



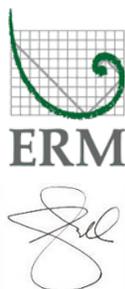
Final Terms of Reference

Environmental Impact Assessment

Liza Phase 2 Development Project

Esso Exploration and Production Guyana, Limited

May 2018



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ACRONYMS AND ABBREVIATIONS

%BFROC	percentage of base fluid retained on cuttings	ILO	International Labour Organization
AOI	Area of Influence	IMO	International Maritime Organization
BOPD	barrels of oil per day	IP	intermediate pressure
BPD	barrels per day	LCDS	Low Carbon Development Strategy
EBS	environmental baseline study	LP	low pressure
EEPGL	Esso Exploration and Production Guyana Limited	MARAD	Maritime Administration Department
EIA	Environmental Impact Assessment	mscfd	million standard cubic feet per day
EITI	Extractive Industries Transparency Initiative	NABF	non-aqueous base fluid
EMC	Environmental Management Consultants	NBSAP	National Biodiversity Strategy and Action Plan
EPA	Guyana Environmental Protection Agency	NDS	National Development Strategy
ERM	Environmental Resources Management	NEAP	National Environmental Action Plan
ESMP	Environmental and Socioeconomic Management Plan	OIMS	Operations Integrity Management System
FLET	flowline end termination	OSRP	Oil Spill Response Plan
FPSO	Floating Production, Storage, and Offloading (vessel)	P&A	plugging and abandonment
GEA	Guyana Energy Agency	PCS	Process Control System
GEMSS	Generalized Environmental Modeling System for Surfacewaters	PDA	Project Development Area
GGMC	Guyana Geology and Mines Commission	ROV	remotely operated vehicle
GHG	greenhouse gas	SCSSV	surface-controlled subsurface safety valve
GSEC	Ground Structures Engineering Consultants Ltd.	SDU	Subsea Distribution Unit
HP	high pressure	SIS	Safety Instrumented System
ICSS	Integrated Control and Safety System	SRU	Sulfate Removal Unit
ICZM	Integrated Coastal Zone Management	SURF	Subsea Umbilicals, Risers, and Flowlines
		ToR	Terms of Reference
		VEC	valued environmental and social component
		VLCC	Very Large Crude Carrier
		VSP	Vertical Seismic Profile
		WI	water injection

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1. INTRODUCTION

Esso Exploration and Production Guyana Limited (EEPGL) is seeking environmental authorization for the second phase of development of the Liza field in the eastern half of the Stabroek Block (hereafter referred to as the Liza Phase 2 Development Project, or the Project). The objective of the Project will be to develop oil reserves from the Liza field. Based on exploration and assessment activities, EEPGL has estimated that the Stabroek Block contains more than 3.2 billion barrels of oil equivalent recoverable resource. This estimate does not include the most recent discovery at Ranger or any subsequent discoveries that may occur in the near term. The Guyana Environmental Protection Agency (EPA) has required EEPGL to hire qualified independent environmental consultants to conduct an Environmental Impact Assessment (EIA) in support of EEPGL's Application for Environmental Authorisation for the Project.

2. PURPOSE OF THE TERMS OF REFERENCE

The purpose of this Terms of Reference (ToR) is to establish the scope, content, and process for the EIA for the Project. The EIA will be conducted in compliance with the Guyana Environmental Protection Act (amended in 2005) and the Environmental Protection (Authorisation) Regulations (2000).

3. OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The following are the objectives of the EIA:

- Describe the components and activities of the Project, including:
 - Development drilling, including well design and drill ships;
 - Subsea Umbilicals, Risers, and Flowlines (SURF);
 - Floating Production, Storage, and Offloading (FPSO) vessel, including topsides facilities and the vessel mooring system;
 - Installation, hookup, and commissioning of FPSO and SURF components;
 - Production operations, including offloading tankers;
 - Onshore support, including shorebases;
 - Marine and aviation support vessels and equipment; and
 - End of Phase 2 operations (decommissioning).
- Describe the existing conditions within the Project Area of Influence (AOI). The evaluation of existing conditions in the Project AOI will leverage the scientific body of knowledge that has previously been acquired during prior environmental authorizations, as well as additional planned studies that are specific to Phase 2 (see Section 8, Description of Existing Conditions). The Project AOI may vary by resource/receptor or by impact, and will not necessarily be limited to the Project Development Area (PDA) or the Stabroek Block. More

details on the extent of the Project AOI are presented in Section 4, Description of the Project, and Section 7.1, Project Area of Influence.

- Identify and assess the potential direct, indirect, and cumulative environmental and socioeconomic impacts that could credibly result from the Project during the drilling, installation, production, and decommissioning stages using an assessment process described in Section 6, Methodology for Preparing the EIA.
- Describe, to the extent possible, potential induced impacts associated with ancillary/support activities or facilities that may not be a component of the Project itself, but are associated with the Project.
- Describe a strategy to manage the potentially significant adverse impacts of the Project.
- Characterize potential positive benefits of the Project.
- Recommend monitoring to assess the effectiveness of the management strategy.
- Provide the factual and analytical basis required by EPA, the Guyana Geology and Mines Commission (GGMC), and the Ministry of Natural Resources to make an informed decision on EEPGL's Application for Environmental Authorisation to permit the Project.

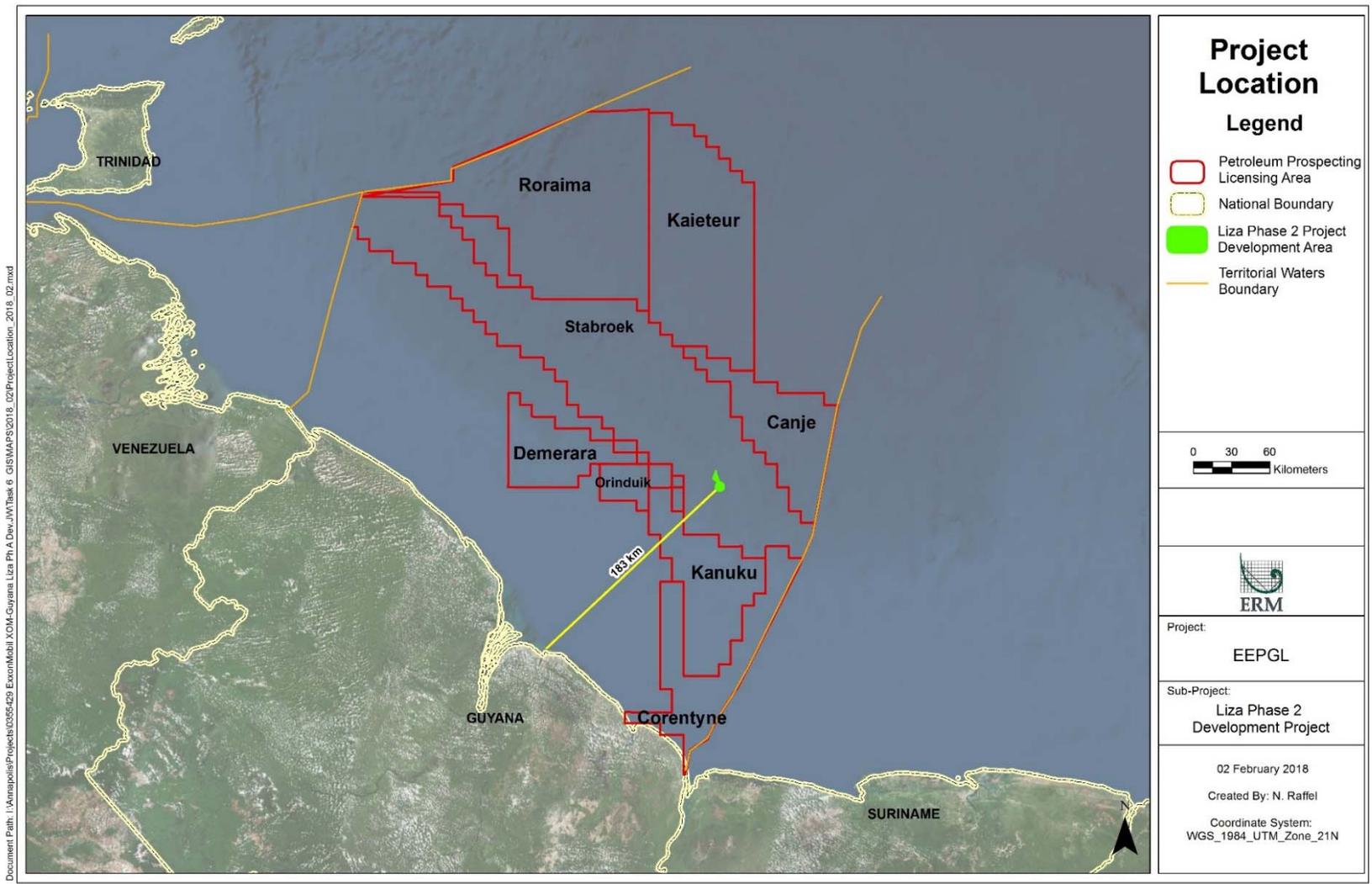
The group of Environmental Resources Management (ERM), an international environmental and social consulting firm with a local registration in Guyana, and the Guyanese consultancies Environmental Management Consultants (EMC) and Ground Structures Engineering Consultants Ltd. (GSEC) (collectively, the Consultants) have been selected by EEPGL and approved by EPA to prepare the EIA.

4. DESCRIPTION OF THE PROJECT

The Project will consist of the drilling of up to 33 development wells (including production, water injection, and gas re-injection wells), installation and operation of SURF equipment, and the installation and operation of an FPSO in the eastern half of the Stabroek Block (Figure 4-1). Onshore logistical support facilities and marine/aviation services will be utilized to support each stage of the Project. The Project information presented in this section is based on conceptual design and will be further defined as the EIA progresses.

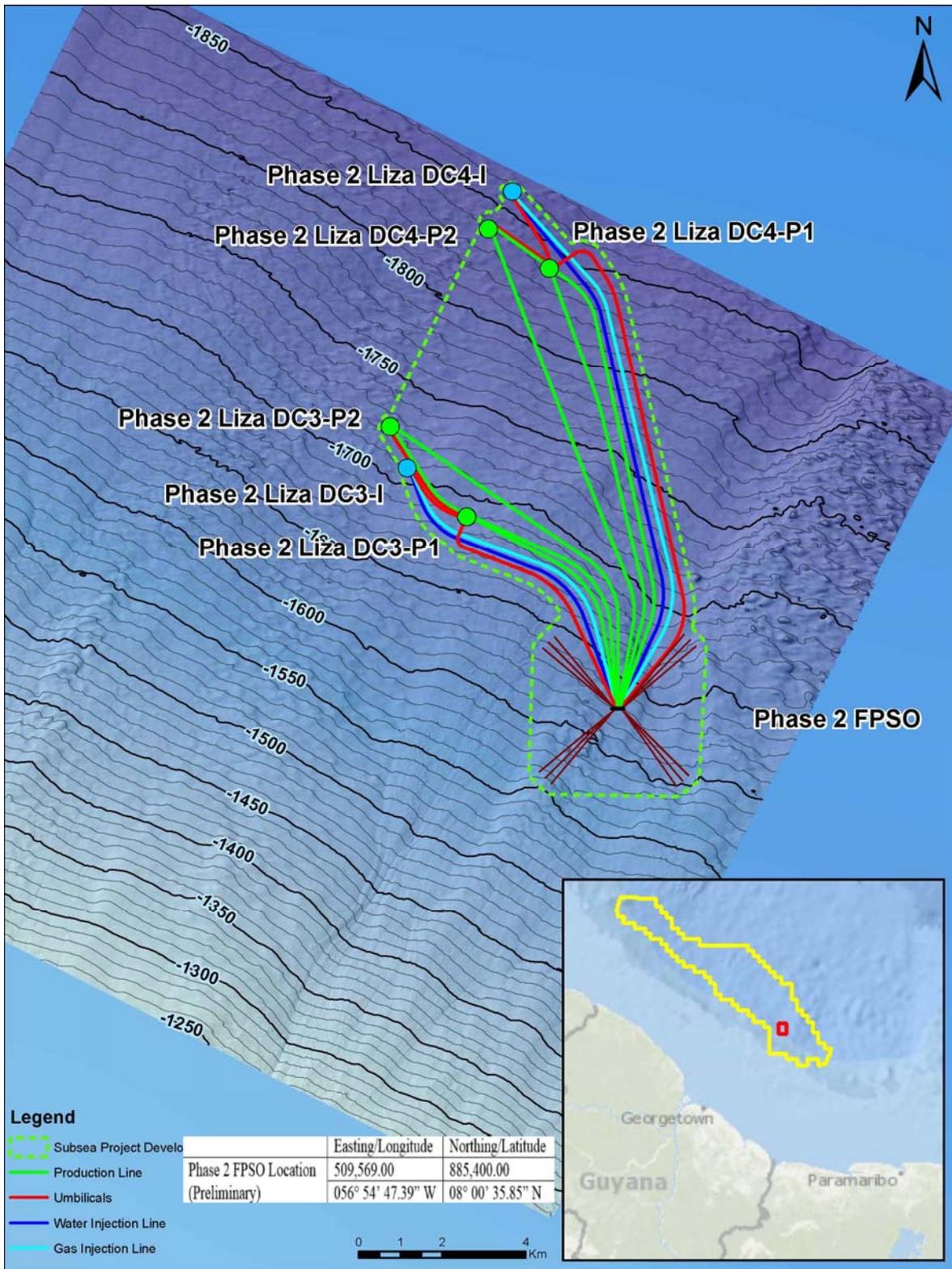
4.1. PROJECT AREA

There will be components of the Project located on the seafloor, suspended in the water column, and at the ocean surface. The combined extent of the area affected by both surface and subsea components and activities is referred to as the PDA. Figure 4-1 illustrates the location of the PDA within the Stabroek Block; the PDA is located approximately 183 kilometers (114 miles) northeast of the coastline of Georgetown, Guyana. Figures 4-2 and 4-3 illustrate the preliminary conceptual layout of the FPSO, the SURF equipment, and the drill centers within the PDA.



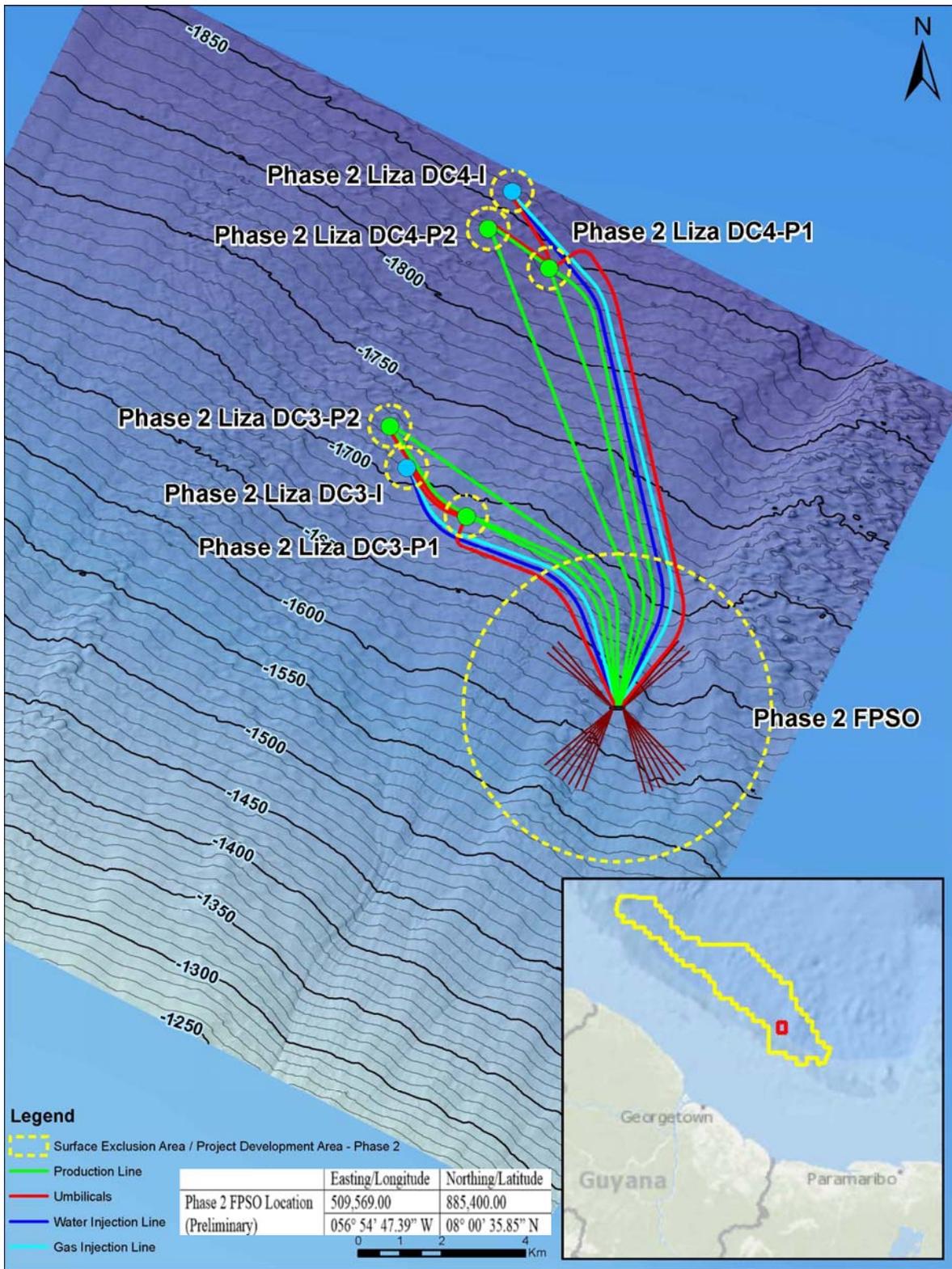
Note: Map does not represent a depiction of the maritime boundary lines of Guyana

Figure 4-1: Location of the Liza Phase 2 Project Development Area within Stabroek Block



Note: Locations on figure subject to change

Figure 4-2: Phase 2 Subsea Project Development Area



Note: Locations on figure subject to change

Figure 4-3: Phase 2 Surface Project Development Area

The exact locations of the Phase 2 development wells have not yet been finalized; however, the wells will be drilled from two main drill centers¹. During drilling and installation of the FPSO/SURF facilities, work may be performed in a subsea area within the PDA that could potentially cover an estimated 7,660 hectares. This area is referred to as the Subsea PDA. Much of this subsea area will not be physically disturbed, except where the SURF equipment and the FPSO mooring system are sited, as shown on Figure 4-2.

During the production operations stage, work performed on the surface of the ocean could potentially cover an estimated 4,500 to 5,000 hectares. This area is referred to as the Surface PDA. As further described in subsequent sections and shown on Figure 4-3, this area of the ocean surface may have operational constraints which would restrict unauthorized vessels from entering defined marine safety exclusion zones during drilling and production operations. While Figure 4-3 shows seven marine safety exclusion zones around the drilling manifold locations, drilling will not occur at all locations simultaneously. The marine safety exclusion zones for the large installation vessels that will conduct FPSO and SURF facility installation are not denoted on Figure 4-3; however, the size of these marine safety exclusion zones would be similar to those utilized for the drill ships.

4.2. PROJECT SCHEDULE

The Project life cycle will include engineering, development drilling, installation, hook-up, commissioning, start-up, operations and maintenance, and decommissioning. Operations and maintenance will follow start-up, and will be the longest stage of the Project.

Figure 4-4 provides a preliminary schedule for the major Project components and activities up to the start of production operations. As depicted in Figure 4-4, initial oil production is planned for mid-2022. To support this timing, development-well drilling is planned to start in early 2021. Installation of subsea components is planned to begin in 2020; the FPSO installation is planned to occur in early 2022. Production will continue for at least 20 years. These milestones are still being refined and are subject to change. This schedule provides for simultaneous development drilling and FPSO/SURF production operations after startup.

¹ For the Project, a *drill center* is defined as a group of wells (including production, water injection, and/or gas re-injection wells) clustered around one or more manifolds. Each drill center incorporates separate manifolds that are separated by several kilometers and are designed for production or injection. For example, Drill Center 3 will be separated into production (DC3-P1 and DC3-P2) and injection (DC3-I) components.

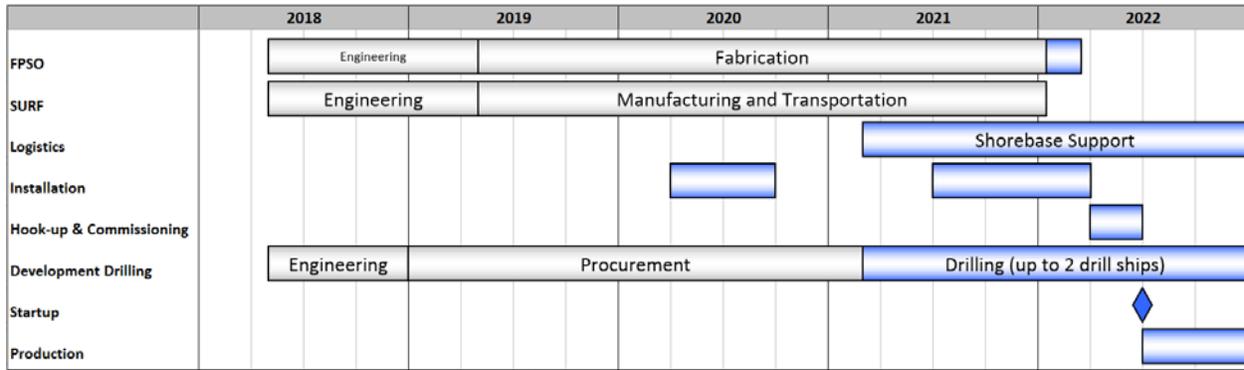


Figure 4-4: Preliminary Project Schedule

4.3. PROJECT WORKFORCE

Preliminary workforce estimates are provided in Table 4-1. These estimates may be further refined following selection and contracting for the drill ship(s), FPSO, SURF installation, support vessels, and shorebase support facilities. The current plan is to conduct primary support activities from shorebases in Guyana and Trinidad and Tobago.

Table 4-1: Preliminary Workforce Estimates

Project Stage	Estimated Workforce
Development well drilling	Approximately 600 persons at peak (Assuming two drill ships; dependent upon final drill ship and support vessel selection)
FPSO and SURF mobilization, installation, and hook-up	Approximately 600 persons at peak (Dependent upon final construction/installation and support vessel selection)
Production operations, including FPSO and conventional export tankers	Approximately 100 to 140 persons at peak (an additional 25-30 persons would be on board each export tanker)
Decommissioning	Approximately 60 persons at peak

In addition to the offshore components, there will also be personnel providing shorebase and marine logistical support onshore (approximately 100 to 150 persons), some of whom will be Project-dedicated while others will be shared resources. The onshore logistical support staff will ramp up gradually through the mobilization and installation stage until reaching a peak during the development drilling campaign and FPSO/SURF installation activities.

4.4. OVERVIEW OF THE DEVELOPMENT CONCEPT

4.4.1. Development Concept

The Liza field will be developed during Phase 2 with up to 33 development wells drilled from two drill centers, each with separate production, gas, and water injection manifolds. Figure 4-5 illustrates the preliminary field layout for the Project facilities, including the development wells, SURF, and a spread-moored FPSO vessel. The facility layout will continue to evolve during the design development process. The various components included in Figure 4-5 are further described below in the relevant drilling, SURF, and FPSO sections.

The development wells include production wells, water injection wells, and gas re-injection wells. A portion of the associated gas produced from the reservoir will be used on board the FPSO as fuel gas, and the remaining balance will be re-injected back into the reservoir via the gas re-injection wells. Water and gas injection will be used as needed to maintain reservoir pressure for optimal production over the life cycle of the Project.

The Project will utilize a spread-moored FPSO (see Section 4.7, Floating Production, Storage, and Offloading Vessel). The FPSO will support the topsides facilities, process the produced fluids from the production wells, and store the processed crude oil until offloading. Offloading of the processed crude oil for export will occur directly to conventional tankers. Subsea production, gas, and water injection wells and manifolds will be tied back directly to the FPSO via flowlines and risers (see Section 4.6, Subsea Umbilicals, Risers, and Flowlines).

4.4.2. Applicable Codes, Standards, and Management Systems

The various aspects of engineering design and operations will be carried out according to applicable Guyana statutory requirements, applicable international design codes and standards, applicable EEPGL and contractor design specifications, the EEPGL Operations Integrity Management System (OIMS)², and the EEPGL Safety, Security, Health, and Environment policies³. EEPGL and its contractors will have a structured management system to verify the ongoing application of all necessary codes, standards, procedures, and management systems. An overview of the EEPGL OIMS framework is included in Section 5, Administrative Framework.

