



Yemen LNG Company



VERIFIED CONSERVATION AREA PROPOSAL

For Yemen LNG Balhaf Site

1. Executive Summary

Balhaf cape headland is the first promontory into the Gulf of Aden along the south coast of Yemen. It presents an important coral diversity estimated at 80 species in which it belongs to mainly 9 coral families. These species are considered of special value and sensitivity for the Balhaf site. In order to conserve this area, it is seen as key to enhance its biodiversity management.

Biodiversity conservation is not only a biological issue but also an economic one of increasing importance; Yemen LNG views it as a significant advancement both socially and environmentally. Implementing a verified conservation area can lead to many positive outcomes such the promotion of environmental friendly fishing with both the local community and the economic development, it also helps in the initiation of the Company's involvement in livelihood improvement and sustainable development, as well as the encouragement of youth into more sustainable intellect and reinforcement in Yemen.

The long-term preservation of this national treasure requires a continuation of high environmental standards thus far applied by the Company as well as the recognition of the area's importance by relevant national and international bodies. Yemen LNG has organized to design a VCA in which it includes; a baseline assessment update, SWOT analysis as well as an action plan.

2. Area Characteristics

2.1 Geographic Location and Extent

The Yemen LNG Company is operating a world-class, highly automated LNG Plant facility in Balhaf harbor area on the coast of Shabwah Governorate at a size of 2100 hectares. Balhaf's marine exclusive zone holds an approximate 1816 hectares of its size. It is approximately 130 kilometers west of Mukalla and 400 kilometers east of Aden (48.1802°E 13.9854°N) as shown in figure 1.



Figure 1: The LNG plant location and pipeline route

2.2 Area Predominate Ecoregion

According to the WWF, the predominate ecoregion are the deserts and xeric shrub lands.

2.3 General Description of the Area, Natural Resources and Ecosystem

The area surrounding the Balhaf LNG Terminal site is remote and contains no existing industrial infrastructure. However, this area has a large natural biological marine abundance and plays a significant part in the regional fishing industry, which is the most important economic activity in the region.



Figure 2: Balhaf Cape before construction

In addition, several archaeological sites including Bronze Age tombs and an old cemetery were found in the site and have been preserved. Also various more recent buildings and structures (c.1930's) including the North and South Towers (the latter of which will be restored and preserved), a Fort, a Customs House and a dozen rudimentary shelters that were temporarily used by the fishermen during the summer when fishing activity in the Balhaf area was higher.

The Balhaf weather is dominated by two monsoon events: the summer southwest monsoon between June and September and the winter northeast monsoon between December and March. The transition period is characterized by variable winds.

The Balhaf area is located at the westernmost boundary of the upwelling influence area, and is characterized by a relative small surface of hard bottoms and a short length of the coast (approximately 10 km of shoreline). During the four summer months, west blowing winds create a coastal upwelling in the north of the Gulf of Aden, leading to an ascent of cold and nutrient-rich deep sea waters. The seawater close to corals can reach low temperatures around 16 and 19°C, up to 10°C colder than the optimal average temperatures for coral growth (25 to 30°C). In this way, corals experience important seasonal temperature and turbidity variations (hot clear situation/cold turbid situation alternation). This regular change can tend to limit the coral growth. Indeed, the coral diversity of the Gulf of Aden is lower than the one observed in other surrounding the Middle East seas as the Red sea. The Gulf of Aden coral biodiversity (117 species) is roughly half of the Socotra Archipelago (253). Within this region the Balhaf-Bir Ali area is the one characterized by the highest number of coral species with 105 species out of 117 found in the Gulf of Aden.

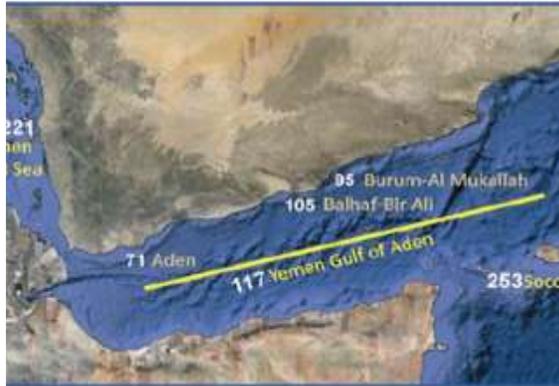


Figure 3: Coral Biodiversity in the Region



Figure 4: Balhaf Monitoring Points

Balhaf coral diversity estimated at 80 species, belonging mainly to 9 coral families. According to the Yemen (National Biodiversity Action Plan (NBSAP), it would represent 81% of the total recorded number of Yemen coral species. There are 9 coral monitoring locations in Balhaf. Overall, 40% of the species are found at each monitoring Area in Balhaf.

