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## Environmental, Social and Health Impact Assessment in Block 6, São Tomé e Príncipe

*Non-technical Summary*

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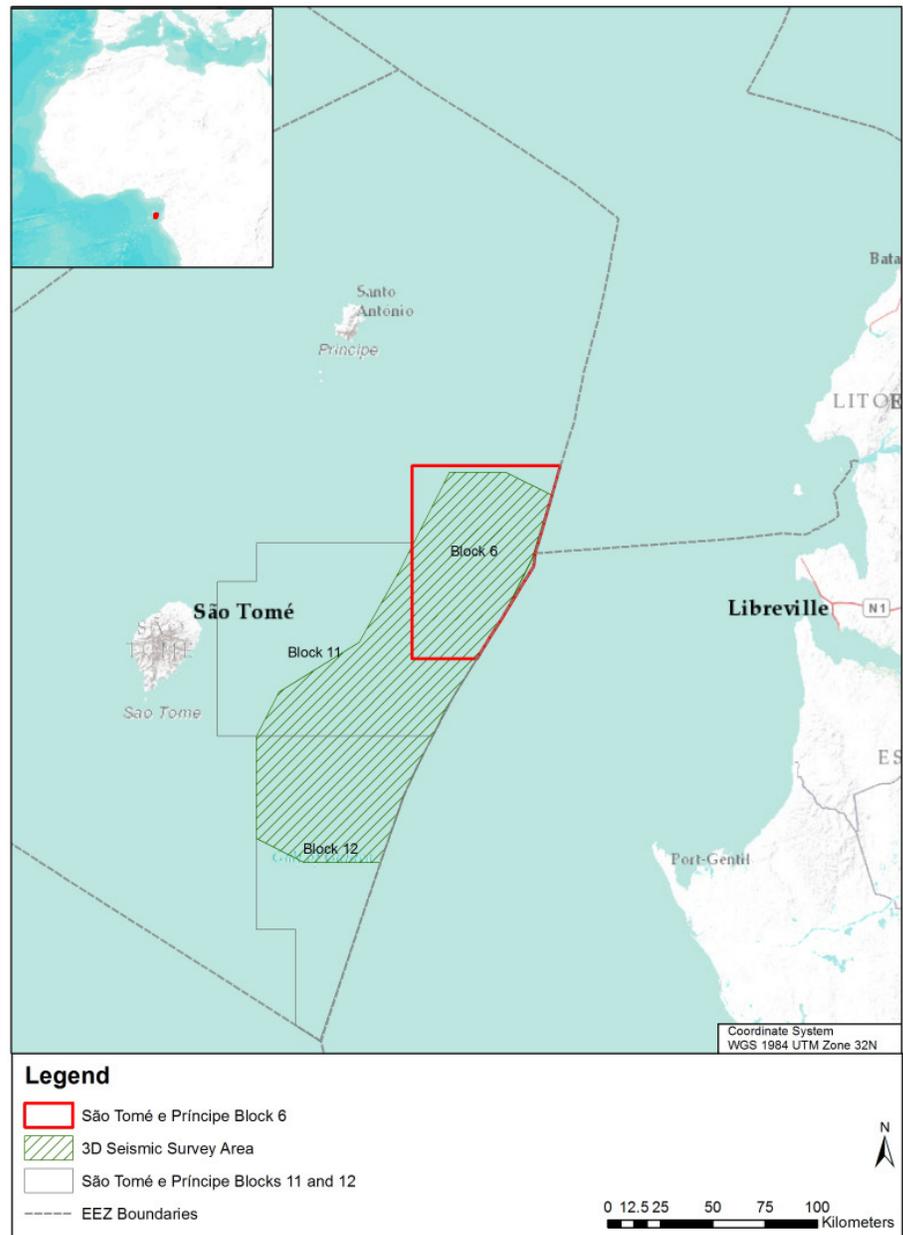
## *NON TECHNICAL SUMMARY*

This document presents the results of the Environmental, Social and Health Impact Assessment (ESHIA) undertaken for the 3-dimensional (3D) marine seismic survey programme proposed by GALP in the Block 6, in São Tomé e Príncipe. This document has been prepared by *Environmental Resources Management Iberia S.A* (ERM).