² <http://corporate.exxonmobil.com/company/about-us/safety-and-health/operations-integrity-management-system>

³ The policies are part of the overall Standards of Business Conduct policy: <http://corporate.exxonmobil.com/en/company/about-us/guiding-principles/standards-of-business-conduct>

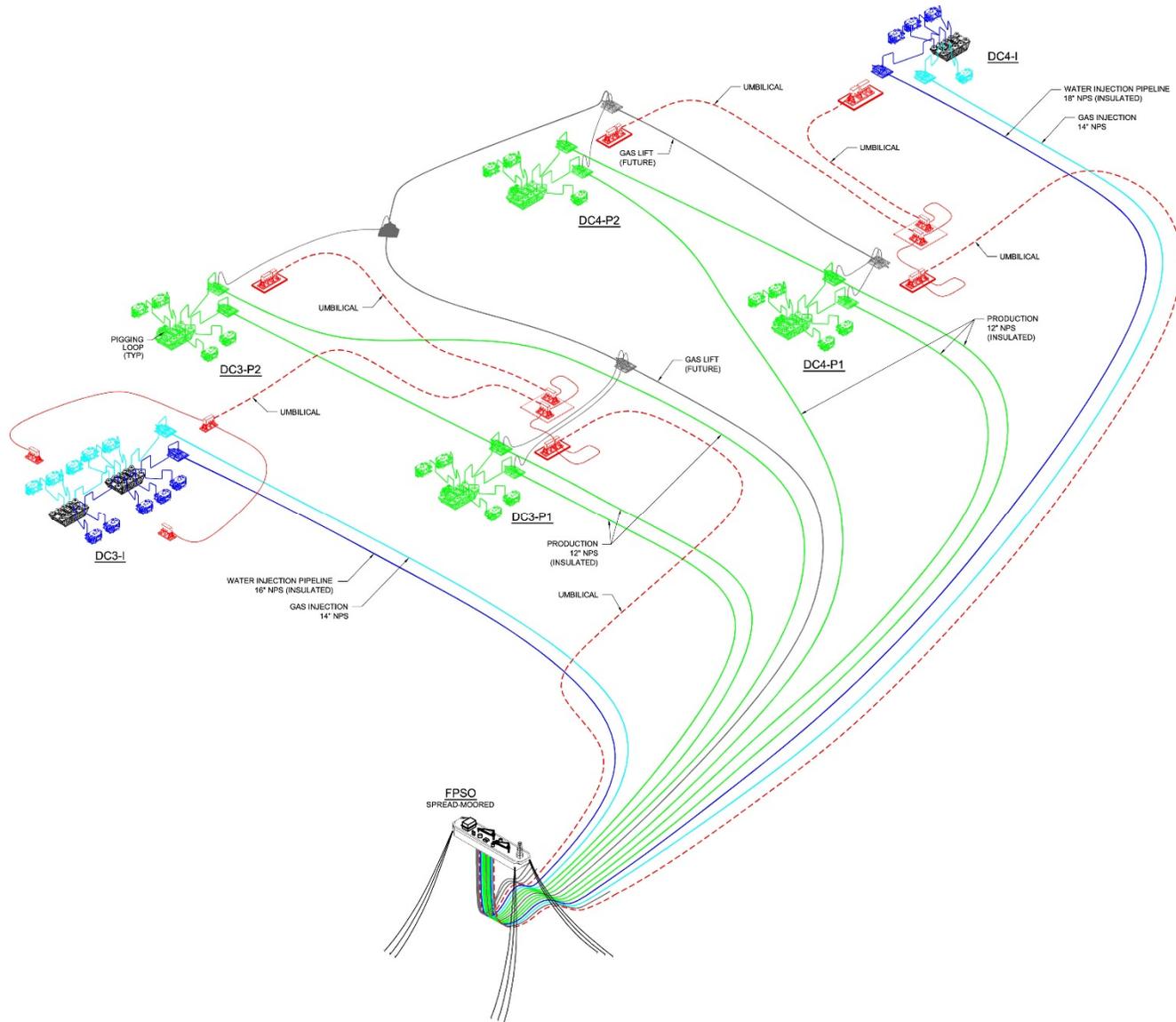


Figure 4-5: Preliminary Liza Phase 2 Field Layout

4.5. DRILLING AND WELL DESIGN

4.5.1. Drilling Program

The Project will use up to two drill ships similar to that shown on Figure 4-6 to drill the development wells. The number of drill ships required will be determined during the design development process based primarily on the number of wells required for initial oil production. Drilling operations may occur prior to, during, and after the installation of the FPSO and SURF components.



Figure 4-6: Typical Drill Ship

During the drilling process, drill ships will require various tubulars⁴, instruments, and devices (collectively referred to as the drill string) to conduct the well construction process, which consists of drilling the borehole, running and cementing casings using a sequential batch drilling program followed by installing the completion and production tubing. The wellheads will be clustered around two major drill centers rather than being distributed over the seabed above the producing reservoirs. This approach reduces the number of drilling locations, thereby reducing the seabed area potentially affected by drilling operations, including discharge of drill cuttings⁵. The planned development drilling program and its cuttings management approach is consistent with industry practices and has previously been the basis for exploration wells in the Stabroek Block, and it is also the basis for the development wells for the Liza Phase 1 Development Project.

4.5.2. Typical Well Design

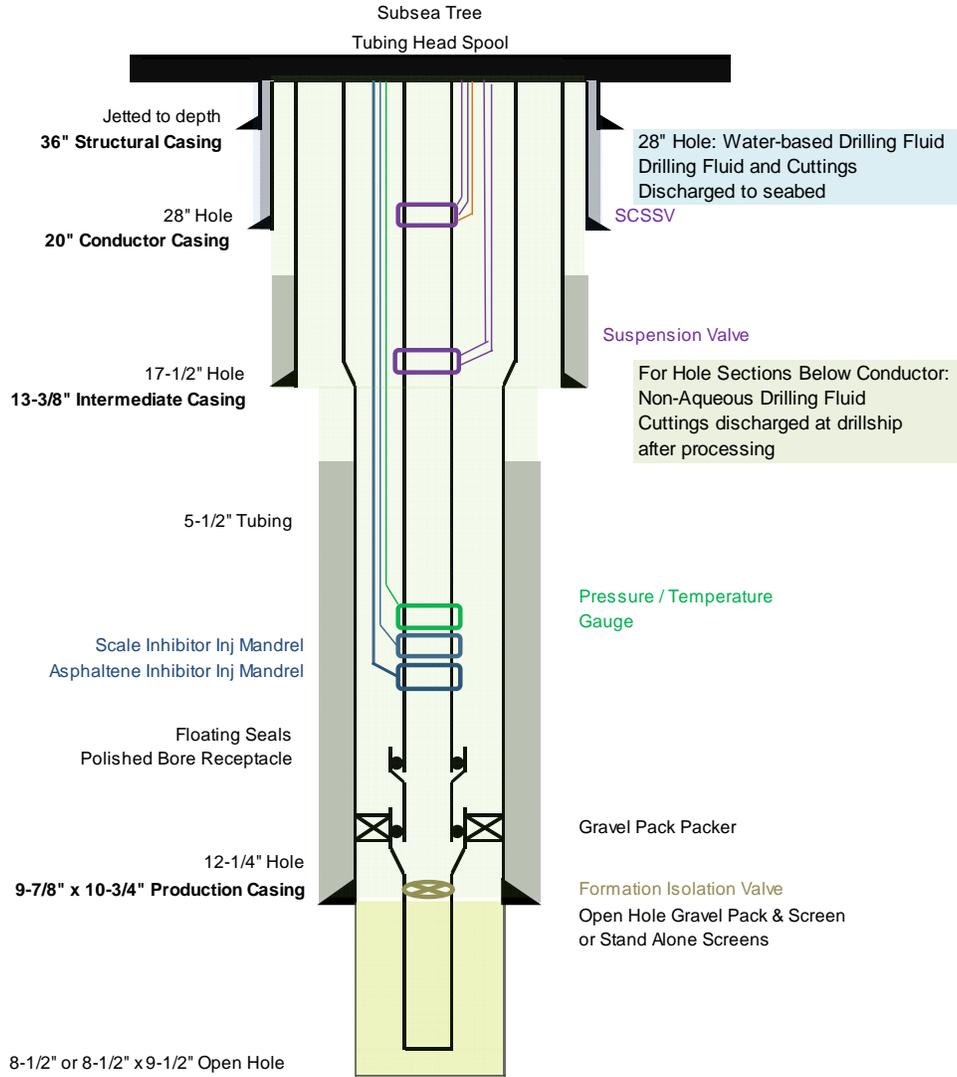
The following information describes development wells for the purposes of the Liza Phase 2 Development Project; however, exploration wells are structurally similar to development wells and are drilled using similar processes and equipment.

Once the borehole is started for a well, pipe (also known as casing) is inserted into the borehole and cemented in place to keep the well from collapsing and to seal the casing to the formation. Various sized casings are progressively set as the well is drilled deeper. After each casing (for the conductor casing and deeper casings) is installed, pressure and integrity testing will be performed according to standard industry practices. A provisional well program and design for the Phase 2 development drilling program, including casing types and sizes, setting depths, drilling fluid types, and discharge locations, is shown on Figure 4-7.

Figure 4-8 shows the various components of a typical subsea drilling system.

⁴ Tubulars include various types of piping, such as drill pipe, drill collars, casing, and production tubing.

⁵ Drill cuttings are the broken bits of solid material produced as the drill bit advances through the borehole in the rock or soil.



SCSSV = surface-controlled subsurface safety valve

Figure 4-7: Provisional Casing Program for Development Drilling Program

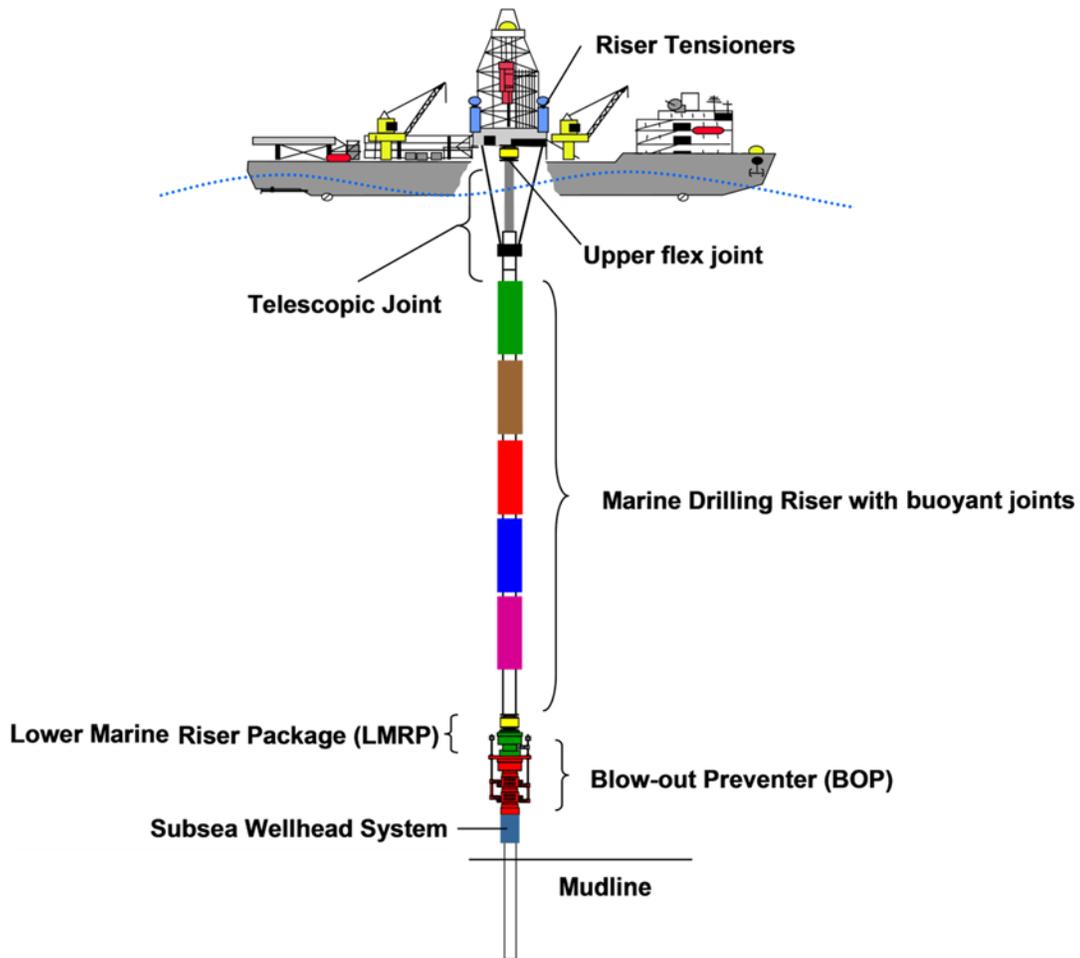


Figure 4-8: Typical Subsea Drilling System

4.5.3. Drilling Fluids

The drilling process will require drilling fluid to remove cuttings and to control formation pressures. The choice of drilling fluids will be based on the challenges associated with drilling in deep-water environments, which differ from shallow-water drilling in the following aspects:

- Colder temperature/higher seawater hydrostatic pressure at the mudline;
- More narrow window between pore pressure⁶ and fracture gradient⁷; and
- Longer drilling risers requiring larger volumes of drilling fluid.

Three categories of drilling fluids will be used: seawater, water-based drilling fluids, and non-aqueous drilling fluids in which the continuous phase is an International Oil and Gas Producers Association Group III low-toxicity non-aqueous base fluid (NABF) with low to negligible aromatic content. Water-based drilling fluids will be used when drilling the upper sections of the well. Based on wellbore stability analysis and experience gained from exploration drilling,

⁶ Pressure of fluids within the pores of a reservoir

⁷ Pressure required to induce fractures in rock at a given depth

non-aqueous drilling fluids will be required to maintain borehole stability while drilling all well sections below the conductor casing.

Solids control and cuttings drying equipment will be installed on the drill ships to process and reduce the percentage of NABF retained on cuttings (%BFROC). The cuttings will be discharged to the sea after treatment, in accordance with standard industry practice. The use of this equipment on other similar projects has significantly reduced the %BFROC.

4.5.4. Well Cleanup and Ancillary Processes

4.5.4.1. Well Cleanup

Development wells will be drilled, completed, and tied-back to the FPSO. Injection wells will not be flowed back (i.e., unloaded) to the FPSO or to the rig before commencing injection. For oil-producing wells, fluids left in the well bore will be flowed back to the FPSO and cleaned up through the subsea tree/flowlines/production equipment.

4.5.4.2. Vertical Seismic Profiling

Vertical Seismic Profile (VSP) data may be collected to improve velocity modeling and reduce uncertainty in reservoir mapping. VSP surveys can be used to correlate the surface-seismic data to the information on the physical properties and characteristics of the hydrocarbons gained from drilling the well. VSP data, along with check shots and well logs, provide further time/depth information from which to improve knowledge and understanding of the structure and stratigraphy of a reservoir.

A VSP survey requires a sound source (commonly compressed air) and a receiver. Data are acquired by the receiver, which is installed within the wellbore. The source may be located above the wellhead or may be located farther away or “walked away” using a boat. The final scope of such a survey and specific geophysical tools to be used is still under review.

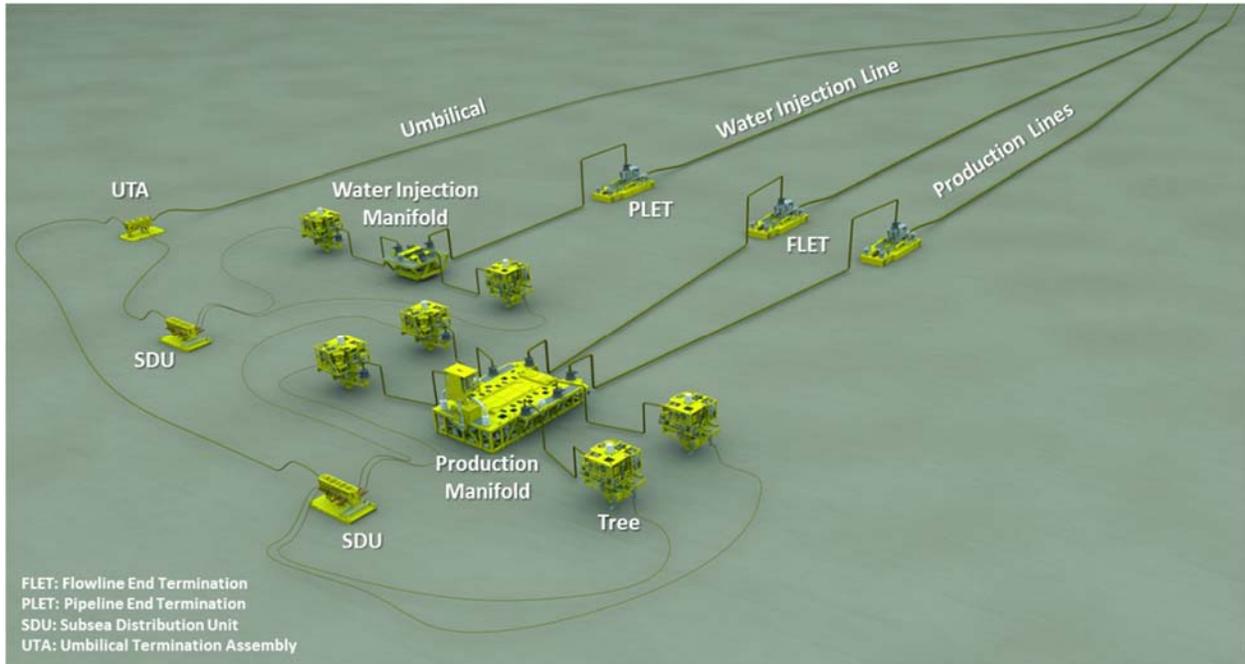
4.6. SUBSEA UMBILICALS, RISERS, AND FLOWLINES

The SURF facilities for the Project will include subsea production, gas re-injection, and water injection wells clustered around subsea manifolds. The development wells will be drilled from two subsea drill centers. This approach of clustering the wells around drill centers reduces the required number of manifolds, flowlines, and umbilicals⁸, as well as the size of equipment and marine vessels needed for installation. The risers and umbilicals will connect the infrastructure on the seafloor to the FPSO. The manifolds will connect the individual development wells to the rest of the subsea system. The subsea system will be monitored and controlled from the FPSO using a control system connected to the FPSO through an umbilical that also supplies power, hydraulic fluid, and chemicals to the subsea manifolds and wellhead trees⁹. The hydraulic fluid for operating the subsea control system will be a low-toxicity, water-soluble hydraulic fluid. The

⁸ A cable and/or hose that provides the electrical, hydraulic, chemical, and communications connections needed to provide power and control between the FPSO and subsea equipment

⁹ Assembly of valves, spools, pressure gauges, and chokes fitted to the wellhead of a completed well to control production

SURF system will be designed to withstand the full shut-in pressure from the production wells, and the gas/water injection components will be designed to withstand the highest required injection pressures. Overpressure protection will be provided on the FPSO, in accordance with industry standards, to protect the subsea systems. Figure 4-9 shows an illustration of a representative SURF system similar to what is currently being designed for the Project.



Note: Schematic is not necessarily representative of number of drill centers or wells.

Figure 4-9: Representative SURF System

The production drill centers also will be connected to the FPSO with round-trip piggable production flowlines. A “pig” is a specially designed device that is placed in the flowline at a launcher at one end and pushed by pressure until it reaches the receiving trap or catcher at the other end. Pigging is performed to aid in the maintenance, operations, cleaning, and/or inspection of flowlines. Figure 4-10 shows an example of a pig.

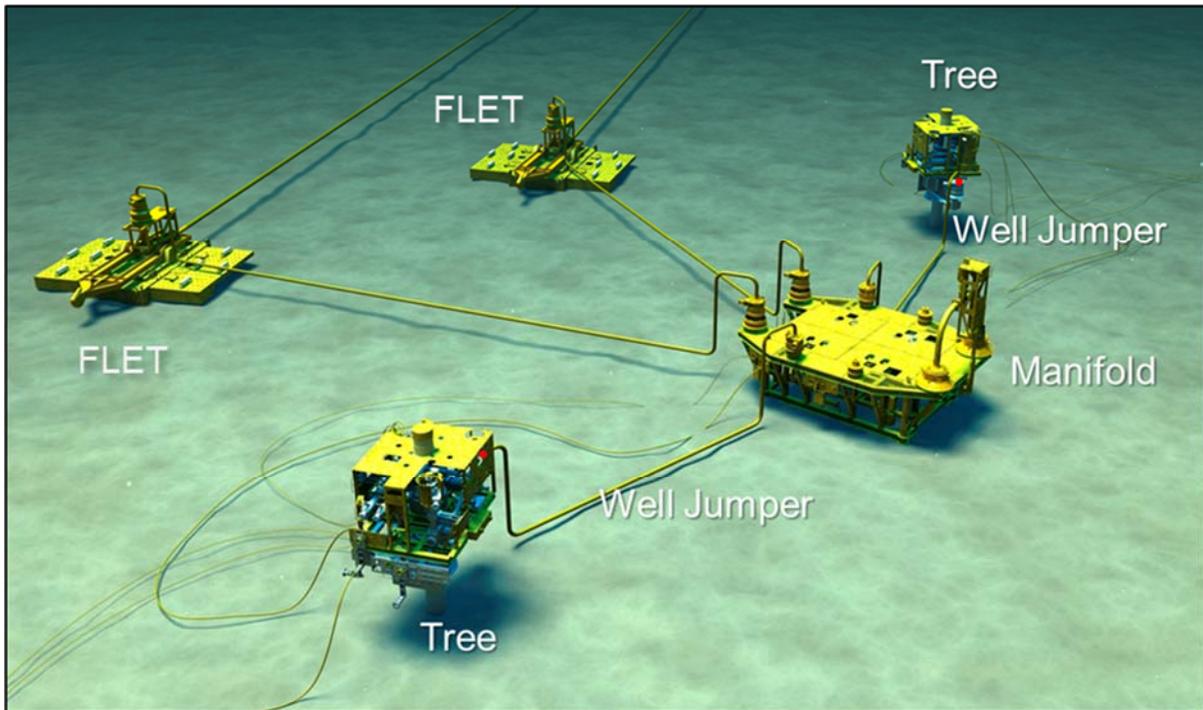


Figure 4-10: Example of Wire Brush Cleaning Pig

4.6.1. Well Flow Connections

Well flow connections between the subsea wells and the FPSO include several components. Each subsea development well is capped by a wellhead tree, which includes a choke valve to control production or water/gas injection. For a given set of wells tied to the same manifold, each wellhead tree is connected by jumpers to the well manifold, which is connected by a flowline jumper to a flowline end termination (FLET) located at the drill center end of the flowline.

A typical configuration of subsea wells, flowlines, and manifolds at a drill center is shown on Figure 4-11.

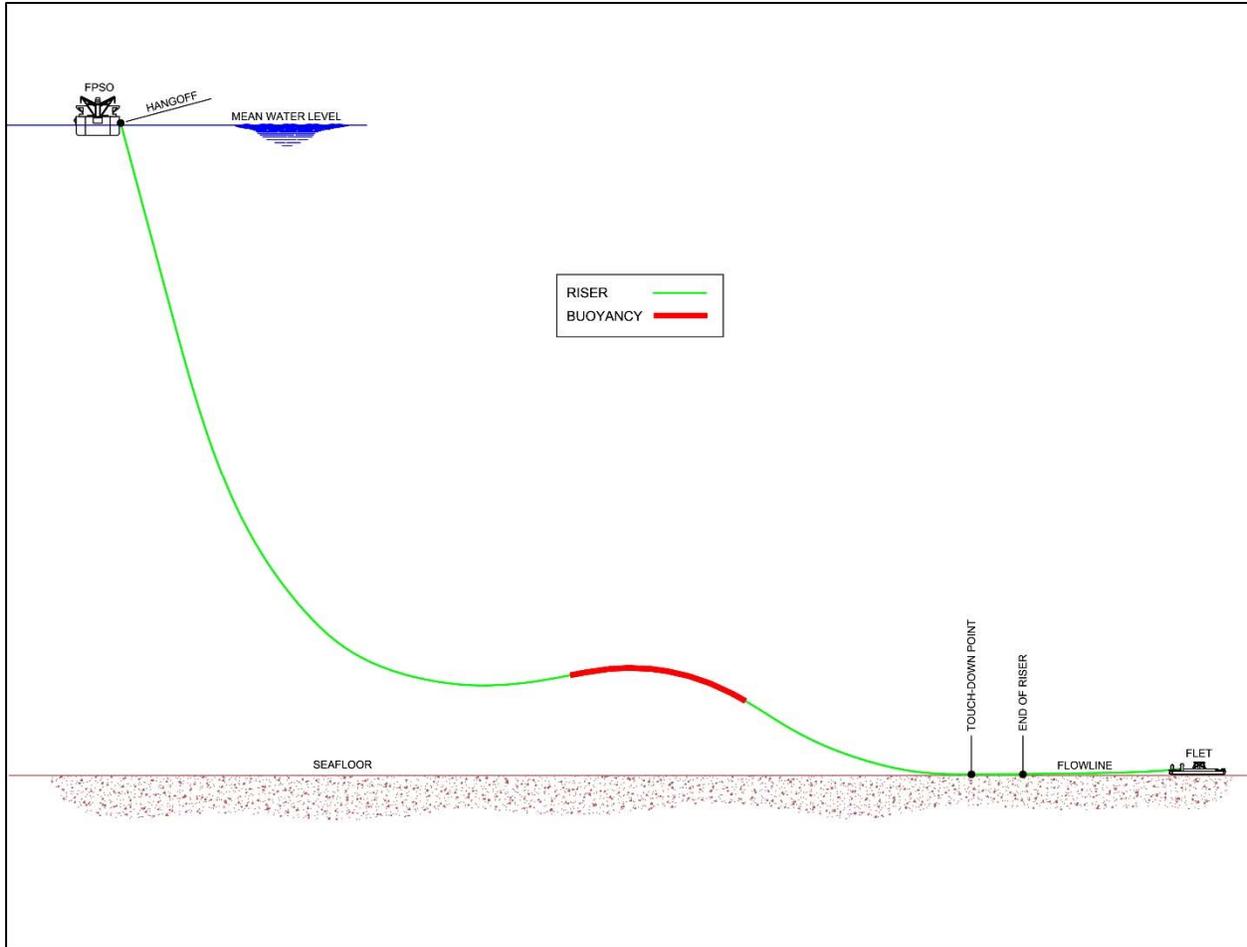


FLET = flowline end termination

Figure 4-11: Typical Subsea Wellhead Tree, Jumper, and Manifold

From the drill center, the rigid flowline travels on the seabed to the vicinity of the FPSO. At the FPSO end of the flowline, the flowline transitions to a riser, which carries the fluids between the seafloor and the FPSO at the surface.