2.4 Native Species

The Balhaf area is also characterized by the presence of particularly important coral species within the frame of the regional and Indo-Pacific coral biogeography, and their presence in Balhaf should be considered as a characteristic of the area (northwest Indian Ocean: Red Sea, Gulf of Aden, the Arabian Sea and Persian Gulf). Although all coral species are regarded as sensitive and endangered, these species are to be considered of special value and sensitivity for the Balhaf area. Coral cover range between 30% in the NW (at station point F) to 80% at the East (at station point A). Porites are the dominant genus in most stations followed by stylophora.

It should be noted that among the 80 corals species reported from Balhaf there are 4 species of particular importance within the frame of the regional and Indo-Pacific coral biogeography and their presence in Balhaf is considered as a highlight of the area (Figure 5). Such species are regarded to as sensitive and endangered by global environmental changes and human activities. All hard coral species have been included in the Convention on International Trade in Endangered Species (CITES) signed by 169 countries and joined by Yemen on 8/3/1997.

Therefore, corals of Balhaf surviving in the peculiar upwelling influenced area are of an even more important scientific value.

Figure 5: Sensitive Coral Specis in Balhaf



2.5 Infrastructure

Balhaf LNG plant consists of the following facilities;

- A jetty for LNG Carriers loading and shipping,
- A Material Offloading Facility (MOF) for tug boat mooring,
- A sea water intake pipe,
- A water outfall pipe,
- A shoreline protection,

- The LNG Plant, Train 1 and 2, common reception facilities, utilizes and flares, LNG Storage and Terminal, buildings, camps and civil.

The conservation of biodiversity is clearly important, both for the long-term and sustainable supply of raw materials and for the spiritual, cultural and recreational benefits that it brings. However, as the human population continues to grow, biodiversity is being lost at an increasing rate. Concern about this loss has prompted international, regional and national legislation, including the United Nations Convention on Biological Diversity that engendered the target to reduce the rate of loss of biodiversity by 2010. The private sector, working with governments, NGOs, science and community partners, has a significant role to play in the conservation of biodiversity. Like many other sectors, the oil and gas industry faces the challenge of understanding what biodiversity conservation means in practical terms and how its day-to-day activities can be organized and managed to maximize the protection and enhancement of biodiversity (IPIECA BAP Guide 2005).



Figure:6 Plant technology

3. Area Manager

The Yemen LNG Company was created in 1995 following a call for tenders in Yemen with the objective of valorizing Yemeni gas reserves discovered on Block 18. Yemen LNG allowed Yemen to become a major player in the growing world gas market.

Following an open tender process, a Gas Development Agreement (GDA) was signed between the State of Yemen and YLNG on September 21st, 1995. This GDA sets out the general framework governing the development of the Yemen LNG project. The GDA was ratified by Parliament and enforced by a presidential decree. The original duration of the development phase was extended several times with Ministerial approval in accordance with the terms of the GDA.

3.1 Contact Details

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4. Rapid Assessment & Analysis

4.1 Marine Biodiversity Baseline Assessment

During the construction phase of the Balhaf Marine Biodiversity Monitoring Programme, a large monitoring plan of the coral communities was implemented to mitigate and thereby minimize the environmental impacts. Findings of this monitoring have been presented in a comprehensive synthesis report published by Creoccean in 2010. Three years after the start of the plant exploitation, Creoccean has been requested to perform a new coral monitoring program to control and assess the coral community health status during the operational phase. The study performed in November 2012, corresponds to the first coral monitoring around Balhaf since the start of the operational phase of the LNG plant. The main goal of the present report is to assess health status of coral communities around Balhaf area and to characterize their temporal evolution since 2009.