The proposed survey area lies 100 km to the north east of São Tomé Island and 63 km southeast of Príncipe Island, in water depths varying between 2,000 and 3,000 meters. GALP intends to acquire approximately 4,365 full fold km<sup>2</sup> of seismic data (see *Figure 0.1*).

Due to the proximity of Blocks 11 and 12 São Tomé e Príncipe, GALP has agreed with Block 11 and Block 12 Operator (Kosmos Energy) to develop a combined offshore seismic survey along the three Blocks (6, 11 and 12). As a result of this partnership the configuration of the Project or seismic layout has been designed covering the three Blocks. Nevertheless, according with São Tomé e Príncipe legislation and as required by the authorities, this document covers the potential impacts of a specific Block, in this case Block 6.

Figure 0.1 Location of São Tomé Block 6



Source: ERM, 2016

### Legislation, legal and institutional framework standards

In São Tomé and Príncipe, the main environmental institution is the Ministry of Infrastructure, Natural Resources and Environment (MINRE). It is the competent body responsible for aspects related with natural resources management, conservation and environment, including environmental management of in-country resources and approval of all sector EIAs.

Key regulations, legislation, as well as international conventions and standards relevant to the Project, are summarized in *Table 0.1*.

**Table 0.1** *Key São Tomean regulations and international conventions relevant to the Project*

	<b>Thematic</b>	<b>Reference</b>
<b>National Framework</b>	Environment	Law No. 10/1999 Environmental Law
		Decree No. 37/1999 relative to Environmental Impact Assessments.
		Decree No. 51/04 establishing the Organization of Public disclosure process for EIA.
		Law No. 11/1999 relative to the protection of flora and fauna and the creation of protected areas.
		Law No. 9/2001 on Fisheries.
		ANP-STP Guideline on the Evaluation of the Environmental Impact Assessment for Offshore Seismic Survey in the Economic Exclusive Zone (2015).
	Hydrocarbons	Law No. 16/2009 Petroleum Operation Law. São Tomé and Príncipe Petroleum Operations Regulations (2010 - 28° Supl., DR n.º114).
		Decree- law No. 57/09. On the exploration zones and petroleum Blocks.
		Law No. 13/2007 relative to the regulation of safe seas and preventing marine pollution.
	Air, Effluents and Waste	Law No. 4/2003 on the management of cultural and natural heritage and its registration.
Decree No. 36/1999 relative to waste management and disposal.		
Health and Safety		Law No. 14/2007 Safety, hygiene an health Law.
<b>Key International Conventions</b>	Marine Resources	Convention on Cooperation for the Protection, Management and Development of Marine and Coastal Environment (Abidjan Convention, 1984).
		United Nations Convention on the Law of the Sea (UNCLOS, 1982).
		Convention on the International Maritime Organization (IMO; 1948).
	Prevention of marine pollution	International Convention for the prevention of Pollution from Ships - MARPOL (1973/1978).
		International Convention on Civil Liability for Oil Pollution Damage (CLC, 1992).
	Flora, Fauna and Protected Areas	Convention on the Conservation of Migratory Species (Bonn Convention, 1979).
		Memorandum of Understanding concerning Conservation Measures of Marine Turtles of the Atlantic Coast of Africa (1999).
		International Convention for the Conservation of Atlantic Tunas (ICCAT, 1969).
		African Convention for the Conservation of Nature and Natural Resources (Algeria, 1968).
		Convention on Wetlands of International Importance (Ramsar Convention, 1971).

	Thematic	Reference
	Chemicals and Waste	Bamako Convention on the ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (1991).
		Convention on the control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989).
International Standards	Environment, health and safety	OGP n°432 Guideline (Oil and Gas Producers) - Managing Health, Safety and Environment in a geophysical contract.
		OGP n°389 (2007) Environmental/Social/Health risk impact management process.
		IPIECA (2003) - The Oil and Gas Industry: Operating In Sensitive Environments.
	Marine fauna	JNCC Guidelines (2010).
GALP's Standards and Policies	Environment, health and safety	GALP's HSE Management System.

