II		3
AVES	Spotted Crake	*Porzana porzana*	LC	II		3
AVES	White-chinned Petrel	*Procellaria aequinoctialis*	VU	II		3
AVES	Pied Avocet	*Recurvirostra avosetta*	LC	II		3
AVES	African Skimmer	*Rynchops flavirostris*	NT	II		3
AVES	African Comb Duck	*Sarkidiornis melanotos*	LC	II	II	3
AVES	Little Tern	*Sternula albifrons*	LC	II		3
AVES	Lesser Crested Tern	*Thalasseus bengalensis*	LC	II		3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
AVES	Greater Crested Tern	*Thalasseus bergii*	LC	II		3
AVES	Wood Sandpiper	*Tringa glareola*	LC	II		3
AVES	Common Greenshank	*Tringa nebularia*	LC	II		3
AVES	Green Sandpiper	*Tringa ochropus*	LC	II		3
AVES	Marsh Sandpiper	*Tringa stagnatilis*	LC	II		3
AVES	Common Redshank	*Tringa totanus*	LC	II		3
AVES	White-headed Lapwing	*Vanellus albiceps*	LC	II		3
AVES	Wattled Lapwing	*Vanellus senegallus*	LC	II		3
MAMMALIA	Blue Whale	*Balaenoptera musculus*	EN	I	I	1
MAMMALIA	Fin Whale	*Balaenoptera physalus*	EN	I/II	I	1
MAMMALIA	Indian Ocean Humpback Dolphin	*Sousa plumbea*	EN		I	1
MAMMALIA	Bryde's Whale	*Balaenoptera edeni*	LC	II	I	3
MAMMALIA	Dugong	*Dugong dugon*	VU	II	I	3
MAMMALIA	Southern Right Whale	*Eubalaena australis*	LC	I	I	3
MAMMALIA	Humpback Whale	*Megaptera novaeangliae*	LC	I	I	3
MAMMALIA	Killer Whale	*Orcinus orca*	DD	II	II	3

Class	English name	*Scientific name*	IUCN	CMS	CITES	CH Criterion
MAMMALIA	Sperm Whale	*Physeter macrocephalus*	VU	I/II	I	3
MAMMALIA	Pantropical Spotted Dolphin	*Stenella attenuata*	LC	II	II	3
MAMMALIA	Striped Dolphin	*Stenella coeruleoalba*	LC	II	II	3
MAMMALIA	Spinner Dolphin	*Stenella longirostris*	DD	II	II	3
MAMMALIA	Indo-Pacific Bottlenose Dolphin	*Tursiops aduncus*	DD	II	II	3
MAMMALIA	Common Bottlenose Dolphin	*Tursiops truncatus*	LC	I/II	II	3

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