The risers transition from the seabed to the FPSO in a “lazy wave” configuration as shown on Figure 4-12.



FLET = flowline end termination

Figure 4-12: Representative Steel Catenary Riser

4.6.2. FPSO Subsea System Control

The FPSO will provide power, utilities, cabling, and tubing/piping tie-ins to equipment installed on its topsides to control the subsea equipment (see Figure 4-13). The FPSO will be configured with backup power so operations can continue in the event primary power is lost.

The subsea wells and manifolds will be monitored and controlled from the FPSO. Each tree will have a subsea control module mounted on it that controls and monitors the tree functions (e.g., choke-valve position) and associated manifold functions. Subsea controls will accommodate typical monitoring requirements such as pressure and temperature measurement.

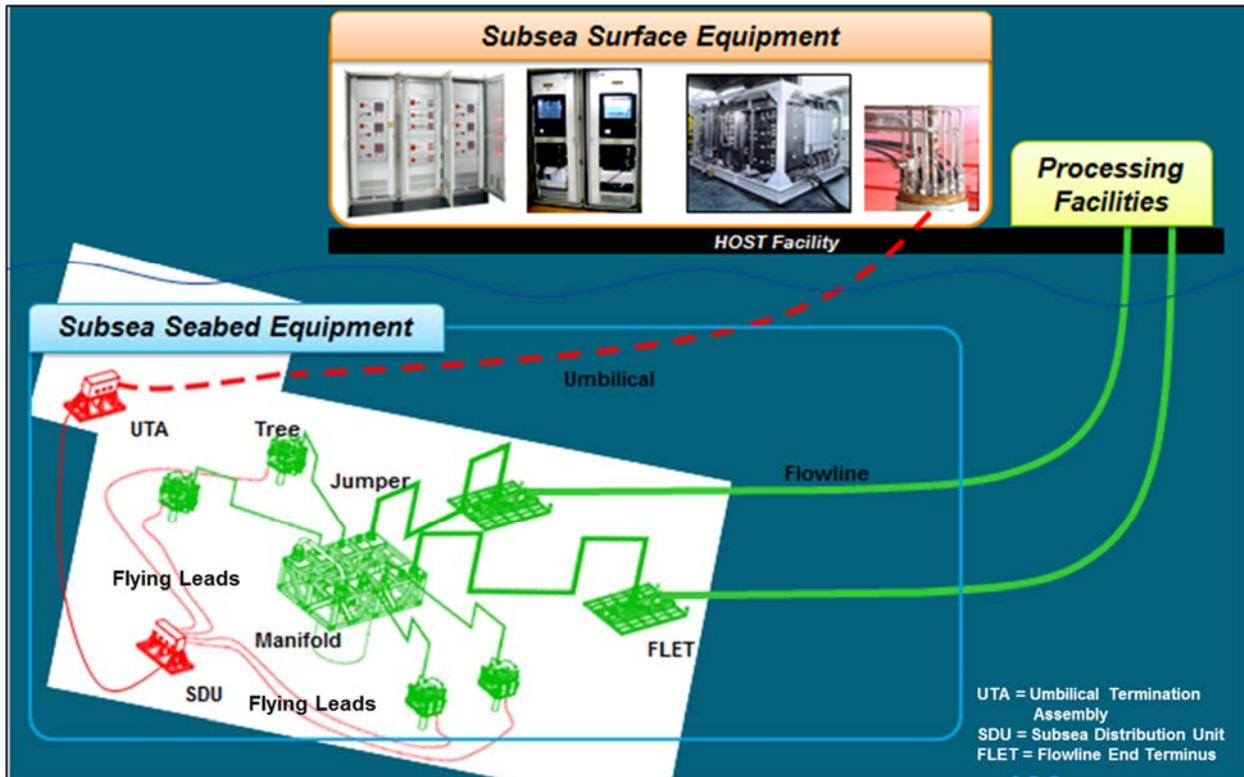


Figure 4-13: Representative Subsea Control System

The control systems at each drill center will be supplied from the Process Control System (PCS) on the FPSO by an umbilical. The umbilical will supply control fluid to operate all hydraulically operated valves, provide chemicals as required to ensure flow to the FPSO, and provide low-voltage power and communication to operate and monitor the SURF facilities. The umbilical will terminate in a Subsea Distribution Unit (SDU). Hydraulic and electrical leads (“flying leads”) will be used to connect the SDU to the well-mounted subsea control modules and may be installed together to reduce congestion on the seabed.

4.6.3. Risers, Flowlines, Umbilicals, and Manifolds

4.6.3.1. Risers and Flowlines

The Project will incorporate production; water injection and gas injection flowlines; and risers, as shown on Figure 4-5. Flowline and umbilical lengths will range from 4 to 13.5 kilometers (approximately 2.5 to 8.4 miles), excluding risers, in water depths of approximately 1,600 to 1,900 meters. The current design lengths are based on preliminary shallow hazard surveys and current field layout, and may be adjusted slightly during detailed design.

4.6.3.2. *Umbilicals*

Umbilicals will be designed as an integrated bundle of tubes and cables to serve multiple functions (see Figure 4-14). Two dynamic umbilicals, each of which will be connected to the FPSO and terminate subsea at a single manifold for one of the drill centers (DC3 and DC4), will service the entire Phase 2 production operation. The remaining drill center components, composed of the subsea trees, manifolds, flying leads, and jumpers, will be connected via in-field umbilicals.

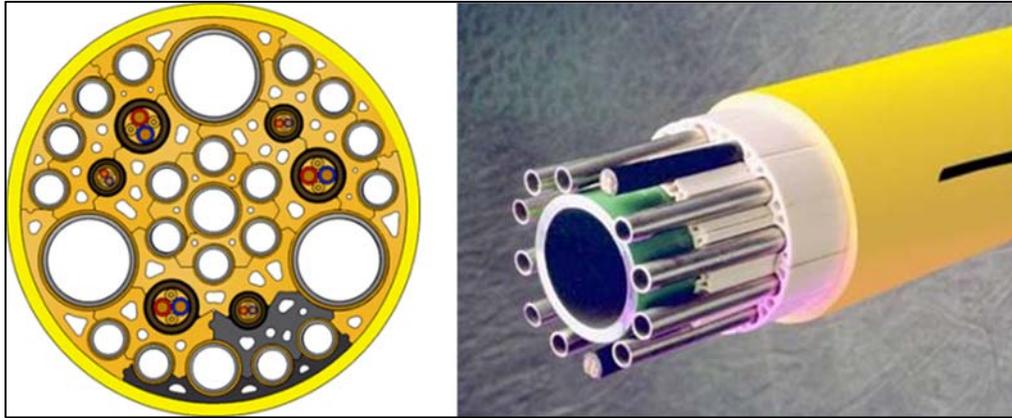


Figure 4-14: Representative Integrated Dynamic Umbilical with Cross Section

4.6.3.3. *Manifolds*

Manifolds are gathering points or central connections made up of valves, hubs, piping, sensors, and control modules. Manifolds (see Figure 4-15) include a protective structural framework that rests on a foundation on the seabed where multiple trees, jumpers, and flowlines gather to consolidate flows before they either are transported to the surface as part of production or back downhole as part of injection into the reservoir.



Figure 4-15: Representative Subsea Manifold

4.6.3.4. Gas Lift System

The FPSO riser support system will be designed for gas-lift capability. The gas-lift system is not required for initial startup and may be installed at some future time during the Phase 2 service life based on the production characteristics of the Liza field. This system will include a riser and flowline to DC3 and DC4 with connections to the production flowline’s FLETs.

4.7. FLOATING PRODUCTION, STORAGE, AND OFFLOADING VESSEL

4.7.1. General Description

The FPSO to be utilized for the Project will utilize a spread-moored configuration to maintain station continuously for at least 20 years. The FPSO will be designed to receive the full production wellstream from the development wells and will process crude oil at a design rate of 220,000 barrels of oil per day (BOPD), with potential to safely operate at sustained peaks of up to 250,000 BOPD. For the purposes of the EIA, potential impacts generated by the Project will be based on a conservative production rate of 300,000 BOPD. The FPSO will be capable of storing a minimum of 2 million barrels of stabilized crude oil. The FPSO will be able to offload approximately 1 million barrels to a tanker in a period of approximately 28 hours.

The FPSO will also have the capability to process, dehydrate, compress, and re-inject the gas produced from the reservoir. The FPSO will be configured to treat seawater used for facility cooling purposes for discharge and injection into the reservoir and to process produced water for discharge overboard. Living quarters and associated utilities will be provided to support the operations on the FPSO. The FPSO topsides equipment and design will have a design life of at least 20 years.

Table 4-2 provides an estimate of the design rates for the FPSO facility.

Table 4-2: FPSO Key Design Rates

Service	Design rate ^{a,b}
Oil production	220,000 BOPD
Produced water	200,000 BPD
Total liquids	300,000 BPD
Produced gas	400 mscfd
Gas injection	370 mscfd (assumes 30 mscfd of produced gas will be used as fuel gas for the FPSO)
Water injection	250,000 BPD

BPD = barrels per day; mscfd = million standard cubic feet per day

^a All design rates are presented as the peak annual average.

^b The facilities will have the potential to safely operate at sustained peaks of oil production up to approximately 250,000 BOPD. For the purposes of the EIA, 300,000 BOPD will be used as the basis to assess potential impacts from the Project.

Key FPSO design features include the following:

- The FPSO will be designed to remain moored for at least 20 years without dry-docking, and will include facilities to support in-water hull/structural surveys and repair and maintenance.
- The FPSO will be designed to operate in extreme (100-year return period) environmental conditions (associated wind, waves, and current).
- The FPSO will be designed to re-inject produced gas back into the reservoir except during times of injection system unavailability, which will require temporary, non-routine flaring during maintenance/repair.

A computer-simulated picture of a typical FPSO is provided on Figure 4-16.



Figure 4-16: Computer Simulated Picture of a Typical FPSO (Offloading Tanker in Background)

4.7.2. FPSO Topsides

The FPSO's topsides design utilizes an interconnected module concept where process equipment is packaged in modules. The design concept maximizes pre-commissioning and functional testing of the modules prior to arrival offshore Guyana. The FPSO will arrive for installation, hook-up, and commissioning in the Stabroek Block fully fabricated, and preassembled.

The following are the principal functions of the topsides process facilities:

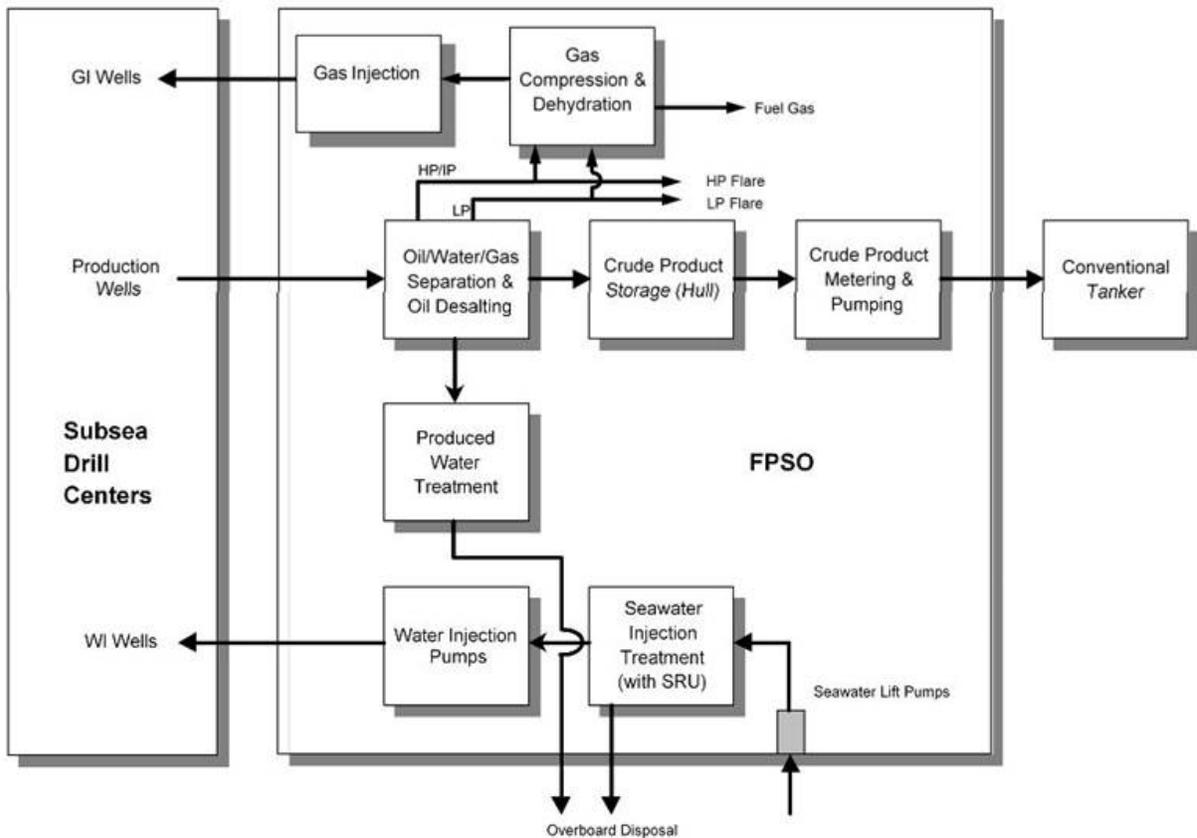
- To receive, separate, and process the produced reservoir fluids to provide:
 - Crude oil for offloading onto conventional tankers;
 - Produced water of sufficient quality for environmentally-acceptable discharge to the sea; and
 - Produced gas that meets fuel gas requirements for FPSO power and for re-injection into the reservoir;
- To treat seawater to provide a suitable supply of water for injection into the reservoir; and
- To provide support systems for the safe accommodation of approximately 80 to 120 personnel involved in the operation of the production facilities and, on occasion, personnel involved with the drilling program.

Temporary accommodations may also be utilized during key activities including hook-up, commissioning and maintenance operations to increase accommodations capacity to 160 to 180 personnel.

Additional information regarding accommodations on the FPSO will be provided in the EIA, to the extent this information is defined as of the date of the EIA's completion.

4.7.3. FPSO Process Systems

The process facilities on the FPSO topsides are shown schematically on Figure 4-17 and are described in the following sections.



GI = gas [re]injection; HP = high pressure; IP = intermediate pressure; LP = low pressure; SRU = Sulfate Removal Unit;
 WI = water injection

Figure 4-17: FPSO Topsides Process Flow Diagram

4.7.3.1. Oil/Water/Gas Separation and Oil Desalting

An inlet manifold is required to receive full wellstream-produced fluids from the reservoir (consisting of oil, gas, and water) via the production flowlines, and to route the fluids to the FPSO processing facilities. The full wellstream-produced fluids will be separated into oil, water, and gas phases. Fresh water will then be added to the stabilized crude oil to remove dissolved salts as part of what is known as “oil desalting.” The final crude oil from the separation/stabilization process will be treated to meet the specifications for sale prior to being sent to the crude oil storage tanks in the FPSO hull. Further processing of the water and gas streams from the separation process and the process for treating seawater for injection are described below.

4.7.3.2. Gas Processing

The purpose of the FPSO gas-processing system is to condition the associated produced gas (that which is not consumed as FPSO fuel gas) to the appropriate specification prior to re-injection into the reservoir. The gas processing system consists of the following subsystems:

- **Flash Gas Compression:** recovers and compresses flash gas from the intermediate-pressure and low-pressure (LP) separators to mix with the gas from the high-pressure (HP) separator.
- **Main Gas Compressor:** compresses gas from the HP separator and the flash gas compressor to an inter-stage pressure where it can be used as fuel gas, with the remaining gas compressed up to an appropriate pressure for gas lift (when required).
- **Gas Dehydration:** removes water vapor from gas to prevent hydrate formation in the gas lift and gas injection systems where HP gas will cool to seabed temperatures.
- **Fuel Gas:** provides fuel gas to all electrical power generation gas turbines, direct-drive gas turbines, and all other LP gas users (marine boilers, pressure control of vessels, etc.).
- **Injection Gas Compression:** compresses discharge gas from the main gas compressor(s) to an appropriate pressure level where it can be re-injected into the reservoir. The HP re-injection gas is routed to the gas injection riser and then directed to the remote, subsea injection wells.

The Project is planning to re-inject any produced gas (that which is not consumed as fuel gas on the FPSO) back into the reservoir.

During equipment maintenance and process upsets, including startup and shutdown scenarios, part or all of the off-gas from the separation/stabilization process will be sent to the HP or LP Flare Systems. Flaring will be temporary and non-routine.

4.7.3.3. *Produced Water Treatment*

The produced water treatment system will be designed to collect produced water from process facilities and treat the water for discharge overboard. Produced water that does not meet the overboard discharge specification after treatment will be routed to an appropriate tank in the hull and managed as described in Section 4.7.8.1, FPSO Cargo Systems.

4.7.3.4. *Seawater Treatment and Water Injection System*

Seawater will be used for water injection and will be treated prior to injection into the producing reservoirs. Water injection will be used for reservoir pressure maintenance to enhance oil production. Seawater lift pumps on the FPSO will be used to pump seawater from depths up to 100 meters below the surface to access colder seawater than is available from the shallower depths. The filtration system will remove particulate from the incoming seawater. Following filtration, the seawater will be treated to remove dissolved oxygen and sulfate ions. The treated seawater will then be pumped at the pressure necessary for injection into the reservoir.

A portion of the treated seawater will be further treated through a reverse osmosis system to make fresh water. Fresh water is required both for potable water requirements as well as for removal of salt from the crude oil as part of oil desalting, as described in Section 4.7.3.1, Oil/Water/Gas Separation and Oil Desalting.

4.7.4. FPSO Utility Systems

This section discusses the utility system requirements for the FPSO.

4.7.4.1. Process Cooling

Cooling of process streams via a closed-loop, water-based cooling medium system is required to dissipate heat generated by the oil and water treating systems, compression systems, and miscellaneous utility systems.

The seawater lifting system will supply the required seawater for cooling (see Section 4.7.3.4, Seawater Treatment and Water Injection System). Process hydrocarbon fluids will not come into contact with this seawater. After use in the cooling system, seawater will be discharged overboard at a rate and configuration suitable to maintain ocean temperatures at or below permitted levels established to avoid adverse effects to marine life.

4.7.4.2. Process Heating

A process heating system is required as part of the crude oil treatment process to achieve the required crude oil specifications. A closed-loop, water-based heating medium system will be used to add heat to the incoming production stream. Waste heat from the power generation system will be used as the source of heat.

4.7.4.3. Flaring System

EEPGL intends to re-inject produced gas under routine conditions, except that which will be utilized as fuel gas for FPSO operations. A flare system will be provided for the collection and safe disposition of produced hydrocarbon gases resulting from unplanned, non-routine relief and blowdown events. Relief events occur to prevent overpressure scenarios in the process equipment. Blowdown events occur to depressurize the facilities in a controlled manner as a result of emergency shutdown events. In addition, temporary, non-routine flaring will occur during equipment maintenance and process upsets, including start-up. The flare system will include both an HP and LP flare sharing a common flare tower. The flare tower has elevated flare tips for both HP and LP flares, which provides for the safe ignition of hydrocarbon gases. Both flares will support high-efficiency combustion and will utilize pilots that have minimal emissions.

4.7.4.4. Topsides and Subsea Chemical Injection

The FPSO will have storage and injection facilities to inject the required amounts of chemicals and methanol into the production fluids to support production operations, both for subsea chemical injection requirements and for topsides chemical injection requirements.

Topsides chemicals may include corrosion inhibitors, scale inhibitors, asphaltene inhibitors, emulsion breakers, anti-foam agents, demulsifiers, oxygen scavengers, biocides, water-treatment chemicals, and hydrogen sulfide scavengers. Subsea chemicals may include methanol, scale inhibitor, corrosion inhibitor, asphaltene inhibitor, and xylene. Methanol and xylene will be stored in tanks that are integrated into one of the FPSO hull cargo tanks.

4.7.4.5. Air

An air compression system will be provided to supply hull and topsides equipment. Compressed air is required primarily for the operation of control valves and other process instrumentation requirements.

4.7.4.6. Nitrogen

Instrument air will feed the nitrogen generation system. Nitrogen will be provided as required for purging, inerting, and blanketing, and as required for miscellaneous utilities.

4.7.4.7. Drains

The topsides will be equipped with the following drain systems:

- Non-hydrocarbon open drain: used to collect drain fluids (e.g., rainwater) from non-hydrocarbon areas and to route them to the slop tank in the FPSO hull or directly overboard;
- Hydrocarbon open drain: used to collect drain fluids (e.g., oil-contaminated water) from hydrocarbon areas and to route them to the slop tank in the FPSO hull; and
- Closed drain system: used to collect drain fluids from produced water systems and to route them back into the process.

4.7.4.8. Other

A minimum of two deck cranes will be provided for supply boat offloading and materials handling and to support general maintenance activities. Workshops, a laboratory capable of checking the properties of the produced and injection fluids as well as select discharges for compliance, a medical facility, and a storage facility for supplies and spare parts will also be provided. Heating, ventilation, and air conditioning (HVAC) systems will be provided for buildings and enclosures.

4.7.5. Power Generation System

The required power for the FPSO will be generated by three systems:

- The main power generation system will be gas turbine-driven generator sets with spares available in the case of unplanned downtime. All generator sets will be dual-fuel (diesel, produced gas).
- The essential services power generation system will be a diesel-driven generator set. Essential services include systems required for facility restart and for flow assurance hydrate mitigation activities after an unplanned shutdown.
- The vessel emergency power generator set will be diesel-driven and will provide power to both the hull and topsides emergency systems (e.g., safety systems including emergency lighting, telecommunication, etc.).

Additionally, for backup power during emergency situations, an uninterruptible power-supply system will be provided to power equipment such as the Integrated Control and Safety System (ICSS), subsea controls, etc.

4.7.6. Integrated Control and Safety System

Monitoring and control of the FPSO production operations will be performed by an ICSS. Located in the main control room of the FPSO, the ICSS will include process shutdown, emergency shutdown, and fire and gas systems to protect the facilities and personnel. These systems will interface with a public address and general alarm system to provide distinct audible and visual alarm notification. The ICSS includes the following subsystems:

- PCS: the PCS will perform primary process control, monitoring, and data acquisition functions.
- Safety Instrumented System (SIS): the SIS will implement functions for abandoning the host facility, emergency shutdown, fire and gas detection, and process shutdown. Also included in the SIS will be a shutdown function for the subsea control/safety system. The SIS will provide detection, logic sequencing, and actuation of devices to place the facility in a safe state.
- Fire and Gas System.
- Alarm Management System.
- Operator graphics/consoles.
- Third-party interfaces to packaged systems (such as compressors, subsea, marine, etc.).