Source: ERM, 2016.

### ***Project description***

#### *Principles of 3D seismic survey*

An offshore seismic survey uses a vessel towing underwater acoustic energy sources to generate a low-frequency acoustic signal into the water column, by releasing compressed air bubbles into the water. This acoustic signal, also known as “seismic wave”, spreads through the water down to the seabed. The acoustic signal emitted in the column of water penetrates the seabed and is then reflected by the rocky layers in the sub-surface. On its return, it can be recorded using submarine microphones, known as hydrophones, distributed along a set of lines towed from the vessel, known as streamers.

The 3D acquisition technique requires at least two seismic sources and several streamers, placed in parallel and separated one from another by several dozen metres. Given the length of the towed equipment and the needs for acquiring seismic data along pre-defined lines, the vessel towing this equipment must travel at regular speed, along predefined navigation lines.

To make them visible to third parties, each streamer is equipped with a tail buoy. The main vessel is supported by two chase vessels, in charge of liaising with third party vessels to reduce the potential for interference between the seismic survey and third party activities.

#### *Schedule*

The proposed 3D seismic exploration survey is scheduled to begin in the first quarter of 2017 (January). Depending on the equipment configuration and the weather conditions, the expected duration of the survey (considering Blocks 6, 11 and 12) is approximately 188 days, running an uninterrupted schedule of 24 hours a day and 7 days per week.

### *Operational details on the 3D seismic survey proposed by GALP*

The Project will be conducted following the conventional steps:

- Mobilisation of one seismic vessels, two chase vessels and one support/supply vessel to the Project area;
- Seismic acquisition campaign including the deployment of the seismic equipment (source and streamers) and data acquisition operations; and
- Demobilisation: once the seismic survey is performed, the seismic, chase and support vessels will leave the study area to navigate to their next assignment or back to the port of embarkation. No trace of the survey activity will be left in the study area after demobilisation.

The seismic vessel will navigate at a speed ranging from 4 to 5 knots, towing seismic sources at a depth of approximately 6-9 m. The hydrophones will be placed along 12 to 14 loose cables (known as streamers), 6 to 12 kilometres in length, also towed by the seismic vessel.

Before the start of the survey, the seismic vessel will berth in a yet-to-be-determined port where crew members and supplies will be taken onboard, and where they will be supplied with fuel, before sailing to the area where the seismic survey will take place. The support vessels will also berth in a yet-to-be determined port.

### *Alternatives to the Project*

3D seismic acquisition is an essential step in the collection of the necessary geological data for evaluating the prospectively of hydrocarbon presence offshore. The technique and the equipment used for this survey can be considered to be necessary for the acquisition of quality data that will allow proper assessment of the hydrocarbon potential of the São Tomé Block 6.

### *Description of the baseline environment and social*

#### *Climate*

In the Gulf of Guinea, where São Tomé e Príncipe islands are located, the climate is typically equatorial and therefore sees little variation throughout the year with typically persistent high temperatures and frequent spells of high humidity.

The regional climate of São Tomé e Príncipe is driven by the northward and southward migrations of the Inter-Tropical Convergence Zone (ITCZ) associated with the south west monsoon and the Northeast Trade Winds, and leading to two main seasons, dry and wet.

The dry season in São Tomé e Príncipe islands occurs from December to February and from June to September, while the wet season takes place between March and May and from October to November.

Mean annual rainfall ranges from 1,000 mm in the northeast of São Tomé island to more than 4,000 mm in the southwest. Average annual temperatures range from a maximum of 30° to 33°C to a minimum of 18° to 21°C, with little seasonal variation and high humidity all year.

#### *Oceanographic conditions*

Water circulation in the Gulf of Guinea is dominated by the Guinea Current that runs parallel to the coast from Senegal to Nigeria and the South Equatorial or Benguela Current that flows northwards along the coasts of Gabon and then turns westward along the equator.

The predominant surface current in Block 6 is therefore the South Equatorial Current (Benguela Current) that flows westwards.