Furthermore, the first detailed assessment was made in 2005 prior to LNG plant construction. The survey was performed in order to establish the ecological status of the Balhaf coastal area before any industrial activity. The work is composed of two parts: a bibliographical work and a field evaluation of the marine chemical and biological characteristics. Although this study was focused neither on corals, nor on fishes, it highlighted the presence of highly sensitive corals and fishes rich zone. In this way, when the project was re-launched in 2005, a second baseline has been implemented from the 5th to the 11th of September 2005, centred on the update of the

1997 baseline, on the evaluation of the biological richness and the ecological status of the coral and fish communities of the study area. A summary of the results can be presented as follows;

4.1.1 Ecological Characteristics of the Balhaf Coastal Area

4.1.1.1 Balhaf Physical Environment

Balhaf cape headland is the first promontory into the Gulf of Aden along the south coast of Yemen in the 400 km from Aden. It represents the start of a rocky shore environment that stretches eastwards from Balhaf cape past Bir Ali 100 km to Burum. Balhaf site is the point of change from the 400 km of sandy beach stretching back westwards to Aden. In this way, the Balhaf site consists of a sandy coastline in the eastern part. The rocky area is formed by basaltic flows caused by volcanic activity. Some inactive old volcanoes and caldera can be found along the coastline.

4.1.1.2 Coral State of Health

Between 1997 and 1998, all the coral reefs underwent the most important and destructive bleaching event to date due to major oceanic disturbances (El Niño). This event was correlated with an increase of the oceanic surface water temperature, estimated between 3 and 5°C above the normal temperatures. In certain regions, notably in Indian Ocean, the coral mortality reached 90%. During this period, the loss of dominant coral species of shallow waters (notably tabular and branching *Acropora*) has been documented in Al Mukalla, Bir Ali and close to various Yemeni islands. This phenomenon has been reported by both 1997 and 2005 baselines. Indeed, the presence of dead corals and a partial modification of the coral composition have been underlined in the Balhaf area. Most of the living *Acropora* colonies observed in 1997, on the east bay and west side of the cape, disappeared. As well as the colonization of their calcareous skeleton by the other coral species, or by the crustose coralline algae, was observed in 2005.

Despite this mortality phenomenon, these two baselines concluded that coral communities in Balhaf area are in a very good health state, a conclusion supported by the lack of coral disease observation.

4.1.1.3 Fish Population

It is observed that coral communities shelter a large number of marine organisms. The coral communities of the Balhaf area present an attractive support for diverse species of reef fishes, of both small and large sizes. The 2005 study has reported 148 fish species, belonging to 43 families.

Considering the limited sample area (approximately 1600 m²), the Balhaf area can be considered as an important fish diversity in comparison with results obtained in other close regions (e.g. Bir Ali - 7500 m², 195 species , Socotra - 20000 m², 211 species . Moreover, according to several studies, it seems that the Balhaf area presents similar fish abundance to other coral reef area such as Moorea (French Polynesia), Hawaii or the Great Barrier Reef (Australia) . At last, the Balhaf coral communities associate favourable environments for the reproduction, recruitment (presence of numerous micro-habitats) and growth of numerous fish species, notably commercial. For this feature, the Balhaf area presents a particular economic interest, supplying an important quantity of fishes to the local fishermen

To complete these observations, a fish nursery baseline has also been carried out during the construction phase.

4.1.1.4 Benthic Fauna

The 1997 baseline recorded 197 invertebrate species in the Balhaf area, belonging to 9 phyla, as molluscs and crustaceans. These values correspond to a high faunal richness, particularly for sediment which is composed mainly by sand particles and whose granulometric structure is relatively homogenous throughout the zone. Diversity seemed to be higher in the west of the cape, but to the contrary, the benthic fauna abundance is more important in the east of the cape.

All these features constitute an important ecological and economical value for the local Balhaf area and for Yemen.

4.1.2 Local Description of the Balhaf Coastal Area

The global Balhaf area could be divided in three main zones, and each one, even if they form a functional unit, presents some different characteristics.

4.1.2.1 The East Zone

The high exposure to the swell (perpendicular to the shoreline) and the important turbulent activity allow “to clean the zone” and to evacuate particles. In this way, the water is clear (low turbidity), which allows corals to extend more in depth (maximum depth limit between 12 and 14m). The important quantity of corals supplies a large quantity of organic matter, which facilitates the development of a diverse marine community. Situated quite far from the plant construction area, this zone will only be submitted to the impacts of the water outfall pipe construction and the discharge of cool water. This water will be discharged offshore at 685m from the coast and 20m deep.

4.1.2.2 The West Zone

The low exposure to the swell (protection by the cape) causes a high natural turbidity and fine particle sedimentation, which limits the development of the coral communities (maximal depth limit 8m). But, although the coral surface is less widened in this area, in some places, corals present high size and complexity which represents attractive media for reef fish (notably commercial) reproduction and grow-up. This area will be more directly impacted by the marine construction activities.