4.7.7. Communication Systems

Telecommunications equipment will be installed on the FPSO to enable safe operation of the facilities in normal and emergency conditions. This equipment will allow communication with the shorebase, support vessels, helicopters, and tankers, as well as communication within the FPSO.

4.7.8. Additional Vessel Systems

4.7.8.1. FPSO Cargo Systems

The main purpose of the FPSO cargo system will be as follows:

- To receive, distribute, and store on-specification crude oil from the process facilities into designated FPSO cargo tanks;
- To receive and store off-specification crude oil from the process facilities into a designated FPSO cargo tank; and
- To offload the crude oil stored in the FPSO cargo tanks into a conventional tanker at regular intervals.

In addition to the FPSO cargo tanks, there will be a slop tank to receive stripping water from the cargo tanks and discharge from the topsides nonhazardous and hazardous drain system. The oil and water in the slop tank will be gravity-separated by a minimum residence and retention time. Once separated, the oil will be skimmed off the top and sent to the cargo tanks and the water will be discharged overboard to discharge specifications.

The FPSO cargo tanks will be blanketed with inert gas. A tank vent system will be provided to release vapor and inert gas from the cargo tanks to a safe location, toward the bow of the FPSO, to prevent an overpressure event in the tanks.

The marine cargo system supports the following routine activities:

- Flushing of the crude oil offloading export hose;
- Emergency and temporary ballasting of FPSO cargo tanks with seawater; and
- Inspection and maintenance of FPSO cargo tanks and piping systems between offloading operations.

4.7.8.2. Crude Oil Offloading

Export of the crude oil from the FPSO will be via a floating hose connected to the manifold of a conventional tanker. The FPSO will be configured for tandem offloading to a conventional tanker. The separation distance between the stern of the FPSO and the conventional tanker will be approximately 120 meters (390 feet). The maximum conventional tanker classification envisioned is a Very Large Crude Carrier (VLCC) class. During offloading operations, the conventional tanker will maneuver and hold station relative to the FPSO with the assistance of up to three assistance tugs, as shown on Figure 4-18. Crude oil will be transported to the buyers' final location(s) by the conventional tankers after each offloading operation.



Figure 4-18: General Offloading Configuration

4.7.8.3. Ballast System

Ballast water will be required during the FPSO transit from the shipyard to offshore Guyana. Once on site, the un-needed ballast water from the FPSO may be discharged overboard.

4.7.9. Spread Mooring System

The FPSO will be permanently moored by fixed, spread mooring with an up to 20-point mooring line system, with each line connected to its respective anchor pile embedded into the seafloor. The anchor piles will be either suction piles or driven piles. The mooring system will be designed to maintain the FPSO on station for a 100-year environmental condition.

4.7.10. Safety and Personnel Protection Systems

Safety systems will include the following:

- Firewater System—The firewater system will have pumps located at the fore and aft ends of the FPSO.
- Fire and Gas Detection Systems—Fire and smoke detectors will be located throughout the topsides and living quarters and will be wired centrally with alarms sounding in the central control room, which will activate the general alarm system on the FPSO. Gas detectors will be placed in areas where gas might be released or could accumulate.
- Blanket Gas Generation—To prevent fires, the cargo tanks will be operated with an inert gas blanket at all times except during tank entry. The inert gas for cargo tanks will be supplied by an inert gas system. To provide gas blanketing for other spaces, including the methanol and xylene tanks, inert gas will be provided by routing compressed air through the nitrogen membrane package.

- Lifeboats and Life Rafts—The FPSO will be provided with lifeboats on either side of the accommodation, having a capacity on each side for 100 percent of the personnel on board. A fast rescue boat will also be provided, complete with a davit launching and retrieving system.

4.8. INSTALLATION, HOOKUP, AND COMMISSIONING

Final design of the installation, hook-up, and commissioning activities for the SURF, FPSO, and associated moorings has not been completed; however, key installation, hook-up, and commissioning activities will include the following:

- FPSO Mooring Installation—Installation of the FPSO’s anchor piles and mooring lines. Following installation, the mooring lines will be staged on the seafloor until arrival of the FPSO.
- Flowline/Riser Installation—Installation of the production, water injection, and gas re-injection flowlines and risers. These components will be cleaned and tested to verify integrity after installation. Some components may be staged on the seafloor until arrival of the FPSO; others may be brought in and installed with the FPSO.
- FPSO Positioning and Mooring Connection—Positioning of the FPSO using support tugs, followed by retrieval of the FPSO mooring lines from the seafloor and hook-up of the FPSO to its mooring system.
- Manifold/Drill Center Components—Installation of the manifold foundation piles/mud mats and subsea components at the drill centers and testing to verify integrity after installation.
- Umbilical Installation—Installation of the umbilicals and SDU.
- Riser Connection—Retrieval from the seafloor, pull-in, and connection of the risers to the FPSO.
- Testing and Commissioning—Testing and commissioning of the connected, integrated FPSO and SURF production systems, including testing and dewatering/displacing flowlines and umbilicals with commissioning fluids and testing SURF control and shutdown systems.

The above activities will be executed in an optimal sequence with activities completed in parallel where possible.

During the installation stage, a remotely operated vehicle (ROV) may be periodically utilized underwater to support the above-mentioned activities (e.g., observations, connections, sampling, etc.).

4.9. PRODUCTION OPERATIONS

This section discusses the production operations for the FPSO.

4.9.1. Common Flow Assurance Additives

Some industry-standard chemicals will be required to process the oil on the FPSO. Both the FPSO and SURF facilities will also require the use of industry-standard additives to provide flow assurance and prevent corrosion, scale formation, hydrate formation, and asphaltene formation, as previously noted in Section 4.7.4.4, Topsides and Subsea Chemical Injection. The chemical requirements and estimated quantities will be determined as part of the ongoing FPSO and SURF facilities design work, and will be addressed in the EIA process. Particular attention will be paid to scenarios that could result in flow instabilities, restrictions, or blockages; or which could jeopardize the integrity of the fluid-transfer systems or reduce overall system operability. The objective of the following sections is to provide a general overview of the flow assurance challenges and strategies.

4.9.2. Hydrogen Sulfide Management

The concentration of hydrogen sulfide will be extremely low for the initial stage (i.e., 5 to 10 years) of FPSO/SURF production operations. There may be potential for the reservoir to sour over time, which influences material selection and corrosion inhibition for certain FPSO, SURF, and drilling systems. In the unlikely event that concentrations of hydrogen sulfide increase to a level that could represent potential health or safety concerns for the Project's offshore workforce, additional management measures will be implemented as appropriate (e.g., training programs, personal protective equipment, response planning, and equipment for leak detection and alarms).

4.9.3. Marine Safety

The Maritime Administration Department (MARAD) of the Ministry of Public Infrastructure is responsible for issuing notices to mariners concerning safety at sea. MARAD will be advised of the location of drill ships during the drilling of the development wells and the performance of well workovers in the PDA so that mariners can be made aware of these activities. As shown on Figure 4-19, marine safety exclusion zones with a 500-meter radius will be established around drill ships during drilling operations and around drill centers during well workovers, as well as around major installation vessels in accordance with industry standards and practices.

Authorizations for in-water activities will be obtained from MARAD and notices to mariners will be issued for all marine vessels, including the FPSO, supply and support vessels, tugs, and those vessels to be utilized during the installation, hook-up, and commissioning stage.

As shown on Figure 4-19, the FPSO will have a 2-nautical mile radius marine safety exclusion zone centered on the FPSO during offloading activities, where marine support and tanker offloading will occur. No unauthorized vessels will be allowed to enter this approximately 4,000-hectare operational marine safety exclusion zone during offloading activities.

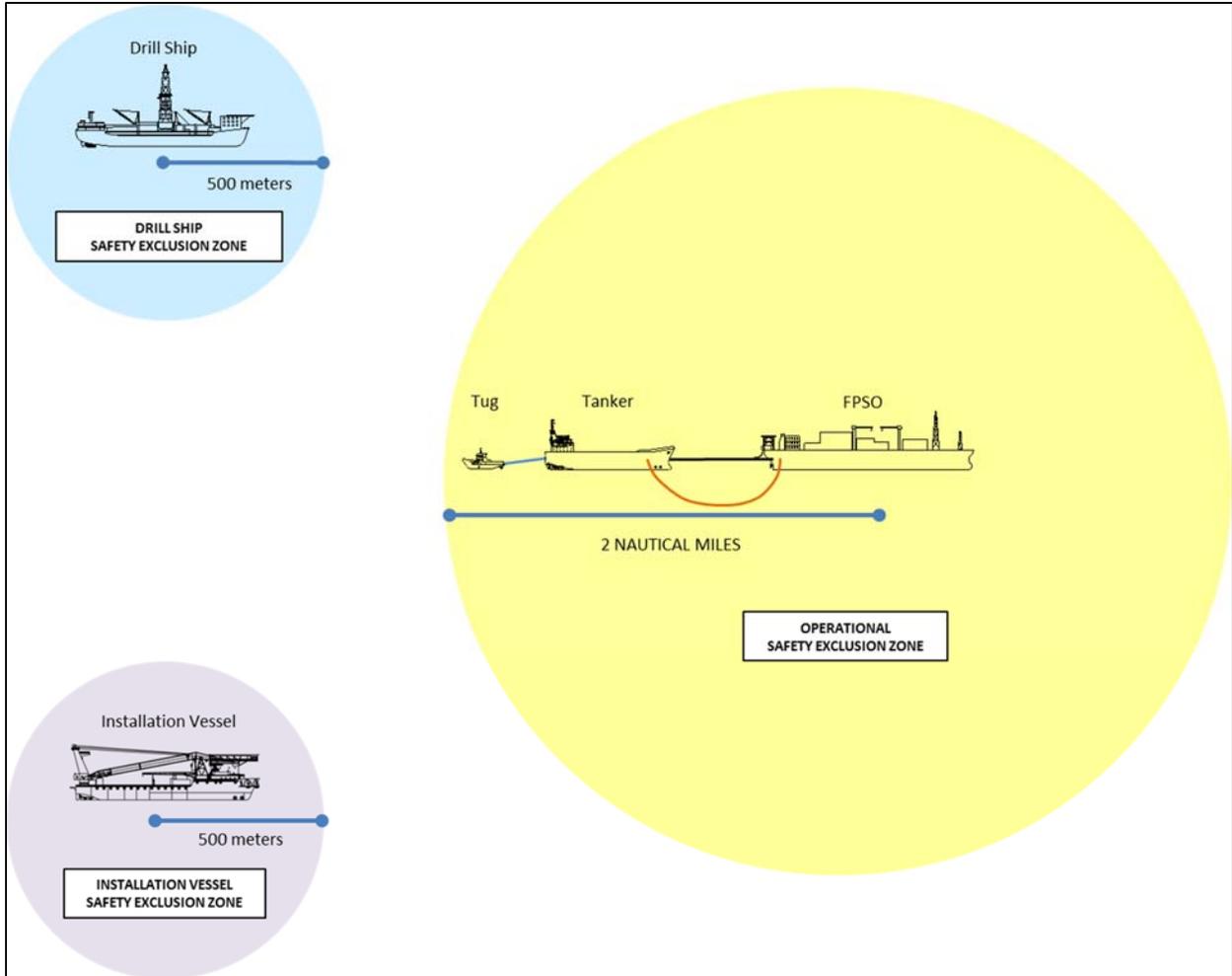


Figure 4-19: Preliminary Marine Safety Exclusion Zones

4.9.4. Offloading Tankers

Conventional tankers supporting offloading operations will typically arrive anywhere from one day to several hours ahead of the scheduled loading time, as a function of weather and ocean conditions. To accommodate these vessels, an anchorage area will be established several kilometers away from the FPSO. When the tanker is ready to approach, a Mooring Master will board the conventional tanker approximately 2 kilometers from the FPSO to guide the conventional tanker to the FPSO and to support the offloading operation. The conventional tankers will export the crude oil for sale after offloading operations have been completed. Conventional tankers will be owned/operated by others and will not be dedicated to the Project.

4.9.5. Onshore Supply and Support Activities

Shorebases, laydown areas, pipe yards, warehouses, fuel supply, heliport, and waste management facilities are planned to support development drilling, FPSO/SURF installation, production operations, and ultimately, decommissioning. EEPGL plans to use the existing Guyana shorebase(s) on the east side of the Demerara River as the primary shorebase(s) supporting the Project. Additional onshore facilities may be utilized by other companies. All onshore support facilities will be owned/operated by others and will not be dedicated to the Project.

Accordingly, the EIA will be conducted on the basis that the Project will primarily utilize the existing Guyana shorebase(s) located in Georgetown. Should any new or expanded shorebase(s) or onshore support facilities be utilized, the construction/expansion and any required dredging of such facilities, as well as the associated environmental authorization, would be the responsibility of the owner/operator and such work scope would not be included in the scope of the EIA for Phase 2.

A typical shorebase quay is shown on Figure 4-20, and a typical laydown yard is shown on Figure 4-21. Additional logistical support may be provided by other regional suppliers outside of Guyana, as informed by inputs from EEPGL contractors after contract award, to address Project needs (e.g., deepwater port access in Trinidad).



Figure 4-20: Typical Shorebase Quay



Figure 4-21: Typical Laydown Yard

Onshore facilities to be utilized will include pier/port/quayside space with sufficient draft for receipt of cargo vessels bringing materials to and from the shorebase; marine support vessels will be used to service the offshore activities and operations. A marine berth and secure warehousing space for indoor and outdoor storage of materials and goods, trucking, stevedoring, freight forwarding, customs logistics, receiving, inspection, and associated container handling and storage operations will also be utilized.

Daily activities and operations to be performed at the shorebase(s) will generally include the following:

- Storage of pipe, equipment, and spares;
- Loading and unloading cargo from trucks and marine vessels;
- Use of cranes and other lifting equipment;
- Bulk storage of chemicals, fuels, and industrial consumables;

- Operation of a cement and drilling fluids and mud plant to support offshore drilling operations; and
- Secure handling, storage, and treatment of wastes pending final recycling, treatment, or disposal.

Most of the major SURF equipment will be preassembled, pretested, and shipped directly to the Phase 2 PDA from their points of origin. Other minor equipment, supplies, and materials may be temporarily staged at shorebase(s), laydown yards, and warehouses until transferred offshore for installation or use. The owners/operators of these contracted facilities will be required to seek environmental authorization for any changes to current operations (e.g., bulk storage of chemicals and fuels).

Support and supply vessels will require sufficient water depths to transit between the Liza field and the shorebase(s). There is potential for some initial and periodic maintenance dredging to be performed by the shorebase(s) owner/operator. Any such dredging would be subject to receipt of environmental authorization by the shorebase(s) owner/operator.

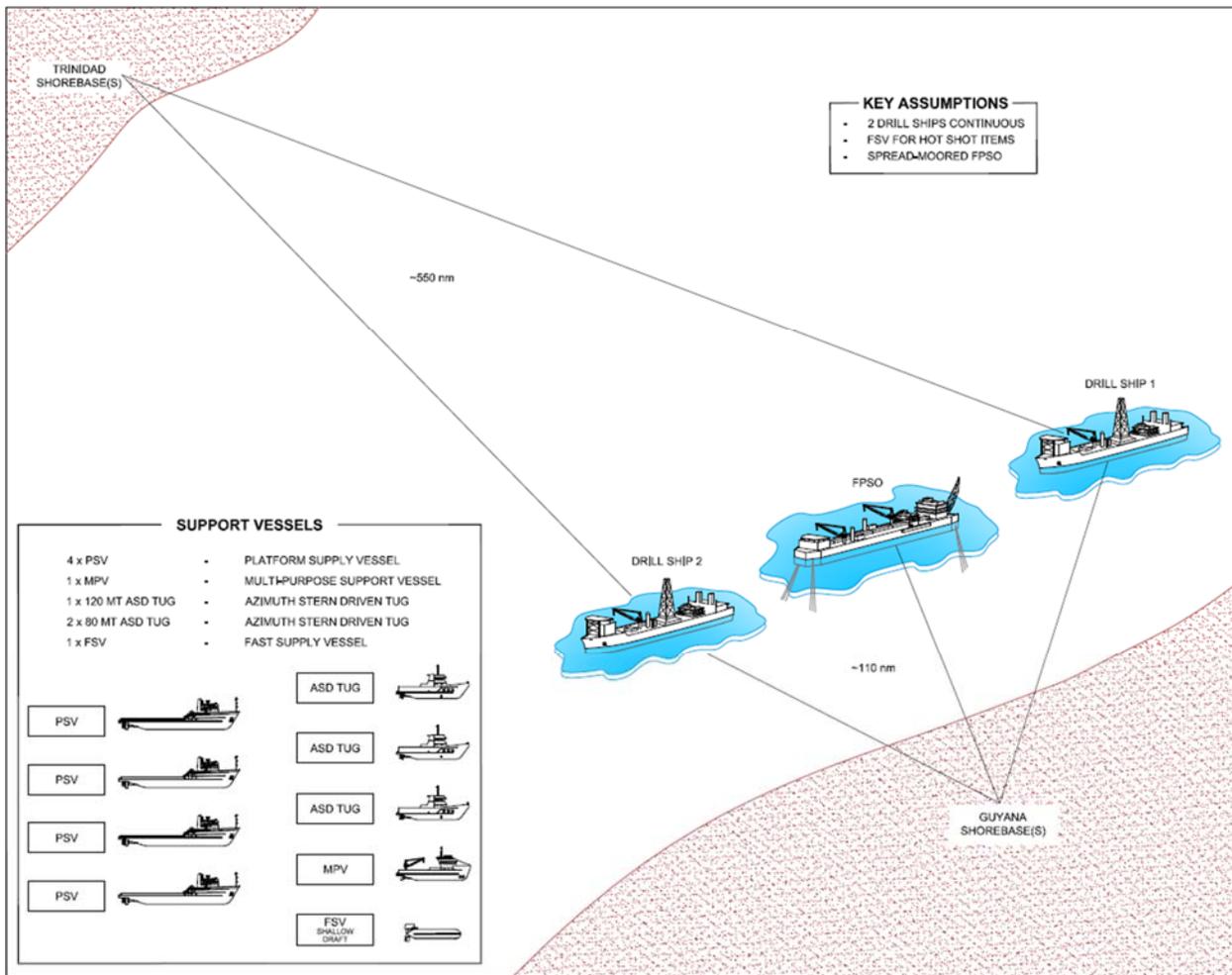
4.9.6. Logistical Support

Logistical support will be optimized and shared between Liza Phase 1 and Phase 2. Typically, up to 10 round-trip helicopter flights are currently being made per week to support ongoing exploration drilling activities. It is estimated that during development drilling and FPSO/SURF installation, flights may increase at peak to a total of approximately 30 to 35 round-trip flights per week. During FPSO/SURF production operations, an estimated maximum of 20 to 25 round-trip flights per week will be necessary to support FPSO/SURF production operations and continued development-drilling activities.

There will be a variety of marine and aviation support equipment supporting the FPSO, installation vessels, and drill ship(s), as shown on Figure 4-22. The support vessels will consist of multiple platform supply vessels and a single fast supply vessel conducting resupply trips to the FPSO and drill ships, tug vessels supporting tanker offloading activities, and multi-purpose vessels supporting subsea installation and maintenance activities. Based on current drilling activities and past experience with similar developments, it is estimated that during development drilling and FPSO/SURF installation, an average of approximately 12 round-trips per week may be made to the Phase 2 PDA by marine vessels. During FPSO/SURF production operations, it is estimated that this number will be reduced to approximately seven round-trips per week. The vessels will be loaded and offloaded at shorebase facilities in Guyana and/or Trinidad. Figure 4-23 depicts a conceptual diagram of the number and types of logistical support equipment that will be utilized to support the Project.



Figure 4-22: Typical Logistics Support Vessels



Note: Total number of drill ships and support vessels to be confirmed based on detailed planning

Figure 4-23: Marine Support Vessels

4.9.7. Waste Management

Waste generated offshore will be reduced, recycled, and treated offshore where practicable, with the remainder directed for onshore treatment, recycling, reuse, or disposal. For the exploration-drilling program, EEPGL is currently utilizing a regional supplier that is operating an existing waste management facility in Georgetown (see Figures 4-24 and 4-25). EEPGL is planning to utilize this facility or similar facilities in Guyana or the region during the Project development drilling and FPSO/SURF production operations stages. EEPGL would potentially consider the use of alternative Guyanese or regional waste management services according to Project needs, should they become available in the future. All waste streams will be managed in accordance with the Waste Management Plan that will be part of the Project Environmental and Socioeconomic Management Plan (ESMP).



Figure 4-24: Typical Waste Management Facilities at Shorebase



Figure 4-25: Vertical Infrared Unit with Wet Scrubber and Oxidizer at Typical Waste Management Facilities

4.10. END OF PHASE 2 OPERATIONS (DECOMMISSIONING)

In advance of the completion of the Phase 2 production operations stage, EEPGL will prepare a decommissioning plan for the facility in compliance with the laws and regulations in effect at that time, while also considering the technology available at that time. The decommissioning plan and strategy will be based on a notice of intent for decommissioning the production facilities and plugging and abandonment (P&A) of the development wells, which will be provided to the GGMC and EPA to obtain approval in accordance with the requirements of the Guyana Petroleum (Exploration and Production) Act (1998) and Environmental Protection Act (as amended in 2005).

EEPGL will perform inspections, surveys, and testing to assess current conditions that will provide the basis and required information to prepare a plan for decommissioning. All risers, pipelines, umbilicals, subsea equipment, and topsides equipment will be safely and properly isolated, de-energized, and cleaned to remove hydrocarbons and other hazardous materials to a suitable level prior to being taken out of service.

Near the time of decommissioning, EEPGL will select, in consultation with the EPA, the final decommissioning strategy based on a comparative assessment designed to evaluate the potential safety, environmental, technical, and economic impacts, and associated mitigation measures to finalize the decommissioning plan.

Wells will be permanently plugged and abandoned by restoring suitable cap rock to prevent escape of hydrocarbons to the environment. P&A barriers will be installed in the wellbore, and will be of adequate length to contain reservoir fluids and deep enough to resist being bypassed by fracturing. The number of barriers required will depend on the distribution of hydrocarbon-bearing permeable zones within the wellbore.

It is expected that the risers, pipelines, umbilicals, subsea equipment, FPSO mooring lines, and anchor piles will be disconnected and abandoned in place on the seafloor, unless an alternative strategy is selected based on the results of the comparative assessments.

The FPSO will be disconnected from its mooring system, removed from the production location, and towed to a new location for re-use or decommissioning.

Selected waste streams associated with decommissioning activities, including hazardous and nonhazardous wastes, will be managed and disposed in accordance with standard industry practice and applicable regulations. Methods may include injection downhole into the reservoir, separation and incineration offshore, or transport to onshore waste management facilities for treatment and/or disposal in accordance with standard industry practice and applicable regulations.

5. ADMINISTRATIVE FRAMEWORK

The Project will be regulated under several Guyanese statutes. These statutes contain requirements that must be implemented to ensure compliance with the applicable laws and regulations of Guyana. The EIA will include a summary of the relevant national legislation, regulations, policies, treaty obligations, and environmental, socioeconomic, and health standards in Guyana that would apply to the Project.

This section reviews the relevant laws and regulations in Guyana that are applicable to the Project and is separated into five subsections:

- Section 5.1, National Legal Framework, describes the laws and regulations that apply to environmental issues in a general context, such as the Constitution of Guyana, as well as specific national laws that focus specifically on environmental issues such as the Environmental Protection Act as amended in 2005. This subsection also identifies several resource-specific environmental laws that are more narrowly focused and have either direct or indirect relevance to the Project.
- Section 5.2, Environmental Permits and Licenses, describes the major environmental-related permits and licenses EEPGL will be required to obtain as part of the Project implementation.
- Section 5.3, National Policy Framework, describes the Government of Guyana's strategies and policies that apply to the Project. These strategies and policies articulate the government's management goals with respect to various environmental issues.

- Section 5.4, International Conventions and Protocols, describes the international and regional conventions and protocols to which Guyana is a signatory and which are relevant to the Project.
- Section 5.5, EEPGL's Operations Integrity Management System, describes EEPGL's framework for addressing risks inherent in its business that can potentially have an impact on personnel and process safety, security, health, and environmental performance.

5.1. NATIONAL LEGAL FRAMEWORK

This section provides an overview of the key legislation currently in force in Guyana that pertains to resources that could be affected by the Project.

5.1.1. National Constitution of Guyana

Guyana is governed according to the Constitution of the Co-operative Republic of Guyana, as amended (the Constitution). The Constitution took effect in 1980 and expressly provides for protection of the environment. Article 25 establishes "improvement of the environment" as a general duty of the citizenry. In addition, Article 36 reads as follows:

In the interests of the present and future generations, the State will protect and make rational use of its land, mineral and water resources, as well as its fauna and flora, and will take all appropriate measures to conserve and improve the environment.