The continental shelf around São Tomé and Príncipe islands is characterized by being very narrow and limited to 5-10 km. The proposed seismic survey area lies in waters where depths vary between approximately 2,175 m in the northeastern edge of Block 6 and 2,800 m in its extreme southwest.

#### *Marine ecological sensitivity*

The proposed seismic survey area in Block 6 is located within the Guinea Current Large Marine Ecosystem (GCLME), characterized by a water column overlying the West African continental shelf which is fed by seasonal upwelling of nutrient rich water, particularly during the rainy seasons as a result of offshore winds. This phenomenon supports high phytoplankton productivity that in turn supports a diverse marine ecosystem and associated fisheries.

The main fish groups encountered in the waters of Sao Tomé and Príncipe are pelagic and demersal fishes, many of them of commercial interest, as well as 26 species considered to be threatened according to the IUCN red list.

The Project area is important for many migratory species, especially marine mammals, marine turtles and birds.

The Waters of São Tomé and Príncipe host up to 28 cetacean species. Three of them are assessed as endangered, the Blue whale (*Balaenoptera musculus*), the fin whale (*Balaenoptera physalus*) and Sei whale (*Balaenoptera borealis*), that could be present along the coasts of São Tomé and Príncipe during their annual migration, mainly in summer and early autumn. The sperm whale (*Physeter macrocephalus*) and the Atlantic Humpback Dolphin (*Sousa teuszii*) assessed as vulnerable by the IUCN, are also known to forage in the Gulf of Guinea.

The Gulf of Guinea serves also as an important migration route, feeding ground, and nesting site for sea turtles, where five species may be observed, all of them assessed as threatened on the IUCN Red list and protected by international agreements. Based on data from the nearby Island of Bioko, olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricate*), green (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) turtles are considered to nest regularly in Saotomean beaches, mainly between October and February.

Seabirds are abundant over the continental shelf but several species can also be present further offshore, along the seismic survey, where they can be observed feeding.

#### *Fisheries in the Project area*

Fisheries in São Tomé and Príncipe are exploited through artisanal, semi-industrial and industrial fleets. In the region, the fisheries sector provides a major source of employment and foreign currency, and represented 4.7% of national GDP in 2012.

The offshore waters, where the seismic survey is planned are exploited by an industrial fleet, mainly of foreign origin. They target small pelagics such as the round sardine (*Sardinella aurita*), european anchovy (*Engraulis encrasicolus*) and jacks (*Caranx spp.*) as well as large migratory pelagic fishes such as tuna (*Katsuwonus pelamis*, *Thunnus albacores* and *T. obesus*). They also harvest crustaceans such as the pink and brown shrimp (*Penaeus notialis* and *Parapenaeopsis atlantica* respectively), cuttlefish (*Sepia officinalis*) and demersal fish species including the cassava croaker (*Pseudotolithus senegalensis*), longneck croaker (*P. typus*) and the golden African snapper (*Lutjanus fulgens*).

#### *Assessment of impacts*

Impact significance categories for potential environmental and social impacts are illustrated in *Table 0.2*. Significance is assessed as the combination of magnitude and receptor quality/importance/sensitivity to evaluate whether an impact is, or is not, significant and if so its degree of significance.

The present ESHIA document is focused on activities to be carried out in Block 6. However, and provided that the seismic survey will be developed jointly along Blocks 11 and 12, certain impacts have been assessed for the whole survey along the three Blocks (i.e. atmospheric emissions) as the potential effects of these cannot be considered independently.

**Table 0.2**      *Significance matrix*

		Sensitivity / Vulnerability / Importance of Resource/ Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Source: ERM, 2016.

The components of the Project taken into account in the assessment are:

- The seismic acquisition vessel and its operations;
- The chase/supply vessels and associated operations; and
- Any non-routine or accidental events.

The main sources of impacts and receptors are summarized in *Table 0.3*.