4.1.2.3 The South Area

This zone will be not submitted to any direct impact of the project. Furthermore, this area presents the most important coral diversity of Balhaf, due to the offshore disposition of the area as well as to both wind influences from the West and from the South. The baselines advised to use this area as a reference to estimate the global quality of the water and to follow the health of the coral communities.

4.1.2.4 Pollution Rate

The study of 1997 showed that the concentrations of metal elements and in hydrocarbons measured in sediments corresponded to values normally recorded in not contaminated environment. The contamination level of the Balhaf area in 1997 was very low. But, this baseline underlined that tar balls and other signs of oil contamination were observed on the shoreline, especially on the eastern coast of the cape, on the beach and the intertidal rocks. This contamination corresponded to recent isolated deposits and several large older deposits (2 to 3

cm thick, covering an area of 5 to 10 square meter). This pollution was attributed to chronic pollution provoked from earlier tanker traffic and associated de-ballasting.

4.1.3 Fish Nursery Baseline

This fish nursery baseline analysis was implemented by MacAlister Elliot & Partners Consultant between May/June and November 2006. Its aim was to evaluate the importance of the waters around the Balhaf area in terms of a function of nursery and source of commercial fish productivity. Moreover, this study analyses the link between reef-building corals and fish populations and shows the direct relationship between coral health and fish abundance and diversity.

The healthy and rich coral habitats are one of the two main pillars of the productivity at Balhaf, the second being the seasonal upwelling from the south west monsoon. This study confirms the links between the coral and the fish communities: the hard coral skeletons have created a complex three-dimensional structural relief which can enable the larvae of invertebrates (including corals) and vertebrates (including fish) to settle, provide refuge for species in their larval, juvenile and adult stages, provide nursery areas for many species, provide food and feeding habitat for many organisms, including commercially important fish.

In this way, the Balhaf coral communities are a source, enhancing the fisheries in surrounding waters. Excess organic production (e.g. mucus from corals, plankton) moves into the open ocean and supplies food chains, which in turn supports the productivity of commercially important fish species. This study has underlined exceptional coastal fish diversity and an important abundance at Balhaf, with a total of 326 species recorded so far in the wider area, belonging to 65 families.

The Balhaf coral communities supply favourable framework for several fish ecological functions. For example, they represent a trap for pelagic larvae and nutrients, and a settlement site for larvae from the pelagic environment for subsequent development into adulthood using the food and shelter provided by the corals.

As a consequence of the fine-tuned cross-linking of the habitats, the removal of one ecological function or component could result in a collapse of the ecosystem. The consequences of habitat loss include;

- decreased abundance and diversity of associated reef-living species,
- disruption to ecosystem functions including the enhancement of open water fisheries,
- decreased abundance of commercially important species that come to the reef edge at dawn and dusk to feed on reef fish,
- loss of genetic diversity,
- decreased capacity for ecosystem recovery following natural disturbances,
- economic and food availability impacts for the people dependent on the fish productivity driven by or enhanced by the coral ecosystem.

It is important to note that this study showed area E to be the only area, of the 5 studied, where fish biomass estimates are lower after the monsoon than before. Construction impacts observed nearby are likely to account for at least some of this decreased productivity. Moreover, this analysis has underlined a lack of large individuals among the demersal species, which can be an indication of high fishing pressure in recent years. It is consistent with other YLNG studies which found that a catch per unit of effort in the inshore fisheries has been dropping since 2002 due to unsustainable fishing practices.

4.2 Present Status of Ecosystem

The Yemen LNG strategy towards marine biodiversity has been to avoid the impact by redesigning facilities (i.e. MOF Bridge) and if impact is unavoidable, mitigation measures are taken to mitigate any possible harm or damage, whether to populations, wildlife or the environment. Secondly, ensuring the residual impact is negligible, or moderate at most, to ALARP (use of silt curtains to protected sensitive coral areas) and thirdly to provide proper compensation (offset measures) to international standards where harm cannot be fully redressed (coral transplantation from construction areas at intake, jetty, and outfall) as well as establishing a positive and enduring legacy in Yemen for the benefit of future generations. In this regard, the Company is committed to invest in the social development of its project neighbours in a sustainable way that would benefit the communities and the company in the long term.

The effectiveness of the above approach is tested by implementing a comprehensive multi-level monitoring program which has been implemented since construction time. This approach also includes seawater quality monitoring as well as qualitative and quantitative monitoring of coral health. The results are regularly checked and verified by an independent body IUCN. Moreover,

the authority has been performing regular inspection visits for an overall regular review of the environmental performance including the marine biodiversity of Yemen LNG.