5.1.2. The Environmental Protection Act

In 1996, the Environmental Protection Act (hereinafter referred to as the Act) was enacted to implement the environmental provisions of the Constitution. The Act is Guyana's single most significant piece of environmental legislation because it articulates national policy on important environmental topics such as pollution control, the requirements for environmental review of projects that could potentially impact the environment, and the penalties for environmental infractions. It also provides for the establishment of an environmental trust fund. Most importantly, the Act authorized the formation of the EPA, and establishes the EPA as the lead agency on environmental matters in Guyana. The Act further mandates the EPA to oversee the effective management, conservation, protection, and improvement of the environment (EPA 2012). It also requires the EPA to take the necessary measures to ensure the prevention and control of pollution, assessment of the impact of economic development on the environment, and sustainable use of natural resources.

5.1.3. The Guyana Geology and Mines Commission Act

The Guyana Geology and Mines Commission Act was enacted in 1979 and authorized the government to establish the GGMC, which is also within the Ministry of Natural Resources. The GGMC promotes and regulates the exploration and development of the country's mineral resources. The GGMC has a dedicated Petroleum Unit charged specifically with regulatory supervision of the oil and gas sector; however, regulation of petroleum-related activities also

occurs in other divisions, such as the Geological Services Division and the Environment Division.

5.1.4. The Petroleum Act

The Petroleum (Exploration and Production) Act was enacted in 1986 to regulate the prospecting for and production of petroleum in Guyana, including the territorial sea, continental shelf, and exclusive economic zone. This act and the regulations promulgated thereunder identify persons allowed to hold prospecting licenses, establish the process for obtaining prospecting licenses, and specify requirements for further resource development in the event petroleum resources are discovered.

In 2012, the Commonwealth Secretariat was commissioned by the Ministry of Natural Resources and Environment (now the Ministry of Natural Resources) to prepare recommendations to reform Guyana’s regulatory regime that governs the upstream petroleum sector. In September 2015, the Minister of Governance (via the GGMC’s Petroleum Unit) announced plans to upgrade the country’s upstream Oil and Gas Policy which was originally crafted in 2012 and finalized in 2014. In June 2016, the Ministry of Natural Resources completed a new National Oil and Gas Policy that is still in draft.

Several Guyanese environmental laws with more narrowly defined scopes pertain to specific biological or physical natural resources. Other laws, which primarily have a public health-related focus, are also relevant to the Project. Several of Guyana’s environmental statutes were enacted prior to the Constitution and were subsequently incorporated into the newly formed national legal framework, but most were enacted after 1980. Table 5-1 identifies these laws and summarizes their relevance to the Project.

Table 5-1: Resource-Specific Environmental and Social Laws with Relevance to the Project

Title	Objective	Relevance to the Project
<i>Biological Resources</i>		
Fisheries Act, 2002	Regulates fishing and related activities in Guyana territorial waters.	Section 33(1) of the Fisheries Act authorizes the prohibition and/or regulation of deposition or discharge of substances harmful to fish.
Wild Birds Protection Act, 1987	Protects listed wild birds in Guyana.	Sections 3 and 6 prohibit knowingly wounding or killing wild birds listed in the First and Second Schedule of the Act and establishes penalties.
Species Protection Regulations, 1999	Provides for the establishment of a Management Authority and a Scientific Authority in compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).	Provides for wildlife protection, conservation, and management.

Title	Objective	Relevance to the Project
Wildlife Management and Conservation Regulations, 2013 (recently supplemented by passing of Wildlife Conservation and Management Bill, 2016)	Provides for the establishment of a Management Authority and the management of the country's flora and fauna.	Provides a supportive mechanism cognizant of the national goals for wildlife protection, conservation, management and sustainable use.
<i>Physical Resources</i>		
Environmental Protection Water Quality Regulations, 2000	Focused on setting effluent standards, reporting requirements, penalties for violations of standards, and permitting requirements for discharges.	Regulates discharges of listed substances, which could include substances used as part of the Project.
Environmental Protection Air Quality Regulations, 2000	Sets ambient air quality standards, reporting requirements, penalties for violations of standards, and permitting requirements for stationary and mobile sources of air emissions.	Regulates emissions that could be part of the Project.
Environmental Protection Hazardous Waste Regulations, 2000	Establishes requirements for generating, handling, and disposing of hazardous waste as well as penalties for violations of these requirements.	Identifies wastes subject to regulation, including several types of waste that could be generated as part of the Project.
Toxic Chemicals Control Act No. 13 of 2000, as amended in 2007	Provides for the formation of a Pesticides and Toxic Chemicals Control Board; establishes requirements for registration, licensure, and trade in pesticides and toxic chemicals. Amended in 2007 to provide rules for the exportation of pesticides and toxic chemicals.	Establishes regulations pertaining to the use of toxic chemicals and pesticides. Pesticides will not be required for the Project, but small amounts of toxic chemicals may be used.
Environmental Protection Noise Management Regulations, 2000	Establishes general provisions for noise avoidance and restrictions from multiple commercial and industrial sources, including sound making devices, night clubs, equipment, tools, and construction activities.	Regulated facilities include any offshore installation and any other installation, whether floating or resting on the seabed.
Draft Guyana Standard, Requirements for Industrial Effluent Discharge into the Environment, 2015	Compulsory standard used for monitoring of effluents discharged into freshwater, estuarine, and marine water resources.	Sets limits for key parameters in discharges of industrial effluent, including Project-related discharges.
<i>Public Health</i>		
Occupational Safety and Health Act, 1997	Legally defines the responsibilities of workers and management with respect to keeping workplaces safe.	Generally applies to Project workers and Project-related activities.
Food & Drug Regulations (Food and Drug Act)	Regulates the sale, advertisement, preparation, and handling of food products; regulates the manufacture, advertisement, trade, and administration of pharmaceuticals; provides the Ministry of Health authority to inspect facilities to establish compliance with sanitation standards.	Governs the preparation of food and provision of medications at Project facilities.

Title	Objective	Relevance to the Project
<i>Social/Cultural Resources</i>		
National Trust Act	Stewardship of historic resources and places of cultural significance.	Governs the management of any building, structure, object, or other man-made or natural feature that is of historic or national cultural significance that could be impacted by the Project (e.g., shipwrecks and other such marine features).
Amerindian Act (2006) Cap. 29:01.	Provides for the recognition and protection of the collective rights of Amerindian villages and communities, the granting of lands to Amerindian villages and communities, and the promotion of good governance with Amerindian villages and communities.	Within the broad context of protection of the collective rights of Amerindian villages, this could include the right of use of coastal resources for traditional and subsistence activities, which could be affected in the event of an oil spill from the Project.

5.2. ENVIRONMENTAL PERMITS AND LICENSES

As part of Project implementation, the Project will be required to obtain the following environmental-related permits:

- Environmental Permit – To undertake the Project, EEPGL is required to obtain an Environmental Authorisation (also commonly referred to as an Environmental Permit) from the EPA. The Application for Environmental Authorisation filed with the EPA on 4 December 2017 initiated this regulatory process. After submission and review of this EIA, the EPA will take into account the review of the Guyana Geology and Mines Commission (GGMC), comments from other Agencies and Ministries, the public’s comments, EPA’s own review, including support from technical experts, and recommendations from the Environmental Assessment Board (EAB) in deciding whether and under what conditions to grant EEPGL an Environmental Authorisation for the Project.
- Hazardous Waste Permit – With regard to onshore waste management, in order to operate a facility that generates, transports, treats, stores or disposes of hazardous waste, an application for environmental authorization must be submitted to the EPA by the operator of the facility. The Application for environmental authorization must be prepared in accordance with the provisions of regulation 17 of the Environmental Protection (Authorisations) Regulations 2000. As such, the vessel owner/operators supporting the Project will be required to obtain authorization for any marine vessels used to transport hazardous wastes to onshore facilities. Also, the vehicle owner/operators will be required to obtain authorization for any vehicles used to transport hazardous waste from the shore to offsite waste management facilities. For any third-party owned/operated marine vessels or vehicles used to transport hazardous waste from the Project, the applications for environmental authorization will need to be obtained by the third-party. Similarly, any

environmental authorizations for third-party operated facilities used to manage hazardous waste will be obtained by the owner/operators of such facilities.

5.3. NATIONAL POLICY FRAMEWORK

Guyana's government has articulated national policies on several environmental and social topics that are relevant to the Project. This section provides an overview of the key government policies applicable to the Project.

5.3.1. National Development Strategy

The National Development Strategy (NDS) sets priorities for Guyana's economic and social development policies for the next decade. The draft document contains technical analysis of problems and future prospects in all sectors of the economy and in areas of social concern.

The NDS contains six volumes. Volumes 3 and 5 are the most relevant to the Project. Volume 3 of the NDS sets government policy with regard to the environment as well as social equality issues. It identifies 12 distinct features of Guyana's natural resources and environment, and sets policies governing the management of each feature. Features covered under Volume 3 with relevance to the Project include the coastal zone, fisheries, waste management, pollution control, and environmental impacts of private-sector activities (NDS 1997).

Volume 5 relates in part to the energy sector. It describes the condition of the energy sector in Guyana, reviews past government policies related to the energy sector, identifies challenges facing the energy sector in Guyana, and describes the government's vision for future development and regulation of the sector (NDS 1997).

5.3.2. National Environmental Action Plan

Guyana's National Environmental Action Plan (NEAP) articulates the government's approach to managing the environment from the perspective of economic development. The NEAP considers the issues of environmental management, economic development, social justice, and public health to be inextricably linked. It identifies deforestation, pollution, and unregulated gold mining as historically minor but with growing environmental problems, and identifies private sector investment as one of the primary opportunities to generate the necessary capacity within Guyana to (1) provide an appropriate level of public services to its citizens; (2) reduce and/or eliminate the avoidable environmental degradation that occurs when resource development occurs in a regulatory vacuum; and (3) reduce unsustainable uses of natural resources due to the socioeconomic pressures of widespread poverty.

The NEAP relates to the Project in several ways. It identifies the coastal zone within which Project activities will occur as an area in need of focused management action due to the concentrated human population along the coast and the susceptibility of the coastal environment to both natural and human-induced degradation. Additionally, it identifies private sector-led development projects as a mechanism to build capacity and ultimately support more responsible environmental management. Finally, it identifies petroleum resources as a potential target for development.

5.3.3. Integrated Coastal Zone Management Action Plan

Guyana's Integrated Coastal Zone Management (ICZM) process is an ongoing initiative to promote the wise use, development, and protection of coastal and marine resources; enhance collaboration among sectorial agencies; and promote economic development. In 2000, after two years of study, the ICZM committee produced an ICZM Action Plan, which was approved by the Cabinet in 2001.

The ICZM Action Plan addresses policy development, analysis and planning, coordination, public awareness building and education, control and compliance, monitoring and measurement, and information management (EPA 2000). Other coastal zone-related tasks currently being undertaken by the government include strengthening the institutional setup for ICZM, conducting a public awareness campaign to increase public understanding of the vulnerability of the coastal zone to sea level rise and climate change, and creating a database of coastal resources to facilitate improved ICZM. Currently, the EPA is mandated to coordinate the ICZM program and coordinate the development of the ICZM Action Plan through the ICZM Committee.

Under the *Caribbean Planning for Adaptation to Climate Change* project, Guyana has also conducted a socioeconomic assessment of sea-level rise as part of a wider vulnerability assessment and developed a Climate Change Adaptation Policy and Implementation Strategy for coastal and low-lying areas.

5.3.4. Protected Area Act

The Protected Area Act was enacted in 2011. It provides for protection and conservation of Guyana's natural heritage and natural capital through a national network of protected areas, and created a Protected Areas Commission to oversee the management of this network. It also highlights the importance of maintaining ecosystem services of national and global importance and public participation in protected areas and conservation, and it establishes a protected-areas trust fund to ensure adequate financial support for maintenance of the network. Other functions of the Act include promoting national pride in and encouraging stewardship of Guyana's natural heritage, recognizing the conservation efforts and achievements of Amerindian villages and Amerindian communities, and promoting the recovery and rehabilitation of vulnerable, threatened, and endangered species.

5.3.5. Guyana's National Biodiversity Strategy and Action Plan

Guyana's current National Biodiversity Strategy and Action Plan (NBSAP) was formally adopted in 2015, and is the third iteration of the NBSAP. It establishes the national vision for biodiversity, which is to sustainably utilize, manage, and mainstream biodiversity by 2030, thereby contributing to the advancement of Guyana's bio-security, and socioeconomic and low carbon development. It is intended to guide national policy with respect to biodiversity through 2020. It recognizes the importance of biodiversity to the growing ecotourism industry and other economic sectors. The NBSAP set forth nine strategic objectives intended to promote conservation and sustainability on a national scale, improve biodiversity monitoring, harmonize

legal and policy-based mechanisms across all levels of government to support biodiversity conservation, and prioritize funding to meet these objectives.

5.3.6. Low Carbon Development Strategy and the Green Economy

In June 2009, the Government of Guyana announced the Low Carbon Development Strategy (LCDS). The LCDS aims to protect and maintain the forests in an effort to reduce global carbon emissions and at the same time attract payments from developed countries for the climate services that the forests provide. In 2013, the LCDS was updated to focus on two main goals: (1) transforming the national economy to deliver greater economic and social development by following a low-carbon development path while simultaneously combating climate change; and (2) providing a model for the world of how climate change can be addressed through low-carbon development in developing countries. The LCDS identifies Reducing Deforestation and Forest Degradation Plus as a primary mechanism for achieving the goals of the strategy.

Although there is no formal government plan for achieving a green economy, the Government of Guyana has expressed interest in the concept. President David Granger has defined the Green Economy as consisting of four pillars: energy, environmental security, ecological services, and enterprise and employment (Kaieteur News 2016). The LCDS provides the conceptual framework for implementing the Green Economy.

5.3.7. Guyana Energy Agency's Strategic Plan

The Guyana Energy Agency (GEA) was established by the Guyana Energy Agency Act of 1997, (as amended) with a mandate to advise the prime minister on energy-related issues, develop a national energy policy, improve energy efficiency, monitor the energy sector, and educate the public on energy efficiency and renewable energy. The GEA's Strategic Plan for 2014-2018 specifically charges the GEA with monitoring the production, importation, distribution, and utilization of petroleum and petroleum products (GEA 2014).

5.4. INTERNATIONAL CONVENTIONS AND PROTOCOLS

Guyana is signatory to a number of international agreements and conventions relating to environmental management and community rights, although not all of these agreements have been translated into national legislation. Table 5-2 lists the key agreements relevant to the Project to which Guyana has acceded or is a signatory.

Guyana is a member state of two organizations that administer multiple international treaties and conventions: the International Labour Organization (ILO) and the International Maritime Organization (IMO). The ILO has established eight fundamental conventions that provide certain general protections to workers in signatory states, such as the right to organize, standards for remuneration, restrictions on child labor (including minimum ages to work), and protection from forced labor. In addition to these fundamental agreements, Guyana is signatory to several specific agreements that would govern certain specific aspects of the Project as they relate to labor.

The IMO is a similar organization whose member states have agreed to one or more conventions related to maritime activities. These include three key conventions (the International Convention for the Safety of Life at Sea, the International Convention for the Prevention of Pollution from Ships, and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) as well as several other agreements concerning more specific aspects of maritime activity, such as safety and security at sea, maritime pollution, and liability for maritime casualties. MARAD manages compliance with the requirements of the IMO agreements to which Guyana is a signatory, with technical assistance from the IMO's Regional Maritime Advisory Office in Port of Spain, Trinidad.

Guyana also belongs to other international organizations such as the Organization of American State, the International Monetary Fund, and the Caribbean Community.

To highlight Guyana's adherence to international standards and guidelines relevant to the oil and gas sector, in May 2010, the country announced its commitment to the implementation of the Extractive Industries Transparency Initiative and most recently, in September 2015, the country recommitted its support to the ILO.

In October 2017, Guyana became the 53rd candidate country in the Extractive Industries Transparency Initiative (EITI). EITI is a global standard to promote the open and accountable management of the extractives resources; it seeks to strengthen government and company systems, inform the public, and promote industry understanding. It was founded in 2003 with an aim of protecting the interests of developing or frontier countries such as Guyana (EITI 2018).

EEPGL's ultimate parent organization, ExxonMobil Corporation ("ExxonMobil"), has been a part of EITI since its inception and is a founding member. ExxonMobil has constructively worked to help develop and support EITI initiatives wherever its affiliates and subsidiaries operate, and EEPGL is committed to continuing this in Guyana.

To gain membership status, Guyana was required to assemble a multi-stakeholder group, which includes equal representation from the government, civil society, and industry. The goal is to develop a consensus reporting system that applies to all extractive companies operating in the country and to make that report public every year. Guyana is now tasked with producing its first report in the next 18 months; these reports will be audited by a third party and distributed publicly for review.¹⁰

In collaboration with the Government of Guyana, in December 2017 EEPGL was the first energy company to release its Petroleum Agreement. The Stabroek Block Petroleum Agreement provides transparent information on revenue share, cost recovery, royalties, taxes, signing bonus, and other topics of interest to the public.

¹⁰ For more information about Guyana EITI visit: www.gyeiti.org

Table 5-2: Guyana-Signed/Acceded International Agreements Relevant to Environmental or Socioeconomic Issues

Agreement/ Convention	Objective	Guyana Status	Relevance to Project
<i>Climate Change/Air Quality</i>			
United Nations Framework Convention on Climate Change	Promotes international cooperation to limit average temperature increases and resulting changes in climate and international cooperation to adapt to these impacts.	Acceded and ratified in 1994.	Provides for controls on GHG emissions within Guyana's territory (maritime and land), and establishes national policy regarding adaptation to climate change. Guyana's Intended Nationally Determined Contributions under the convention are focused on preserving the country's forests as a carbon sink and include avoiding deforestation, minimizing emissions from forestry and mining operations, expansion of renewable energy sources, and integrated water resource management.
Kyoto Protocol	Extends the United Nations Framework Convention on Climate Change and commits countries to reduce GHG emissions.	Acceded in 2003.	Establishes national GHG emission reduction targets.
Vienna Convention on the Protection of the Ozone Layer	Provides a framework for the protection of the ozone layer.	Acceded in 1993.	Establishes measures for protecting the ozone layer.
Montreal Protocol on Substances that Deplete the Ozone Layer	A protocol to the Vienna Convention designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.	Acceded in 1993.	Prohibits the use of several groups of halogenated hydrocarbons that may deplete the ozone layer.
<i>Pollution Prevention</i>			
International Convention for the Prevention of Pollution from Ships	Regulates various forms of marine pollution, including oil and fuel, noxious liquid, hazardous substances, sewage, garbage, air emissions, and ballast water.	Acceded in 1997.	Impacts the handling and disposition of controlled substances from the drill ships, FPSO, and support vessels.

Agreement/ Convention	Objective	Guyana Status	Relevance to Project
International Convention for Safe Containers	Promotes the safe transport and handling of containers through generally acceptable test procedures and related strength requirements, and facilitates the international transport of containers by providing uniform international safety regulations, equally applicable to all modes of surface transport.	Acceded in 1997.	Regulates the manufacture, use, and integrity of containers used on board the drill ships, FPSO, and support vessels.
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	Confirms the right of coastal member states to take specific actions when necessary to prevent pollution from oil following a maritime casualty.	Acceded in 1997.	Would protect Guyana's rights to respond to an oil spill if such an event were to occur.
International Convention on Civil Liability for Oil Pollution Damage	Establishes vessel owners' liability for damages caused by pollution from oil spills and provides for compensation where oil pollution damage was caused by maritime casualties involving oil tankers.	Acceded in 1997.	Would apply to potential spills from tankers that had received oil from the FPSO.
Basel Convention on the Transboundary Movement of Hazardous Wastes and Their Disposal	Reduces and controls the movements of hazardous waste between nations and discourages transfer of hazardous waste from developed to less developed countries.	Acceded in 2001.	Would apply to the Project only if hazardous waste generated in Guyana is disposed outside Guyana.
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Provides a mechanism for formally obtaining and disseminating decisions of party nations as to whether they wish to receive future shipments of listed chemicals, and for ensuring compliance with these decisions by exporting party nations.	Acceded June 2007.	Would apply to the Project only if chemicals and/or pesticides used by the Project and listed under the Convention are shipped into or out of Guyana.
Stockholm Convention on Persistent Organic Pollutants, as amended	Requires party nations to take measures to eliminate or reduce the release of persistent organic pollutants.	Acceded September 2007.	Would apply to the Project only if persistent organic pollutants are released to the environment during the course of Project-related.
International Convention on Oil Pollution Preparedness, Response and Cooperation	Establishes measures for dealing with marine oil pollution incidents.	Ratified in 1997.	Requires ships to have a shipboard oil pollution emergency plan.

Agreement/ Convention	Objective	Guyana Status	Relevance to Project
<i>Ecological/Environmental Quality</i>			
The Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region	Provides a framework for international protection and development of the marine environment across the Caribbean region.	Acceded and Ratified in 2010.	Sets general goals for protection for the marine environment, especially from possible pollution.
Protocol on Specially Protected Areas and Wildlife	Protocol supplementing and supporting the Cartagena Convention. Requires signatories to adopt an ecosystem approach to conservation. Provides mechanism for compliance with the Convention on Biological Diversity.	Acceded and Ratified in 2010.	Elaborates on the wildlife goals established in the Cartagena Convention and Convention on Biological Diversity.
Convention on Biological Diversity	Promotes biological conservation within the framework of sustainable development and use of biological resources, and the fair and equitable sharing of benefits of genetic resources.	Signed in 1992, ratified in 1994.	Discourages activities that would negatively impact biodiversity.
United Nations Convention on the Law of the Sea	Defines nations' rights and responsibilities in terms of their use of oceans and provides guidance on environmental and natural resource management.	Concluded in 1982 and ratified in 1994.	Defines legal status of subsea mineral resources as the "common heritage of humankind," encourages resource development be done in a way that supports healthy global economic growth and trade balance, and mandates that states take measures to prevent, control and reduce pollution of the oceans.
Convention on International Trade in Endangered Species of Wild Flora and Fauna	Protects endangered plants and animals from international trade.	Acceded in 1977.	Restricts collection and trade of endangered species.
United Nations Educational, Scientific and Cultural Organization Convention on the Protection of the Underwater Cultural Heritage	Protects "all traces of human existence having a cultural, historical, or archaeological character" that have been underwater for over 100 years.	Ratified in 2014.	Would apply to any shipwrecks or other submerged cultural heritage in the Project AOI.

Agreement/ Convention	Objective	Guyana Status	Relevance to Project
<i>Labor/Health/Safety</i>			
International Convention for the Safety of Life at Sea	Specifies minimum standards for the construction, equipment, and operation of vessels compatible with their safety; allows governments of participating states to inspect vessels flagged in other participating states to ensure compliance.	Acceded in 1997.	Affects construction, operation, and equipment on board the drill ships, FPSO, installation vessels, and support vessels.
Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation	Promotes safety at sea by criminalizing actions that would endanger a vessel or its cargo, or that contribute to activities that would do so.	Acceded in 2003.	Would apply to any activity intended to endanger vessels while conducting Project-related activities.
Dock Work Convention	Regulates activities associated with the loading and unloading of cargo onto/from oceangoing vessels when at port.	Acceded 1983.	Applies to loading and offloading activities at Project shorebase(s).
Repatriation of Seafarers Convention (Revised)	Requires vessel owners/operators to repatriate (at the operator's expense) seafarers that have successfully concluded a minimum period of service on board a vessel (minimum time to qualify for this benefit to be determined by the member state but not to exceed 12 months).	Acceded 1996.	Would apply to workers on board both EEPGL-owned/operated vessels, those of their contractors, and tankers receiving oil from the FPSO.
Seafarer's Identify Documents Convention	Requires signatory states to issue identity cards to seafarers and for other signatory states to allow holders of these cards entry to their territories for the purposes of shore leave, joining a crew, or repatriation after completing a voyage.	Acceded 1966.	Applies to seafarers entering or egressing Guyana prior to or following employment on vessels operated by EEPGL or those of its contractors, and to seafarers on shore leave while employed by EEPGL or its contractors.
Convention on the International Regulations for Preventing Collisions at Sea	Officially recognizes the importance of traffic separation in the marine environment and codifies basic measures to accommodate traffic separation, including safe speed, signalling conventions, and general vessel conduct.	Acceded in 1997.	Governs maritime operation of drill ships, FPSO, installation vessels, and support vessels.

Agreement/ Convention	Objective	Guyana Status	Relevance to Project
International Convention on Standards of Training, Certification and Watchkeeping	Obligates crews operating vessels flagged in signatory states to adhere to minimum standards relating to training, certification and watchkeeping; requires signatory states to submit detailed information to the IMO concerning administrative measures taken to ensure compliance with the convention.	Acceded in 1997.	Impacts required capabilities of crew on board the drill ships, FPSO, installation vessels, and support vessels, and provides for inspection by authorities to ensure compliance.
Convention on Facilitation of International Maritime Traffic	Prevents unnecessary delays in maritime traffic arising from burdensome documentation requirements and establishes uniform formalities and other procedures to permit transboundary maritime commerce and travel.	Acceded in 1998.	Facilitates entry of drill ships, FPSO, installation vessels, and support vessels into Guyana.