Table 0.3 Summary of potential sources of impact and potential receptors

	Potentially impacted environmental aspect								
	Physical impacts		Biological Impacts			Socio-economic Impacts			
	Air Quality	Water Quality	Marine Flora	Marine Fauna	Protected Areas	Artisanal and Industrial Fishing	Maritime Navigation	Local Population and Health	Coastal Infrastructure, Tourism and Cultural Heritage
<b>Sources of impact</b>	<b>Routine activities</b>								
Atmospheric emissions from vessels	X								
Liquid discharges from vessels		X	X	X		X		X	X
Discharge of solid waste from vessels (macerated food and kitchen waste)		X	X	X		X		X	X
Underwater Noise emissions (seismic acquisition)				X		X			
Physical presence of the vessels (mobilization, survey, demobilization)			X	X		X	X		X
Artificial light illumination			X	X					
	<b>Accidental events</b>								
Accidental spillage / discharge		X	X	X	X	X	X	X	X

Source: ERM, 2016.

Table 0.4 presents a summary of the significance of residual impacts (after implementation of mitigation measures) resulting from the 3D seismic acquisition survey planned by GALP in the São Tomé and Príncipe Block 6.

**Table 0.4 Summary of Residual Impacts**

Receptor	Potential Impact	Impact Significance
<b>Impacts from Routine Activities</b>		
<b>Air Quality</b>	Potential reduction in localized air quality and contribution to greenhouse gases.	<b>Negligible</b>
<b>Seawater Quality</b>	Potential localized reduction in water quality, including increased turbidity and BOD.	<b>Negligible</b>
	Potential introduction of alien invasive species from ballast water discharges.	
<b>Marine Flora</b>	Potential localized increase in organic matter.	<b>Negligible</b>
<b>Marine Fauna</b>	Potential disturbance to Marine wildlife due to noise emissions (behavior effects, physical impacts from temporary TTS and potentially PTS)	<i>Marine mammals and Turtles</i> <b>Minor</b>
		<i>Fish</i> <b>Negligible</b>
		<i>Seabirds, invertebrates and plankton</i> <b>Negligible</b>
	Potential disturbance to marine wildlife due to secondary effects from liquid and solid waste discharges on the water column.	<b>Negligible</b>
	Potential disturbance to marine wildlife due to collisions with Project vessels or entanglement with towed array equipment	<b>Minor</b>
	Potential disturbance to marine wildlife due to entanglement with towed array equipment	<b>Minor</b>
	Potential impacts derived from the use of artificial lightning.	<b>Negligible</b>
<b>Protected Areas</b>	Potential impacts to biodiversity features of coastal protected areas.	<b>Negligible</b>
<b>Artisanal and Commercial Fishing</b>	Temporary disruption or cessation of access to fishing grounds, interference of fishing boats or temporary fishery stock displacement.	<b>Negligible</b>
<b>Marine Traffic</b>	Project vessel's movements	<b>Negligible</b>

Receptor	Potential Impact	Impact Significance
<b>and Navigation</b>	may disrupt maritime traffic in the area.	
<b>Local Population</b>	Potential nuisance impacts and local socioeconomic conditions.	<b>Negligible</b>
<b>Coastal Infrastructure, Cultural Heritage and Tourism</b>	Potential impacts and or interference with coastal resources.	<b>Negligible</b>
<b>Event-related impacts</b>		
<b>Impact on Water Quality</b>	Refueling operations at sea, collisions or vessel maintenance activities leading to accidental oil spills.	<b>Minor</b>
<b>Coastal Area Impact</b>		

Source: ERM, 2016.

All the impacts from the Project, considering the implementation of mitigation measures were assessed as being *Negligible* or *Minor*. Conclusions on key identified impacts are summarized as follows:

- **Potential disturbance from i) noise emissions and ii) presence of survey equipment on marine mammals and sea turtles (Minor significance)**

The presence of a Marine Fauna Observer on-board together with the installation of Passive Acoustic Monitoring (PAM) on the seismic vessel will ensure the proper application of the JNCC guidelines (*Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, 2010*) and the implementation of the soft start procedure, both designed to minimize impacts on wildlife due to noise emissions, that will reduce the significance of the potential noise impact on sea turtles and on marine mammals to Minor. The reduction in the vessel's speed during transits from or to Port together with the presence of fauna observers will reduce the risk of collision between vessels and marine mammals. Similarly, the use of turtle exclusion devices will also reduce potential disturbance from entanglement.