Based on the recent Yemen LNG monitoring results of the marine biodiversity in Balhaf, and as confirmed by the IUCN last mission, the present situation in Balhaf can be summarized as: no major change in community composition since 2012 monitoring. An increase in recruitment was observed, in almost all sites, however a mass mortality of large Stylophora was also noticed in all sites including the reference point C (which is far from the effect of operation). This is most likely related to the 2010 coral bleaching event due to regional rise in water temperature. Some sediment are still shown to depositing particularly in area D. Area F is the lowest in terms of coral cover, diversity, and recovery.

4.3 Yemen LNG's Biodiversity Action Plan (BAP) Approach for the Operation Phase

In 2011, an action plan has been prepared and implemented in order to conserve and enhance biological diversity at the Balhaf site. Needless to say, biodiversity conservation is not only a biological issue but also an economic one of increasing importance; socioeconomic biodiversity related issues in places outside project area have also been considered during operation.

The BAP describes the biodiversity status of the Balhaf and the surrounding affected area, setting targets for its conservation and outlining the mechanisms for achieving these targets and the degree of implementation.

The approach of the action plan for biodiversity conservation and sustainable use of the marine resources is in line with the draft national biodiversity strategy and action plan, as well as Yemen LNG's Environment and Social Management Plan. Therefore, this BAP is contributing to the conservation of Yemeni biodiversity. Three themes and four objectives have been developed and being implemented. For each objective an action plan has been identified as fully described in the attached BAP (appendix 1).

5. Expected Conservation Outcomes

Some of the key conservation outcomes expected from implementing a verified conservation area management plan could be as follows;

5.1 Marine Biodiversity Conservation at Balhaf

- Adequate anticipation and management of biodiversity risk at Balhaf site by reducing infrastructure and industry adverse impacts on habitats and ecosystems through eco-tech introduction and EIA enforcement.
- Ensure the conservation and preservation of marine biodiversity in a sustainable way to the local natural resources.
- Promote environment friendly fishing with local communities and economic development.
- Increase knowledge and awareness of YLNG staff and local communities and share our biodiversity experience with universities, schools and administrations.
- Development of a strategic approach to coastal zone management, and outreach on the biodiversity positive activities of Yemen LNG at regional and international conference through reports and presentation.
- Developing and designing a cost effective fish monitoring in Balhaf.

5.2 Local Communities and Other Stakeholders

- To establish a partnership work with relevant stakeholders to ensure that the planning and implementation of the company's BAP is undertaken in a manner which is mutually acceptable to key stakeholders within the private sector, the public sector, and also the broader conservation community.
- To establish a dual channel of communication between the communities and the Company.
- To encourage, in particular the youth, towards seeing the Company as a sustainable development partner in Yemen;
- To initiate thinking about the Company's involvement in livelihood improvement and sustainable development in directly affected communities.

6. Work Plan Registering the VCA (2014-2016)

TIMING	DELIVERABLES
Year One (2014)	<p>STEP ONE</p> <ul style="list-style-type: none"> - 20-page VCA Area Proposal. - Register the 'Balhaf Marine Conservation Area as a Proposed VCA Area. <hr/> <p>STEP TWO</p> <ul style="list-style-type: none"> - IUCN and Créocéan field visit and diving operation. - Design of a VCA Area Management Plan including an updated Baseline Assessment, SWOT Analysis and Action Plan. - Report on preliminary baseline survey of the fishery resources of the site and possible benefits to the surrounding areas. - Workshop to revise and finalize the VCA Area Management Plan (building on the Company's BAP and the recommendations of the IUCN Panel in Phase 1). - Submission to VCA Board for Compliance Review <p>Achieve VCA certification subject to national and international review.</p>
Year Two (2015)	<p>STEP THREE</p> <ul style="list-style-type: none"> - Implement and report on VCA-certified Management Plan. - Review and submit paperwork (Annual Biodiversity Performance Report). - Annual field visit potentially set to coincide with Créocéan visit. - Monitoring report supported by desk review.
Year Three (2016)	<p>STEP THREE (CONTINUED)</p> <ul style="list-style-type: none"> - Implement and report VCA-certified Management Plan. - Review and submit paperwork (Annual Biodiversity Performance Report). - Annual field visit to asses condition of marine biodiversity and potentially set to coincide with Créocéan visit. - Monitoring report supported by desk review.

Appendix 1

Area Manager supporting evidence