GHG = greenhouse gas; IMO = International Maritime Organization

5.5. EEPGL’s OPERATIONS INTEGRITY MANAGEMENT SYSTEM

ExxonMobil (EEPGL’s parent organization) and its affiliates (including EEPGL) are committed to conducting business in a manner that is compatible with the environmental and economic needs of the communities in which it operates, and that protects the safety, security, and health of its employees, those involved with its operations, its customers, and the public. These commitments are documented in Safety, Security, Health, Environmental, and Product Safety policies. These policies are put into practice through a disciplined management framework called OIMS.

ExxonMobil’s OIMS Framework establishes common expectations used by ExxonMobil affiliates worldwide for addressing risks inherent in its business. The term “Operations Integrity” is used to address all aspects of its business that can impact personnel and process safety, security, health, and environmental performance.

Application of the OIMS Framework is required across all ExxonMobil affiliates, with particular emphasis on design, construction, and operations. Management is responsible for ensuring that management systems that satisfy the OIMS Framework are in place. Implementation will be consistent with the risks associated with the business activities being planned and performed. Figure 5-1 provides a high-level description of the OIMS Framework and its 11 essential elements.



Figure 5-1: Operations Integrity Management System

6. METHODOLOGY FOR PREPARING THE EIA

The impact assessment process is a comparative process that identifies differences between existing physical, biological, and socioeconomic conditions and the projected conditions that could be potentially directly or indirectly attributable to the Project. For the purposes of the EIA, an “impact” will be defined as any alteration of existing conditions, adverse or beneficial, caused directly or indirectly by the Project. Under the provisions of the Environmental Protection Act, these could include the following:

1. Impairment of the quality of the natural environment or any use that can be made of it;
2. Injury or damage to property or to plant or animal life;
3. Harm or material discomfort to any person;
4. An adverse effect on the health of any person;
5. Impairment of the safety of any person;
6. Rendering any property or plant or animal life unfit for use by humans or unfit for its role in its ecosystem;
7. Loss of enjoyment of normal use of property; and
8. Interference with the normal conduct of business.

The Environmental Protection Act does not provide specific examples of positive impacts, but examples could include increased employment opportunities and improvement or expansion of wildlife habitats.

Information on potential impacts, including potential cumulative impacts generated from the activities required to develop the Project in Guyana, will be obtained from various sources, including consultation with the EPA, Government of Guyana, and other stakeholders; environmental impact assessments for other similar projects worldwide; scientific literature; and Project-specific studies.

6.1. THE EIA PROCESS

The key stages for this EIA approach are:

- Screening
- Scoping and Terms of Reference
- Assessing existing conditions
- Project description and interaction with Project design and decision-making process
- Stakeholder engagement
- Assessment of impacts and identification of mitigation, management, and monitoring measures
- Disclosure and reporting

It is standard impact assessment practice to “rate” potential impacts. This rating process:

- Provides a basis for prioritization of impacts that require management;
- Provides a method of assessing the effectiveness of proposed management measures; and
- Provides a scale that shows the level of impact both before and after proposed management measures are adopted.

Potential adverse impacts will be rated according to the magnitude of the potential impact, and the sensitivity/vulnerability/importance of the impacted resource or receptor. Magnitude and sensitivity/vulnerability/importance designations will be assigned using a range of quantitative and qualitative information sources. Additional detail on this approach is presented below.

6.2. CRITERIA FOR RATING IMPACTS

Impacts will be rated according to (1) the magnitude of the potential impact and (2) the sensitivity/vulnerability/importance of the impacted resource or receptor. These elements are described in greater detail below.

6.2.1. Magnitude

Magnitude essentially describes the degree of change that the identified potential impact is likely to impart upon the resource or receptor. Magnitude is a function of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency
- Likelihood (for unplanned events only)

The magnitude of impacts will take into account all the various dimensions of a particular impact to determine where the impact falls on the spectrum (in the case of adverse impacts) from negligible to large. Some impacts will result in changes to the environment that may be immeasurable, undetectable, or within the range of normal natural variation. Such changes will be characterized as having a negligible magnitude.

Taking into account the magnitude of impact characteristics identified above, the magnitude of each potential impact will be assigned one of the following five ratings:

- Positive
- Negligible
- Small
- Medium
- Large

Not all impacts can be assessed according to the same criteria, so the magnitude ratings for specific impacts may be determined differently according to the resource/receptor (or the type of impact) being assessed.

6.2.2. Sensitivity/Vulnerability/Importance

A range of factors will be taken into account when defining the sensitivity/ vulnerability/ importance of a resource or receptor. For physical resources (e.g., marine water quality), the resource's sensitivity to change and/or importance will typically be considered. For biological or cultural resources or receptors (e.g., a mangrove forest), the importance (e.g., local, regional, national, or international importance) and sensitivity to the specific type of impact will be considered. For human receptors, the vulnerability of the individual, community, or wider societal group will generally be considered. Other factors may also be considered when characterizing sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views, and economic value.

As in the case of magnitude, the sensitivity/vulnerability/importance designations will be consistent, but the approach for determining ratings will vary on a resource/receptor basis. The following sensitivity/vulnerability/importance designations will be used in the EIA:

- Low
- Medium
- High

6.2.3. Determining Impact Significance

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterized, a significance rating can be assigned for the potential impact. Impact significance is designated using the matrix shown on Figure 6-1. The significance categories provided in Figure 6-1 are standardized across all impacts and resource/receptor categories, and range from negligible to major.

		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

Figure 6-1: Impact Significance Rating Matrix

Mitigation measures or management measures will be proposed commensurate with the impact significance ratings. Management measures will generally not be developed for potential adverse impacts that are deemed to be of negligible significance.

Magnitudes are generally not assigned in the case of positive impacts. It is usually sufficient to indicate that the Project will result in a positive impact without characterizing the exact degree of positive change likely to occur.

Following identification of mitigation measures or management measures, the residual significance of each impact (i.e., considering the implementation of the identified mitigation or management measures) will be characterized.

Where possible, the spatial and temporal extent of potential adverse impacts will be described to provide context to the impacts assessment. In addition, the concept of reversibility will be addressed, as appropriate.

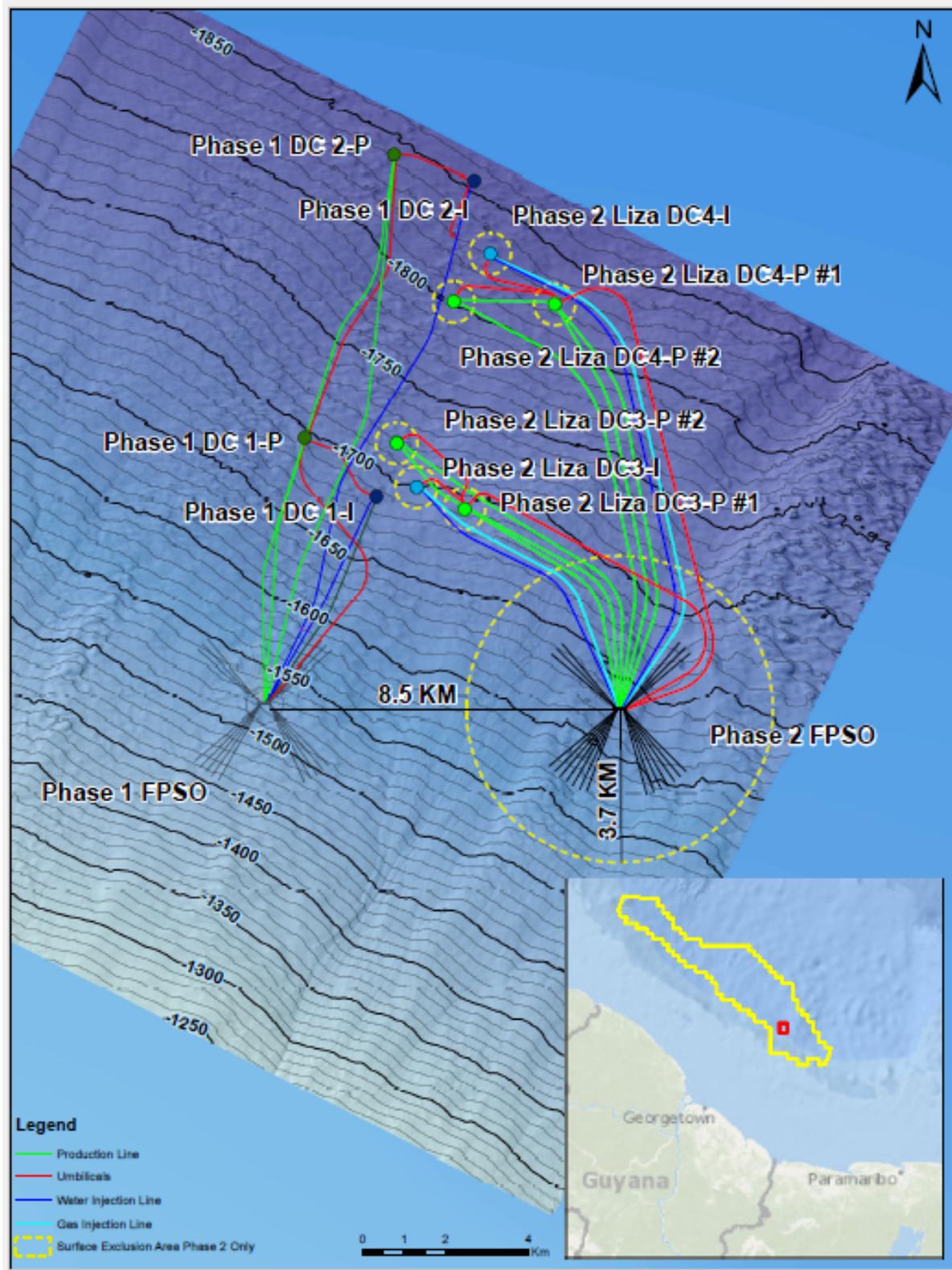
6.3. CUMULATIVE IMPACTS

Cumulative impacts are defined as the successive, incremental, and/or combined effects of a Project or activity, accumulated with other Projects or activities. Cumulative impacts can result from minor actions undertaken over a period of time that collectively represent a more substantial action. For cumulative impacts to occur, there must be a connection or linkage between Project-related impacts and impacts of other unrelated projects or undertakings on the same resource/receptor. Therefore, the same environmental and socioeconomic resources/receptors identified for consideration in the impact assessment will be considered in the cumulative impacts analysis. If the Project will not result in potentially significant impacts on a resource/receptor, then that resource/receptor will not be included in the cumulative impact evaluation.

The EIA will assess cumulative impacts using international good practice methodology, consistent with the *Good Practice Handbook: Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets* (IFC 2013). This methodology focuses on environmental and social receptors that are highly valued by stakeholders, referred to as valued environmental and social components (VECs), which may be cumulatively impacted by the Project, other projects, and sources of external pressure (IFC 2013).

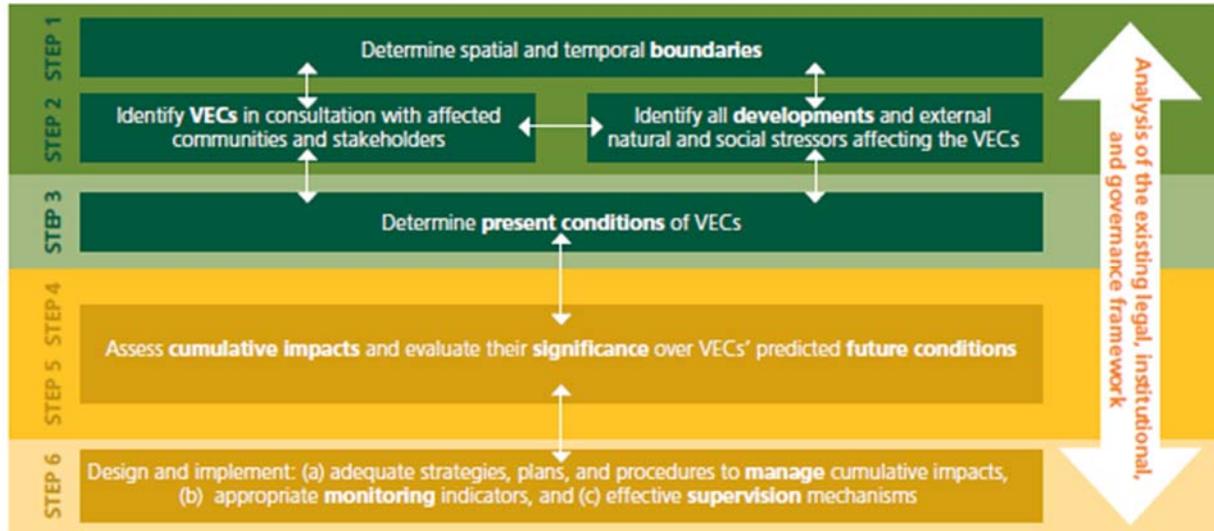
The assessment of cumulative impacts in the EIA will consider the interactions between impacts from the Project and impacts of non-Project activities (including but not limited to other EEPGL activities such as the Liza Phase 1 Development Project and exploration drilling activities¹¹ that will be conducted concurrently with construction/installation of the Liza Phase 1 Development Project). The cumulative impact assessment will consider relevant past, existing, or sufficiently approved/planned activities that are considered reasonably foreseeable. Due to the proximity of the marine components of the Liza Phase 1 and Phase 2 Development Projects, the Liza Phase 1 Development Project likely represents the most significant source of potential cumulative impacts when combined with the impacts of the Liza Phase 2 Development Project. Figure 6-2 shows the location of the Liza Phase 1 and Phase 2 Development Projects. The cumulative impact assessment will be informed by information provided by EEPGL, existing conditions information generated in the EIA, information available in the public domain, and information gathered during the stakeholder consultation process. Figure 6-3 summarizes the key steps in the cumulative impact assessment process.

¹¹ Exploration wells are structurally similar to development wells and are drilled using similar processes and equipment, but are drilled for different purposes. Exploration wells are typically not converted to production wells, so exploration programs have a fundamentally different duration and their impacts occur over different timescales.



Note: Locations on figure subject to change

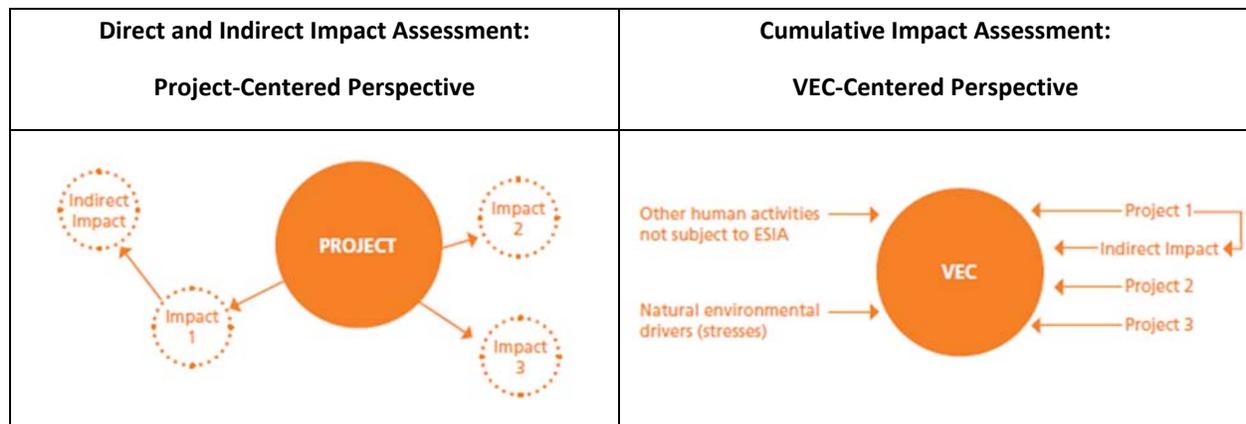
Figure 6-2: Location of the Liza Phase 1 and Phase 2 Development Projects



Source: IFC 2013

Figure 6-3: Cumulative Impact Assessment Process

Unlike the assessment of potential direct and indirect Project impacts in the EIA, where the focus is the *Project as a generator of impacts* on resources or receptors, the assessment of cumulative impacts focuses on *VECs as receptors of impacts* from multiple projects and activities (Figure 6-4).



Source: IFC 2013

Figure 6-4: Comparing Direct and Indirect Impact Assessment with Cumulative Impact Assessment

7. SCOPE OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The scope of the EIA will include all elements listed in Section 3, Objectives of the Environmental Impact Assessment, for all aspects of the Project (as described in Section 4, Description of the Project) and for all of the environmental and socioeconomic resources/receptors detailed in Section 9, Scoping and Identification of Potential Sources of Project-Generated Impacts. The EIA will address development drilling operations, SURF and FPSO installation, production operations, logistical support, and decommissioning, as well as marine/aviation logistics and onshore support facilities. The types of activities and potential impacts associated with the Project will be similar to those associated with the Liza Phase 1 Development Project; however, the scale of some aspects of the Project will be larger as compared to the Phase 1 Development Project (e.g., larger number of development wells in Phase 2 and a larger capacity FPSO with greater design production rate in Phase 2).

7.1. PROJECT AREA OF INFLUENCE

The area potentially impacted by a project is referred to as its AOI. For purposes of the EIA, a Direct AOI and an Indirect AOI were defined, as described below:

- Direct AOI, within which the Project is expected to have potential direct impacts (Figure 7-1). This area includes: (1) the PDA (i.e., the subsea development area including the wells, SURF equipment, and other subsea infrastructure; and the surface development area including the FPSO, drill ships, other Project marine vessels and associated marine safety exclusion zones); (2) the marine and aviation transit corridors between the PDA and onshore activity centers in Guyana and Trinidad (within territorial boundary of Guyana); and (3) the City of Georgetown. These areas collectively were defined as the Direct AOI because they comprise, based on the potential impacts identified during the scoping phase, the geographic extent in which direct Project impacts (i.e., potential impacts resulting from a direct interaction with planned Project activities and environmental or socioeconomic resources) are anticipated to potentially occur. The planned Project activities will generate discharges to water and emissions to air, which could result in potential impacts to water quality and air quality, respectively, outside of the geographic extent encompassed by the Direct AOI. The EIA will include modeling of these discharges and emissions, and the results of the modeling will be used to confirm that the Direct AOI is inclusive of the extent of potentially significant impacts to these resources.
- Indirect AOI, within which the Project is expected to have potential indirect impacts (Figure 7-2). This area includes: (1) coastal areas and marine waters within the territorial boundary of Guyana that could potentially be impacted by an unplanned event (e.g., an oil spill); and (2) coastal Regions 1 to 6, which could be impacted to a greater extent than other regions because of their degree of reliance on subsistence and commercial marine fisheries (i.e., related to potential impacts on fish and marine transport) and increased exposure to potential Project socioeconomic impacts. Although all ten regions of Guyana would potentially benefit from the shared government revenue stream from the Project, the Indirect

AOI does not include the entire country because the extent to which any specific region could benefit from the revenues is dependent on the government's policies rather than on the Project activities assessed in the EIA. Based on prior oil spill modeling conducted for the Liza Phase 1 Project, only (portions of) the Region 1 coastline could potentially be impacted by a spill. This prior modeling also indicates an oil spill would not have a reasonable likelihood of affecting marine waters southeastward or seaward of the FPSO. However, considering the potential for community members from all coastal regions (in particular fishermen and other marine users) to be indirectly affected in the event of an oil spill, as well as the potential for socioeconomic impacts from some planned Project activities (e.g., Project vessel movements), all six coastal regions and the entire extent of Guyana's marine waters downgradient of the FPSO were defined collectively as the Indirect AOI. As with discharges to water and emission to air, the EIA will include modeling of an oil spill from the Phase 2 PDA, and the results of the modeling will be used to confirm that the Indirect AOI is inclusive of the extent of potentially significant impacts to resources from this type of an unplanned event.

The Direct AOI and Indirect AOI are depicted in Figures 7-1 and 7-2, respectively. The geographic area of concern for a cumulative impacts analysis will be consistent with the Project's Direct or Indirect AOI for the specific resource/receptor under consideration.

If unmitigated, a subsea release of crude oil from a loss of well control event, could have the potential to affect resources outside of Guyana waters. While it would be inappropriate to extend the AOIs beyond Guyana's jurisdiction in a regulatory EIA, as this would require the EPA to assess potential impacts on resources over which it has no jurisdiction, the EIA will discuss potential transboundary effects that could result from an unmitigated oil spill.

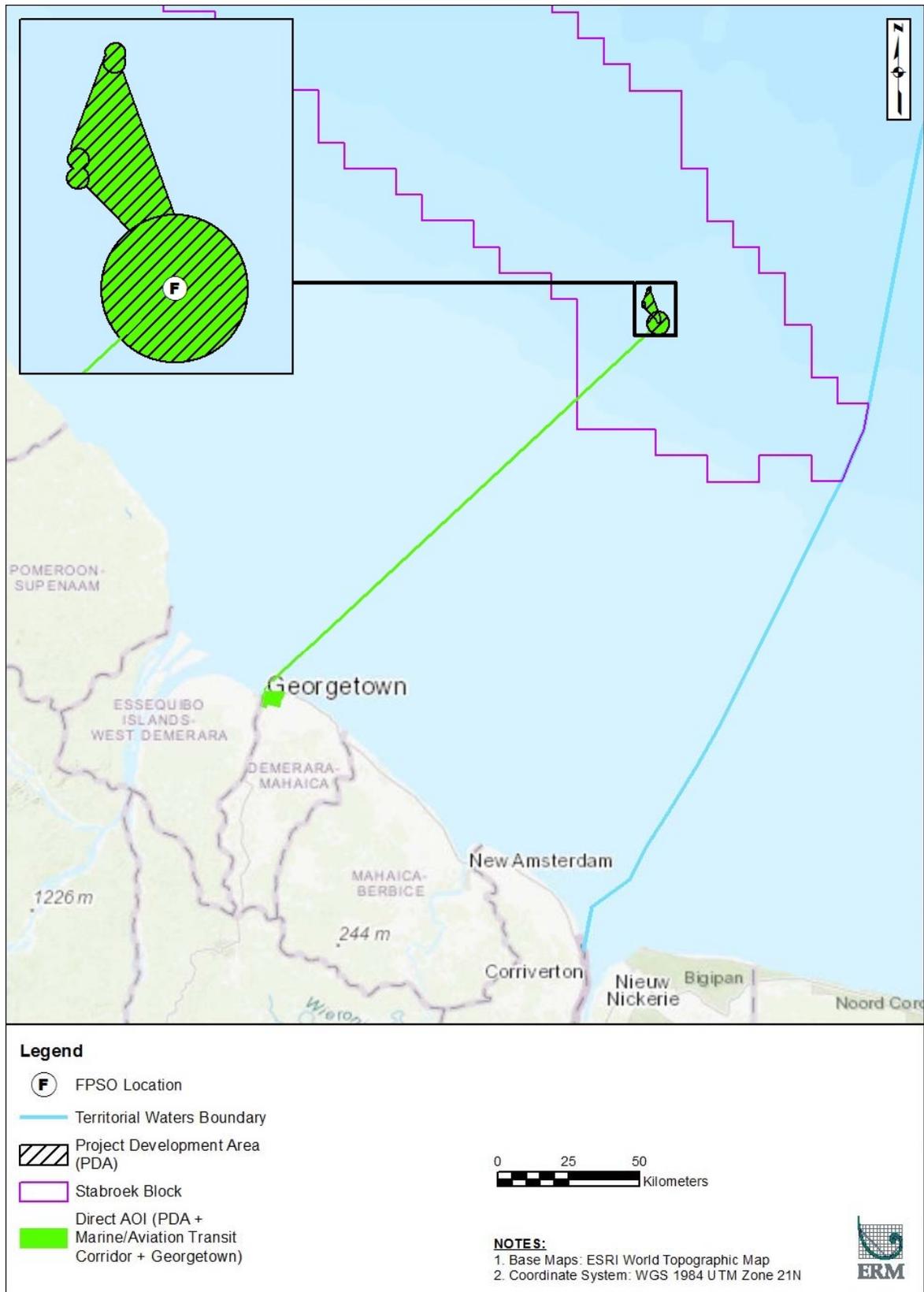
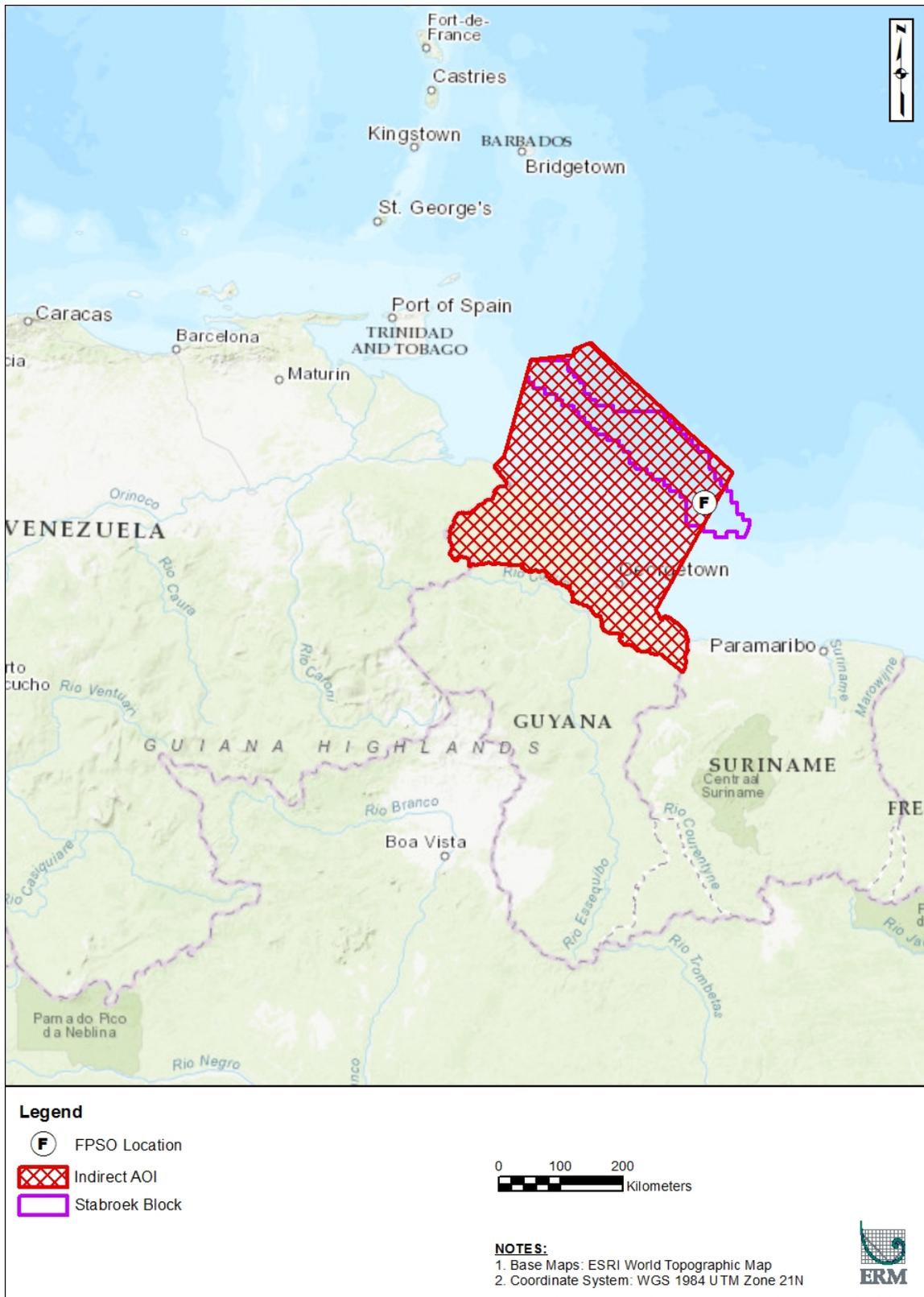