- **Potential disturbance from the presence and movements of Project vessels on i) fisheries and ii) maritime traffic and navigation (Negligible significance)**

The Project will notify Naval, Transport and Port authorities about the development plans, timing and location of activities, that together with the direct information to other ships through Notice to Mariners and by periodic broadcasts on appropriate communication channels will ensure other marine users are aware of the activities and location of Project vessels. Prior to the start of the survey a Fishery information campaign will be undertaken. In addition, the presence of chase vessels and a Fisheries Liaison Officer will ensure the exclusion area around the seismic vessel is properly maintained and any incident is avoided. Given the presence of two chase vessels, together with the presence of sensitive marine fauna observers, and the mobile nature of the exclusion zone as the seismic vessel advances, the reduction in the risk

of residual impacts derived from the physical presence of the seismic vessel and the presence of the exclusion zone on sea users is considered to be Negligible.

- **Accidental Hydrocarbon Spill (Minor Significance)**

The seismic acquisition vessel will have a plan and procedures to implement in case of any accidental spillage of hydrocarbons (or other pollutants) at sea (also known as the SOPEP - Shipboard Oil Pollution and Emergency Plan), that meets the demands of the International Marine Organisation. This plan will be supported by the patrolling of chase vessels which will reduce the possibility of a collision. The likelihood that a spillage could lead to any large volume is considered unlikely and in view of mitigation measures described, the distance to the coast and the sensitivity of the environmental receptors, the resulting residual impact is assessed as Minor.

### *Environmental and Social Management Plan*

In this ESHIA, no impacts were identified that could not be minimised to acceptable levels through the application of the proposed mitigation measures detailed in the impact assessment chapter and further described in the project's Environmental and Social Management Plan (ESMP). The ESMP will ensure that all the mitigation measures provided for in the ESHIA are implemented while the Project is carried out, in accordance with the commitments made by GALP. The ESMP is to be considered a dynamic document that may be continuously revised as part of an on-going environmental management and improvement process.

The objectives of the ESMP are:

- To provide the mechanism to ensure compliance with STP legislation, GALP HSE policies, management system and procedures, international law and standards, and Oil & Gas industry best practices;
- To ensure that all the mitigation measures and all the commitments made by GALP and identified in the ESHIA report are taken into account during the survey planning and operation phases;
- To provide a framework for mitigating impacts that may be unforeseen or unidentified;
- To establish an environmental surveillance and monitoring programme so that the ESMP can be updated and improved as the survey progresses.

Based on the key identified impacts, specific operational controls and mitigation procedures have been considered for the following environmental and social aspects:

- Sensitive marine fauna protection: the project will adopt the Joint Nature Conservation Committee (JNCC, 2010) *Guidelines for Minimising the Acoustic Disturbance on Cetaceans*. These guidelines will further protect

other marine fauna such as turtles through the use of: marine mammal observers (MMO), visual monitoring and seismic source operation protocols (i.e. soft start, restart procedures) and Passive Acoustic Monitoring (PAM) technologies.

- Oil pollution emergency procedures: in order to ensure effective management of refuel operations a Shipboard Oil Pollution Emergency Plan (SOPEP) and Bunkering Procedures will be in place before commencement of operations.
- Waste management procedures: the development of a Waste Management Plan (WMP) in accordance with MARPOL 73/78 (Annex V) and other relevant guidelines for the storage, collection and disposal of all identified waste streams, and especially with regards to hazardous substances.
- Liaison with ships and fisheries: through an effective communications plan, Seismic Contractor and GALP will implement proposed protocols at the pre-survey stage (information to Fishing and Port authorities and associations) and Fisheries Liaison Officers (FLO) will implement mitigation during operational stages (chase vessel investigation and warning actions).
- The ESMP further establishes the procedures set forth to effectively implement all proposed actions, relevant information to be communicated and change management procedures when modifications of the ESMP may be warranted.