Figure 7-1: Direct Area of Influence



Note: map does not represent a depiction of the maritime boundary lines of Guyana

Figure 7-2: Indirect Area of Influence

7.2. PROJECT INTERACTIONS WITH ENVIRONMENTAL AND SOCIOECONOMIC RESOURCES/RECEPTORS

To define the scope of the environmental and socioeconomic impact analysis, it is necessary to identify the potential interactions between the Project and the resources/receptors within the Direct and Indirect AOIs (collectively, “the AOI”). These interactions are the mechanisms that could result in direct or indirect Project-related impacts to resources/receptors. Additionally, the impacts of other past, present, or reasonably foreseeable projects, activities, or external pressures in the Project AOI could interact with the impacts of the Project, resulting in cumulative impacts.

The Project activities and potential unplanned events listed below may potentially interact with existing resources/receptors, and these interactions could potentially create direct, indirect, or cumulative environmental or socioeconomic impacts:

- Development drilling stage
 - Drill ship and drilling operations
 - Power generation
 - Drill cuttings discharges
 - Drilling fluids discharges
 - Wastewater effluent discharges
 - Offshore waste treatment and disposal, potentially including incineration
 - Vertical seismic profiling
 - ROV operations
 - Onshore waste management, recycling, treatment, and disposal
- Installation of FPSO/SURF components stage
 - Marine installation vessels and FPSO
 - Power generation
 - Installation of FPSO mooring system
 - Discharge of hydrostatic test water, hydrate inhibitor, and ballast water
 - Wastewater effluent discharges
 - Offshore waste treatment and disposal, potentially including waste incineration
 - ROV operations
 - Installation of SURF equipment
 - Hookup and commissioning of FPSO and SURF equipment
 - Onshore waste management, recycling, treatment, and disposal
- Production operations stage
 - FPSO vessel operations
 - Power and heat generation
 - Non-routine, temporary flaring
 - Treated produced water discharge
 - Brine discharges from sulfate removal and potable water processing
 - Treated sanitary wastewater effluent discharge

- Ballast water discharge (one time at mobilization)
- Non-hydrocarbon (non-contact) cooling water discharge
- Gas re-injection into reservoir
- Seawater intake
- Treated seawater injection into reservoir
- Chemical use (topsides, subsea, downhole)
- Oil offloading to conventional tankers
 - Tanker power generation
 - Venting of cargo tanks during oil loading
 - Seawater intake for ballast operations
 - Tanker ballast water discharge on arrival
 - Tanker treated domestic wastewater effluent discharge
- Offshore waste treatment and disposal, potentially including waste incineration
- Onshore waste management, recycling, treatment, and disposal
- Decommissioning stage
 - Marine decommissioning vessels and FPSO
 - Power generation
 - Disconnection of mooring system and SURF equipment
 - Wastewater effluent discharges
 - Offshore waste treatment and disposal, potentially including waste incineration
 - Onshore waste management, recycling, treatment, and disposal
- Logistical support (across all Project stages)
 - Supply and support vessel/aircraft operations
 - Onshore fuel transfers from suppliers
 - Utilization of shorebase(s), including pipe yards and warehouses
 - Onshore waste management, recycling, treatment, and disposal
- Non-routine, unplanned events
 - Oil spill or release – FPSO/SURF production operations
 - Oil spill or release – loss of well control event
 - Other oil spills or releases
- Other unplanned events (e.g., vehicular accident, helicopter accident, vessel collision)

The EIA will describe the key marine operational procedures and safety controls associated with tanker transit within Guyana waters and during offloading of oil from the FPSO to the tankers within the Stabroek Block. Although outside the scope of the EIA, the EIA will also provide a conceptual description of the key marine and terminal operational procedures and safety controls that will be utilized during international transit outside of Guyana waters, in order to enhance stakeholder understanding on tanker-related maritime spill prevention and response outside of the Guyana jurisdiction.

Ancillary/support activities or facilities that are not components of the Project but are associated with the Project also may potentially interact with existing resources/receptors, and these interactions could potentially create induced environmental or socioeconomic impacts.

The EIA will discuss EEPGL's use of existing onshore facilities which are owned and operated by others (noting that none of these will be Liza Phase 2 Project-dedicated facilities). Where EEPGL has obligations to ensure its employees and its contractors are working within regulatory requirements and the measures established in the EIA and related Environmental Permit conditions, the EIA will discuss measures to ensure conformance with these requirements. The Liza Phase 2 Project is not expected to include any new onshore facility expansion; accordingly, the EIA will not assess potential impacts from such expansions (if they were to occur), if they were to be proposed by those parties in the future.

7.3. SCOPE OF THE ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING ELEMENT

The EIA will include an environmental and social management element, which will be informed by the findings of the impact assessment chapter of the EIA. In keeping with the "modular" organizational structure of the existing conditions and impact assessment components of the EIA discussed in Section 10, Structural Organization of the EIA, recommended management measures that apply to a particular environmental receptor or medium (e.g., water quality, air quality, vehicular traffic) will be described in the relevant section of the EIA. These measures will also be compiled as part of a comprehensive ESMP, which will be submitted as a supplement to the EIA.

7.3.1. ESMP Structure

The comprehensive ESMP will also include affiliate-level management plans (e.g., stakeholder engagement, grievance management), plans affecting numerous environmental media (e.g., end of operations and decommissioning) or plans developed to manage specific contingencies that are reasonably foreseeable but not part of the proposed Project (e.g., chance finds of cultural heritage, oil spill). These plans will include the following (as components of the comprehensive ESMP):

- Environmental Management Plan, including:
 - Air Quality Management
 - Water Quality Management
 - Waste Management Plan
 - Marine Ecosystems Management
- Socioeconomic Management Plan, including:
 - Stakeholder Engagement
 - Grievance Management (Grievance Management Procedures will be made available to communities within the Project's Direct and Indirect AOIs)
 - Marine Transportation Management
 - Air and Road Transportation Management

- Cultural Heritage Management, including Chance Finds
- Oil Spill Response Plan (OSRP), including:
 - Oil Spill Modeling
 - Net Environmental Benefit Analysis
 - Emergency Preparedness and Response Procedures
 - Wildlife Response Plan
 - Geographic Strategic Response Maps
- Preliminary End of Operations Decommissioning Plan
- Environmental and Socioeconomic Monitoring Plan

All management measures will be linked to specific potential impacts from the Project and will be accompanied by recommendations for implementing the recommended management measures, as well as auditing and reporting procedures that can be used to assess and communicate the effectiveness of such measures.

The management strategy will adapt the implementation of management measures to seek the desired outcomes. This adaptive approach will provide the Project, in consultation with the EPA and other stakeholders, the following opportunities:

- Address any unanticipated adverse impacts that are encountered;
- Adjust or replace management measures, when appropriate, during the Project life cycle to address evolving impacts;
- Retire management measures when they are no longer demonstrating value; and
- Add new management measures when required to address new impacts.

The Project will apply a hierarchy of controls when developing the management plans. The hierarchy is a series of sequential steps that emphasize proactive (in preference to reactive) strategies to limit adverse impacts throughout the Project's life cycle. The hierarchy consists of the following steps, in order of preference:

- Avoid risks related to environmental and socioeconomic impacts by employing alternative approaches to achieve Project objectives;
- Reduce the probability and/or consequence of impacts that cannot be avoided through mitigation measures; and
- Remedy impacts that occur despite avoidance and reduction actions, which may include rehabilitation, reclamation, restoration, and/or compensation.

At each step in the hierarchy, options for reducing the impact magnitude and resource/receptor sensitivity/vulnerability/importance that underpin the significance of each potentially adverse impact will be evaluated. Demonstrating capacity to manage non-routine, unplanned events such as emergencies or spills is an important and integral component of the permitting process. As such, the EIA will account for the possibility of non-routine, unplanned events as part of the environmental and socioeconomic management strategy.

7.3.2. International Oil & Gas Sector Environmental Standards

The ESMP will specify the environmental performance criteria that will be utilized by the Project. These environmental performance criteria will be consistent with good international industry practice and the ESMP will include a discussion of EEPGL’s proposed cuttings management approach, among other performance criteria (e.g., residual oil and grease limits for produced water, temperature limits for cooling water). Table 7-1 presents a preliminary summary of the key environmental performance criteria the Project will utilize; these are consistent with the related performance criteria referenced in the *World Bank Group EHS Guidelines for Offshore Oil and Gas Development and other international standards (e.g., International Maritime Organization, IOGP)*. The EIA will expand on this list, as appropriate.

Table 7-1: Preliminary Summary of Environmental Performance Criteria to be Utilized by the Project

Aspect	Performance Criteria to be Applied	International Standard Which References Applied Performance Criteria
Drilling Fluids and Cuttings – NADF	Use low-toxicity IOGP Group 3 Non-Aqueous Base Fluid (NABF).	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Drilling Fluids and Cuttings – NADF	Use solids control and cuttings dryer systems to treat cuttings, such that, for discharged cuttings, end of well maximum weighted mass ratio averaged over all well sections drilled using NABF does not exceed 6.9 percent wet weight base fluid retained on cuttings.	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Produced Water	Treat to comply with an oil in water content of 29 mg/L (monthly average) and 42 mg/L (daily maximum).	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Cooling Water	Avoid increases in ambient water temperature of more than 3°C at 100 m (~328 feet) from the point of discharge.	World Bank Group EHS Guidelines for Offshore Oil and Gas Development
Sewage	Treat sewage with a marine sanitation device and comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78
Food Waste	Comminuted to 25 mm diameter particle size or less and comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78
Deck Drainage	Comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78
Bilge Water	Comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78
Ballast Water	Comply with requirements.	International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78

7.3.3. Occupational Safety and Health Management

While not a requirement of the Environmental Protection Act or the EPA's published EIA guidelines, the EIA will include a summary of key occupational safety and health management programs that will be put in place as part of the Project, including training- and induction-related aspects utilized to verify Project personnel are familiar with expectations and understand the requirements.

The EIA will discuss the potential occupational safety and health risks posed by potential radiation exposure from industrial radiation sources that could be used by the Project (e.g., radiography for non-destructive testing) or Naturally Occurring Radioactive Material (NORM) that could potentially be associated with the production operations stage. The EIA will describe the standard industry controls that EEPGL and its contractors would utilize to manage risks associated with radiation exposure.

7.3.4. Management Organization

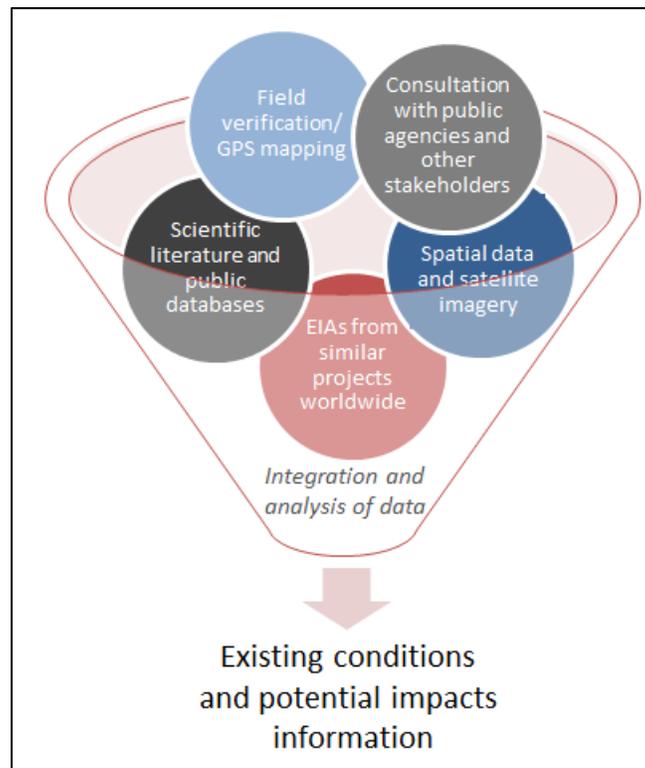
The ESMP will include a section on the management organization that will ensure implementation of the ESMP, including organizational roles and responsibilities.

7.4. PURPOSE AND NEED AND ALTERNATIVES

The EIA will describe the purpose and need for the Project, including a description of the intended results of the Project, and what benefits the Project results are expected to generate. With this purpose and need in mind, the EIA will describe alternatives considered when defining the proposed Project, including development concept alternatives and alternatives for key technology, equipment, and processes. This will include alternatives related to management of produced gas.

8. DESCRIPTION OF EXISTING CONDITIONS

Information on existing conditions in the Project AOI will be obtained using a mixed-methods approach that integrates various sources of data, as illustrated on Figure 8-1. The data obtained from this approach will also inform identification and understanding of potential impacts, including potential cumulative effects.



GPS = global positioning system

Figure 8-1: Mixed Methods Approach for Existing Conditions Characterization

EEPGL will build upon the prior characterization of existing conditions as established and assessed in the Liza Phase I Development Project EIA, as well as other EEPGL-related environmental authorizations in and around the Stabroek Block. Existing conditions will continue to be characterized based on remote-sensing imagery and data, available desktop studies, literature reviews, interviews and consultations with local stakeholders and communities, prior field studies, surveys and monitoring efforts conducted by EEPGL, and/or other planned studies, as further described below.

As described in Section 9.2, Additional Analyses to Support the EIA, the EIA will include a robust Stakeholder Engagement Plan, which will be provided to the EPA. The stakeholder engagement activities will build upon prior engagements with regulators and stakeholders conducted during the exploration campaigns and the Liza Phase 1 Development Project EIA process. EEPGL will conduct oil and gas industry-focused, technical capacity-building

workshops (e.g. oil spill preparedness and response) for regulators and other stakeholders as appropriate to enhance understanding of this emerging sector. Stakeholder engagement activities will also include one-on-one engagements with stakeholders from government agencies, the business community, civic organizations, and the public.

8.1. PRIOR AND ONGOING ENVIRONMENTAL STUDIES

EEPGL consultants conducted a number of studies prior to submitting the Application for Environmental Authorisation for the Project. Although all of these studies were not scoped specifically to support the Project, they will provide information that is relevant to the Project EIA. Table 8-1 summarizes these studies and their relevance to the Project EIA.

Table 8-1: Prior and Ongoing Studies that will Support the Project EIA

Study	Relevance to the Project EIA
Marine Mammal and Protected Species Observation Study	This study is ongoing since 2015, and observations continue to be collected by trained marine mammal and protected species observers on board EEPGL’s offshore vessels. Findings will be incorporated into the marine mammals and marine turtles sections of the EIA.
Marine and Coastal Bird Study	The marine bird study was initiated in late 2017 and included offshore and coastal components. A second survey will be conducted in March/April 2018 to provide comparative data on bird abundance and distributions from different seasons. Findings will be incorporated into the coastal birds and seabirds sections of the EIA.
Marine Fish Study	The marine fish study was initiated in late 2017 and included deep water and coastal components. A second survey will be conducted in March/April 2018 to provide comparative data on fish abundance and distributions from different seasons. Findings will be incorporated into the marine fish and marine benthos sections of the EIA.
Environmental DNA Study	An environmental DNA study is ongoing, involving collection of water and sediment samples opportunistically acquired during offshore work, and DNA analysis of the samples. The study provides information on the number of species present in the AOI on the basis of remnant DNA in the water column from naturally shed tissue fragments. The result of this study will be used to enhance the understanding of biodiversity in the AOI.
Marine Turtle Tracking Study	This study will be initiated in late March 2018 and will include tagging of nesting sea turtles in the Shell Beach Protected Area and subsequent tracking of the sea turtles using telemetry. Data from this study will be used to supplement existing information on sea turtle movements (and their consequent susceptibility to Project-related impacts).
Coastal Mapping Field Verification Study	Field verification of previously conducted coastal sensitivity mapping was performed in 2017 in Regions 2-6, and additional verification mapping using similar field methodologies will be conducted in Region 1 in March/April 2018. This effort includes confirmation of existing coastal sensitivity maps for coastal Regions 1, 2, 3, 4, 5, and 6. The field verification procedures involved visiting each shoreline unit (distinct polygon on the existing Coastal Sensitivity GIS Maps) to confirm shoreline types, document habitat features, and determine habitat conditions. Habitat classification is based on the U.S. National Oceanographic and Atmospheric Administration environmental sensitivity index mapping procedures for shoreline types that may occur in Guyana. Coastal biological resources field surveys are also conducted in tandem with the Coastal Mapping Field Verification Study.

Study	Relevance to the Project EIA
	The coastal study includes an assessment of ecosystem services, which are typically defined as the benefits that people obtain from the natural environment. This portion of the study is being completed using a Community-Based Participatory Research approach, which integrates Traditional Cultural Knowledge into the assessment. The condition of mangroves and other sensitive shoreline habitats are also documented. After ecosystem services in the coastal regions are identified through participatory stakeholder engagement, they are subsequently mapped in the field. Data from this study will be cited in the biological and socioeconomic resource/receptor sections of the EIA, and will be used to refine EEPGL’s OSRP, which will be included in the Project ESMP. Updated coastal sensitivity maps also will be incorporated into the EIA.
Environmental Baseline Study (Water and Sediment Quality; Benthic Fauna)	EEPGL has commissioned iterative environmental baseline studies (EBS) within and surrounding the direct AOI since 2014. Findings from the water quality component of the EBS will be incorporated into the marine water quality section of the EIA, and data from this study will inform the water quality models that will be used to quantify the potential effects of routine and unplanned discharges from the Project. Findings from the marine sediment component of the EBS will be incorporated into the marine sediment section of the EIA. Findings from the benthic fauna component of the EBS will be incorporated into the marine benthos section of the EIA.
Metocean Conditions Study	EEPGL has been collecting metocean data in the Stabroek Block since 2016 and will continue to collect these data until mid-2018. The results will refine the characterization of meteorological and oceanographic conditions within the Stabroek Block. This information will inform the air dispersion and water quality models that will be integrated into the physical impact analyses in the EIA.
Offshore Air Quality Monitoring Study	In October 2016, an offshore air quality measurement event was conducted in and around the Phase 1 PDA. The event included measurement of ambient concentrations of the particulate matter (PM ₁₀), carbon monoxide, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, and volatile organic compounds.

DNA = deoxyribonucleic acid

8.2. ADDITIONAL PLANNED STUDIES

In addition to the studies described in Section 8.1, Prior and Ongoing Environmental Studies, that were scoped prior to submission of the Project Application for Environmental Authorisation and are currently underway, several additional studies will be conducted to further support the assessment of impacts from the Project.

8.2.1. Marine Bird Study

Due to the limited knowledge and highly variable nature of marine bird presence, abundance, and distribution in offshore Guyana, an additional marine bird survey will be conducted to supplement the marine bird surveys referenced in Section 8.1, Prior and Ongoing Environmental Studies. This will include a survey focused on the Phase 2 PDA, conducted in conjunction with other planned offshore activities. The findings of the study will inform the analysis of direct and indirect impacts on marine birds in the Liza field by identifying any particularly sensitive species in the Project AOI. The findings of the study will also support prioritization of response activities in the OSRP.

8.2.2. Marine Fish Study

Building on the information gathered on the distribution and abundance of marine fish and benthic communities in offshore Guyana during the Liza Phase 1 post-permitting fish study, additional marine fish study work will be conducted to support the Phase 2 EIA. This study will feature more sampling in the continental shelf and offshore/deepwater areas that could be potentially affected by Project-related activities. The findings of the study will inform the analysis of direct and indirect impacts on marine biota in the Liza field by identifying any particularly sensitive species and describing the distribution of fishery resources relative to the Project AOI. The findings of the study will also support prioritization of response activities in the OSRP.

8.2.3. Onshore Traffic Study

The Project's offshore activities will require onshore vehicular traffic, as personnel, materials, and supplies supporting offshore operations are transported in and out of Guyana shorebase(s). An onshore traffic study will be conducted to characterize existing traffic conditions in the vicinity of the Guyana shorebase(s), and to support an assessment of onshore traffic impacts considering anticipated level of Project-related traffic.

8.2.4. Marine Vessel Traffic Study

The Port of Georgetown (the mouth of the Demerara River inland past the Demerara Harbour Bridge) contains more than 40 separate wharves, including six primary cargo wharves, ferry docks, and fishing docks, among others. Marine vessels in support of the Project will use the Port of Georgetown as their base of operations in Guyana. This study will quantify vessel activity in Georgetown Harbor in terms of ingoing, outgoing, and intra-harbor vessel trips. The findings of the study will inform the assessment of the Project vessels' potential impacts to marine use and transportation, as well as the Project's predicted contribution to cumulative impacts from congestion in the lower Demerara River.

8.2.5. Offshore Air Quality Monitoring Study

Building on the information gathered during the offshore air quality monitoring survey referenced in Section 8.1, Prior and Ongoing Environmental Studies, an additional set of offshore air quality measurements will be collected from the vicinity of the Phase 2 PDA. These data will be considered together with prior offshore air quality monitoring data to aid in assessing impacts to air quality from Project-related activities and will be used to validate the initial assumptions in the modeling regarding offshore air quality.

9. SCOPING AND IDENTIFICATION OF POTENTIAL SOURCES OF PROJECT-GENERATED IMPACTS

This section of the ToR discusses the scoping of the EIA by resource/receptor, as well as the identification of the potential direct and indirect environmental and socioeconomic impacts that could credibly result from the Project.

Table 9-1 identifies the resources/receptors that could potentially be impacted by the Project, describes the potential impacts, describes the potential Project sources of the impacts, and summarizes the proposed assessment approach to be utilized in the EIA.

Table 9-1: Summary of Resources/Receptors, Potential Impacts, Sources of Potential Impacts, and Assessment Approach

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
<i>Physical Resources</i>			
Air Quality and Climate	Air emissions resulting from the Project have the potential to change ambient air quality in the Project AOI on a localized basis. Air quality is important for health of humans and wildlife.	<ul style="list-style-type: none"> • Power generation • Other marine vessel and support aircraft combustion sources • Non-routine, temporary flaring • Fugitive emissions from crude oil storage and offloading • Waste incineration 	<p>Ambient offshore air quality data were collected in and around the PDA for the Liza Phase 1 Development Project, approximately 190 kilometers (approximately 120 miles) offshore of Guyana, and included measurements of respirable particulate matter (PM₁₀), carbon monoxide, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, and volatile organic compounds. An additional set of offshore air quality monitoring data for these constituents, as well as for fine particulate matter (PM_{2.5}), will be collected in the vicinity of the Phase 2 PDA. The collective data set will inform the assessment of potential impacts to air quality by validating the initial assumptions in the modeling regarding ambient air quality conditions.</p> <p>Project emission inventories will be prepared for these pollutants and air quality dispersion modeling will be conducted to identify potential air quality impacts associated with planned Project activities.</p> <p>Estimated greenhouse gas emissions for the Project will be calculated.</p>
Sound	Operations on the FPSO and other Project marine vessels will have the potential to result in auditory impacts to Project workers. Potential underwater sound impacts to biological receptors are addressed below for those groups of receptors.	<ul style="list-style-type: none"> • Equipment/machinery operating on board the FPSO, drill ships and other marine vessels (relative to potential impacts to Project workers) 	<p>The EIA will discuss that occupational-related risks will be managed through appropriate design and industrial hygiene and exposure management practices.</p>
Marine Geology and Sediments	The Project will disturb marine geology and sediments on a localized basis in the PDA and could impact sediment quality from deposition of NABF adhered to discharged drill cuttings. Indirect impacts on seismicity and other natural hazards are not expected; the rationale for this will be provided in the EIA.	<ul style="list-style-type: none"> • Drilling of development wells, including cuttings discharge • Installation of FPSO mooring lines and SURF components 	<p>EEPGL conducted prior sampling of marine sediments in the Stabroek Block as part of iterative EBS events. Additional data will be collected from the Phase 2 PDA to expand this data set. The collective EBS data will inform the assessment of potential impacts to sediment quality by describing the biophysical attributes of the seafloor (e.g., composition, stability) that influence stability and recovery after disturbance.</p> <p>A fate and transport model will be used to simulate cuttings and drilling fluid deposition surrounding the Project development wells. The predicted changes to the native seafloor morphology from the accumulated drill cuttings and other Project-related activities that will impact the seafloor, as well as the distribution of residual NABF on drill cuttings, will be described based on the results of the modeling analysis.</p> <p>The EIA will describe the reasonably foreseeable effects of oil extraction and injection of water and gas on geological stability, as well as an assessment of the Project's foreseeable impact on geological/seismic hazards (to the extent they may exist).</p>
Marine Water Quality	The Project could have localized impacts to marine water quality in the PDA from discharge of drill cuttings and from routine operational and hydrotesting discharges. The Project also could potentially impact marine water quality in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Drilling of development wells (cuttings and drilling fluid discharge) • Cooling water discharges • Installation of FPSO and SURF components • Wastewater effluent discharges • Produced water discharges • Hydrotesting discharges • Non-routine, unplanned event (i.e., oil spill or release) 	<p>EEPGL conducted prior sampling of marine water quality in the Stabroek Block as part of iterative EBS surveys. The collective data will inform the assessment of potential impacts to marine water quality by validating the assumptions of the model regarding ambient water quality conditions.</p> <p>Fate and transport modeling will be used to evaluate total suspended solids concentrations resulting from discharge of cuttings. The GEMSS model will be used to simulate the mixing zone around the drill ships and FPSO, and to support an analysis of impacts on marine water quality from routine production operations discharges and one-time hydrotesting discharges. Oil spill modeling will be used to estimate concentrations of dissolved hydrocarbons that might result from different unplanned event scenarios (i.e., oil spills or releases).</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
<i>Biological Resources/Receptors</i>			
Protected Areas and Special Status Species	<p>The Project is not expected to impact protected areas as a result of routine, planned activities in the Project AOI. The Project could potentially impact protected areas in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).</p> <p>The Project could potentially impact some special status species individuals (e.g., listed endangered or threatened species) in the PDA as a result of underwater sound, light, seawater withdrawal, and/or changes in marine water quality. The Project could potentially impact special status species in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).</p>	<ul style="list-style-type: none"> • Underwater sound generated by marine operations • Lighting on offshore facilities (e.g., FPSO, drill ships) • Seawater intake by FPSO • Wastewater effluent discharges • Drilling of development wells (cuttings and drilling fluid discharge) • Cooling water discharges • Produced water discharges • Hydrotesting discharges • Vessel movements • Non-routine, unplanned event (e.g., oil spill or release, vessel strikes with marine mammals or turtles) 	<p>As part of an ongoing study initiated prior to scoping for the Project EIA, data on marine fish abundance and distributions are being collected from the Stabroek Block. An additional marine fish sampling survey will be conducted in the Phase 2 PDA. The combined data set from these surveys will be incorporated into the EIA to inform the assessment of impacts to special status marine fish species. The study will be used to determine whether the fish community in the Project AOI includes any particularly sensitive species, as well as to characterize the distribution of fishery resources relative to the Project AOI.</p> <p>A study initiated prior to scoping for the Project EIA includes tagging and tracking of movements of nesting sea turtles in the Shell Beach Protected Area. Data from this study will be used to supplement existing information on sea turtle movements (and their consequent susceptibility to Project-related impacts).</p> <p>Marine mammal and other protected species observations from EEPGL's offshore vessels have been ongoing since 2015. Findings from these observations will be incorporated into the assessment of impacts to protected marine mammal and other protected fish and turtle species.</p> <p>Based on a review of the Phase 1 Development Project subsea noise modeling analysis, the physical attributes of the Phase 2 Project subsea infrastructure, and marine features that could affect subsea noise propagation (primarily depth, proximity to unique bathymetric features, and angle and direction of the continental slope), the modeling conducted for the Phase 1 Development Project EIA is relevant to the assessment of potential impacts from the Phase 2 project. Accordingly, these results will be incorporated into the Phase 2 Project EIA by reference, and used as the basis for the assessment of potential underwater noise impacts to sensitive species.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and assess the potential risk of oiling impacting any designated protected areas. Consistent with the approach taken for marine mammals, turtles, and fish without special-status designation, the scientific literature will be reviewed for information on the impacts of planned offshore activities on special status species, including marine turtles, marine fish, and marine mammals. Oil spill modeling will be used to assess potential spill-related impacts.</p> <p>The GEMSS model will be used to simulate the mixing zone around the drill ships and FPSO and to support an analysis of changes to marine water quality from routine operational discharges and one-time hydrotesting discharges (and to assess any associated impacts to special status marine species). A fate and transport model will be used to evaluate total suspended solids concentrations resulting from discharge of drilling fluid and cuttings, and to assess associated impacts to on special status marine species.</p>
Coastal Habitats	<p>The Project is not expected to impact beaches, mangroves, or wetlands in the Project AOI as a result of routine, planned activities. The Project could potentially impact beaches, mangroves, and wetland habitats in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).</p>	<ul style="list-style-type: none"> • Non-routine, unplanned event (e.g., oil spill or release) 	<p>As part of a study initiated prior to scoping for the Project EIA, coastal sensitivity mapping, and field verification is being conducted to characterize coastal habitats within the Project AOI. The results of this study will be used primarily to prioritize oil-spill response activities.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and the results of the oil spill modeling will be considered together with coastal sensitivity mapping data to assess the risk from oiling beaches, mangroves, or wetlands.</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
Coastal Wildlife and Shorebirds	The Project is not expected to impact coastal wildlife or shorebirds during routine, planned activities in the Project AOI. The Project could potentially impact coastal wildlife and shorebirds in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Non-routine, unplanned event (e.g., oil spill or release) 	<p>As part of a study initiated prior to scoping for the Project EIA, coastal sensitivity mapping and field verification are being conducted to characterize coastal biodiversity with the Project AOI. The results of this study will be used primarily to prioritize oil-spill response activities.</p> <p>As part of a study initiated prior to scoping for the Project EIA, surveys are being conducted to characterize coastal bird abundance and distributions from different seasons.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and the results of the oil spill modeling will be considered together with coastal biodiversity data and coastal bird data to assess the risk to these resources/receptors from an oil spill or release.</p>
Seabirds	The Project could potentially impact seabirds in a localized manner as a result of light (i.e., disorientation) and other offshore marine operations. The Project could potentially impact seabirds in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Drill ships, FPSO, and support vessel operations • Lighting on offshore facilities (related to potential for disorientation of seabirds) • Non-routine, temporary flaring • Waste incineration • Non-routine, unplanned event (e.g., oil spill or release) 	<p>As part of a study initiated prior to scoping for the Project EIA, surveys of marine bird abundance and distributions from different seasons are being conducted within the Stabroek Block. The combined data set from these surveys will be incorporated into the EIA to inform the assessment of impacts to marine birds by identifying any particularly sensitive species in the Project AOI.</p> <p>Oil spill modeling will be used to simulate the trajectory of an oil spill and the results of oil spill modeling will be considered together with the marine bird data to assess potential spill-related impacts on seabirds.</p>
Marine Mammals	The Project could potentially impact marine mammal individuals in a localized manner in the Project AOI as a result of Project-related underwater sound, light, seawater withdrawal, and/or changes in marine water quality. The Project could potentially impact marine mammal individuals in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Underwater sound generated by marine operations • Changes in forage availability • Lighting on offshore facilities (e.g., FPSO, drill ships) • Seawater intake by FPSO • Wastewater effluent discharges • Drilling of development wells (cuttings and fluid discharge) • Cooling water discharges • Produced water discharges • Hydrotesting discharges • Non-routine, unplanned events (i.e., oil spill or release, vessel strikes) 	<p>Marine mammal and other protected species observations from EEPGL's offshore study vessels have been ongoing since 2015. Findings from these observations will be reviewed together with information from scientific literature to inform the assessment of impacts to marine mammal species by identifying any particularly sensitive species and describing the distribution of fishery resources relative to the Project AOI.</p> <p>Based on a review of the Phase 1 Development Project subsea noise modeling analysis, the physical attributes of the Phase 2 Project subsea infrastructure, and marine features that could affect subsea noise propagation (primarily depth, proximity to unique bathymetric features, and angle and direction of the continental slope), the modeling conducted for the Phase 1 Development Project EIA is relevant to the assessment of potential impacts from the Phase 2 project. Accordingly, these results will be incorporated into the Phase 2 Project EIA by reference, and used as the basis for the assessment of potential underwater noise impacts to marine mammals.</p> <p>The GEMSS model will be used to simulate the mixing zone around the drill ships and FPSO and to support an analysis of changes to marine water quality from routine operational discharges and one-time hydrotesting discharges (and to assess associated impacts to marine mammals). A fate and transport model will be used to evaluate total suspended solids concentrations resulting from discharge of drilling fluid and cuttings, and to assess associated impacts to marine mammals.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and the results of oil spill modeling will be considered together with the marine mammal data to assess potential spill-related impacts on marine mammals.</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
Marine Turtles	<p>The Project could potentially impact marine turtle individuals in a localized manner in the Project AOI as a result of Project-related underwater sound, light, seawater withdrawal, and/or changes in marine water quality. The Project could potentially impact marine turtle individuals in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).</p>	<ul style="list-style-type: none"> • Underwater sound generated by marine operations • Changes in forage availability • Lighting on offshore facilities (e.g., FPSO, drill ships) • Seawater intake by FPSO • Wastewater effluent discharges • Drilling of development wells (cuttings and fluid discharge) • Cooling water discharges • Produced water discharges • Hydrotesting discharges • Non-routine, unplanned events (i.e., oil spill or release, vessel strikes) 	<p>A study initiated prior to scoping for the Project EIA includes tagging and tracking of movements of nesting sea turtles in the Shell Beach Protected Area. Data from this study will be used to supplement existing information on sea turtle movements (and their consequent susceptibility to Project-related impacts).</p> <p>The GEMSS model will be used to simulate the mixing zone around the drill ships and FPSO and to support an analysis of changes to marine water quality from routine operational discharges and one-time hydrotesting discharges (and to assess associated impacts to marine turtles). A fate and transport model will be used to evaluate total suspended solids concentrations resulting from discharge of drilling fluid and cuttings, and to assess any associated impacts to marine turtles.</p> <p>Based on a review of the Phase 1 Development Project subsea noise modeling analysis, the physical attributes of the Phase 2 Project subsea infrastructure, and marine features that could affect subsea noise propagation (primarily depth, proximity to unique bathymetric features, and angle and direction of the continental slope), the modeling conducted for the Phase 1 Development Project EIA is relevant to the assessment of potential impacts from the Phase 2 project. Accordingly, these results will be incorporated into the Phase 2 Project EIA by reference, and used as the basis for the assessment of potential underwater noise impacts to marine turtles.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and the results of oil spill modeling will be considered together with the marine turtle data to assess potential spill-related impacts on marine turtles.</p>
Marine Fish	<p>The Project could potentially impact marine fish as a result of underwater sound, light, seawater withdrawal, and changes in marine water quality in the PDA. The Project could potentially impact marine fish in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).</p>	<ul style="list-style-type: none"> • Underwater sound generated by marine operations • Changes in forage availability • Lighting on offshore facilities (e.g., FPSO, drill ships) • Seawater intake by FPSO • Wastewater effluent discharges • Drilling of development wells (cuttings and fluid discharge) • Cooling water discharges • Produced water discharges • Hydrotesting discharges • Non-routine, unplanned events (i.e., oil spill or release) 	<p>As part of an ongoing study initiated prior to scoping for the Project EIA, data on marine fish abundance and distributions are being collected from the Stabroek Block. An additional marine fish sampling survey will be conducted in the Phase 2 PDA. The combined data set from these surveys will be incorporated into the EIA to inform the assessment of impacts to marine fish species by identifying any particularly sensitive species and describing the distribution of fishery resources relative to the Project AOI. The findings of the study will also support prioritization of response activities in the OSRP.</p> <p>The GEMSS model will be used to simulate the mixing zone around the drill ships and FPSO and to support an analysis of changes to marine water quality from routine operational discharges and one-time hydrotesting discharges (and to assess associated impacts to marine fish). A fate and transport model will be used to evaluate total suspended solids concentrations resulting from discharge of drilling fluid and cuttings, and to assess any associated impacts to marine fish.</p> <p>Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and the results of oil spill modeling will be considered together with the marine fish data to assess potential spill-related impacts on marine fish.</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
Marine Benthos	The Project could potentially disturb some benthic habitat and organisms in a localized manner in the PDA.	<ul style="list-style-type: none"> • Drilling of development wells (cuttings discharge and deposition) • Installation of FPSO (mooring structures) and SURF components 	<p>EEPGL conducted prior sampling of marine benthos in the Stabroek Block as part of iterative EBS surveys. The collective EBS data will inform the assessment of potential impacts to marine benthos. Additionally, as part of an ongoing study initiated prior to scoping for the Project EIA, ancillary observations of marine benthos are being collected from the Stabroek Block as part marine fish studies. An additional marine fish sampling survey will be conducted in the Phase 2 PDA. The combined data set from these surveys will be incorporated into the EIA to inform the assessment of impacts to marine benthos by characterizing the overall rarity or sensitivity of the benthic community and identifying any particularly sensitive species.</p> <p>A fate and transport model will be used to predict the extent and thickness of cuttings discharged on the seafloor surrounding the development wells. This data will be considered in combination with the above information to assess any impacts to marine benthos as a result of drill cuttings deposition.</p>
Ecological Balance and Ecosystems	The Project could have indirect impacts on ecological functions in the Project AOI, particularly if special status species or trophic relationships are disturbed.	<ul style="list-style-type: none"> • Underwater sound generated by marine operations • Lighting on offshore facilities (e.g., FPSO, drill ships) • Seawater intake by FPSO • Installation of FPSO and SURF components • Installation-related disturbances to seafloor • Wastewater effluent discharges • Ballast water discharges • Waste incineration • Non-routine, unplanned event (e.g., oil spill or release) 	The scientific literature will be reviewed to assess the ecological relationships between major marine taxonomic groups. Oil spill modeling will be used to assess potential spill-related impacts on marine organisms.
<i>Socioeconomic Resources / Receptors</i>			
Economic Conditions	The Project is generally anticipated to have a positive impact on the economy of Guyana as a result of government revenue sharing from the Project, as well as employment and local procurement opportunities. Potential adverse impacts may include potential shorter-term increases in the cost of living as a result of increased demand for specific goods and services. Potential adverse impacts to income from agriculture and fisheries could also occur as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Government revenue sharing from Project • Local Project purchases of select materials, goods and services • Limited local Project employment (direct and indirect) • Increased spending on select materials, goods and services (indirect multiplier impacts for local/regional population) 	Government reports will be reviewed and key informant interviews will be conducted to identify key economic drivers in the national, regional, and local economies and determine the likely Project-related effects on these economic factors. A particular emphasis will be placed on livelihoods that are important to coastal communities.
Employment and Livelihoods	The Project is expected to build capacity in the local labor force, increase demand for skilled labor, and increase demand for service industries. There is the potential for limited adverse impacts to fishing activities as a result of marine safety exclusion zones or marine traffic, and non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Local employment for • Drill ships • Installation vessels • FPSO topside equipment and operations • Marine support and supply vessels • Tankers • Tugs and support vessels • Aviation operations • Marine safety exclusion zones • Project-related marine traffic • Drilling; FPSO/SURF installation, hookup and commissioning; and FPSO and support vessel operations (aspects relating to occupational health and safety for Project workforce) • Non-routine, unplanned event (e.g., spill or release) 	<p>Project workforce projections and types of labor requirements will be assessed against data obtained through key informant interviews on the existing service industry within Guyana. The potential for adverse impacts to fishing activities will be assessed by taking into consideration the distance from shore at which different fishery types typically operate, in comparison to the locations and durations of Project-related marine activity and marine safety exclusion zones. As part of studies initiated prior to scoping for the Project EIA, consultations were conducted with fishermen and others that may be directly or indirectly dependent on fishing to characterize catch quantities at key fish landing sites. Concerns regarding potential impacts on fishing were also discussed during the Phase 2-focused scoping consultation meetings. The collective body of information from these consultations will be used to assess potential socioeconomic impacts to fishermen in the AOI.</p> <p>The EIA will discuss that occupational-related risks will be managed through appropriate design and industrial hygiene and exposure management practices.</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
Community Health and Wellbeing	<p>Most Project activities will be located offshore and will have no direct impacts on communities in Guyana. Project-related increases in vehicular traffic could increase the potential for vehicle accidents. Introduction of limited levels of foreign labor for the Project workforce could potentially have community health and socioeconomic impacts due to social interaction or pressure on wages and increased competition for skilled labor. Non-routine unplanned events (i.e., oil spill or release) could impact health and wellbeing of communities via impacts to resources on which these communities depend.</p>	<ul style="list-style-type: none"> • Increased traffic as a result of Project activities at the Project shorebase locations (related to increased potential for vehicle accidents) • Social interaction between foreign Project workers and residents • Pressure on wages from introduction of foreign Project workers and increased competition for skilled labor • Non-routine, unplanned event (e.g., oil spill or release) 	<p>Potential risks to safety and health of local communities posed by shorebase operations will be assessed. Key informant interviews will be conducted to characterize existing road, marine and air traffic safety conditions, as well as coastal agriculture, aquaculture, and offshore/coastal fishing resources.</p> <p>As part of a study initiated prior to scoping for the Project EIA, the uses of natural resources by local coastal communities are being mapped to identify specific dependencies on resources that could be impacted by the Project. These data will be assessed to assess potential Project impacts on the quality or accessibility of these services. Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and to assess potential spill-related impacts on community health and wellbeing.</p>
Marine Use and Transportation	<p>The Project activities will result in increased marine shipping and general marine-related traffic, which could potentially contribute to marine vessel congestion in port areas.</p>	<ul style="list-style-type: none"> • Marine vessel operations 	<p>Key informant interviews will be conducted to characterize communities dependent on marine transportation and use for livelihoods (e.g., speedboat operators and fisherfolk), and to characterize existing marine vessel operations in the Project AOI. Publically available records of existing marine vessel traffic within the Port of Georgetown will be reviewed and these will be supplemented with additional primary data collected via observations of marine vessel traffic operating between the Guyana shorebase(s) and the mouth of the Demerara River. These data will be considered in conjunction with estimates of anticipated Project-related traffic and marine use to assess the incremental change in demand on the port's and harbor's capacities to accommodate foreseeable marine use and transportation demands.</p> <p>The EIA will also include a discussion of the tanker activities anticipated as a result of the Project, as well as the key operational procedures and controls (both within and outside of Guyanese waters) that will be implemented in relation to these activities.</p>
Social Infrastructure and Services	<p>The Project will use public infrastructure and services and thus could potentially compete with other existing businesses and consumers across a range of services (e.g., roads, medical and emergency response, accommodation, and utilities).</p> <p>The Project will result in increased vehicular traffic in Georgetown, which could potentially contribute to vehicular congestion in certain areas.</p>	<ul style="list-style-type: none"> • Project demand requirements for selected infrastructure and services, which could increase the burden on existing capacity and supply • Shorebase operations and other Project-related onshore transportation of materials and personnel, which could contribute to traffic congestion 	<p>Key informant interviews and review of publically available government reports will be conducted to assess existing demand on public infrastructure and services and to assess the impact that additional Project-related demand on these resources could have on impacted communities.</p> <p>Existing vehicular traffic conditions will be characterized through a traffic study conducted in the vicinity of the Guyana shorebase(s). Information from this study will be considered together with estimates of Project-related onshore traffic to assess the impact of Project-related vehicle movements on local traffic conditions and identify any problem areas in the vicinity of the Guyana shorebase(s) that currently present congestion-related concerns. These results will be used to assess the need for optimizing Project-associated vehicular traffic in the vicinity of the Guyana shorebase(s). The impact assessment section will include transportation and road safety management procedures that will be informed by the traffic study and focused on impacts predicted in the impact analysis.</p>
Cultural Heritage	<p>The Project has the potential to adversely affect cultural heritage through localized disturbance of any archeological or historic resources present in the subsea Project footprint. Such resources could have conservation, cultural, and other values to stakeholders. The Project also could potentially impact cultural heritage resources outside of the subsea Project footprint as a result of non-routine, unplanned events (i.e., oil spill or release).</p>	<ul style="list-style-type: none"> • Drilling of development wells • Installation of FPSO and SURF components • Non-routine, unplanned event (i.e., oil spill or release) 	<p>EEPGL has completed a geophysical and shallow geotechnical analysis that assessed the layout and field architecture for the Project AOI to site facilities away from faults, seabed obstructions, archaeological resources, sensitive biological resources, or other resources or hazards that could either damage the wells or SURF or be damaged by installation of these components. Autonomous underwater vehicles and other geophysical surveys will be utilized to assess for the presence of man-made objects on the seabed within the PDA.</p> <p>As part of an ongoing study initiated prior to scoping for the Project EIA, coastal communities in the Project AOI, including indigenous communities, are being engaged with respect to characterizing areas along the coast with cultural heritage significance. As part of this effort, key informant interviews are being conducted and Traditional Cultural Knowledge is being leveraged. Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill and to assess the potential for a release from an unplanned event to contact terrestrial cultural heritage sites.</p>

Resource or Receptor	Potential Impact	Primary Sources of Potential Impacts	Proposed Assessment Approach
Land Use	No new Project-dedicated land disturbance is planned. There is the potential that third-party onshore facilities may elect to expand or impact adjacent land as a result of supporting Project-related needs; however, these impacts are outside the scope of this EIA.	<ul style="list-style-type: none"> • Shorebase operations • Pipe yards • Warehouses • Bulk fuel storage and transfers • Onshore waste recycling, treatment and disposal facilities 	Land use in the area surrounding onshore facilities planned for Project use will be reviewed and assessed with respect to the potential for impacts to land use as a result of the Project.
Ecosystem Services	Project-related impacts on natural resources could lead to shorter-term direct or indirect impacts on the services and/or values derived from natural resources and ecosystems in the Project AOI.	<ul style="list-style-type: none"> • Direct or indirect impacts derived from one or more of the impacts on physical, biological, or socioeconomic resources described above 	As part of an ongoing study initiated prior to scoping for the Project EIA, the uses of natural resources by local coastal communities, including indigenous communities, are being engaged to identify specific dependencies on resources that could be impacted by the Project. Data from this effort, including Traditional Cultural Knowledge, will be used to aid in assessing dependencies on natural resources that could be impacted by the Project in terms of local communities' access to and use of impacted resources. Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill from the Project and to assess the potential for oil to contact areas providing ecosystem services.
Indigenous Peoples	The Project is not expected to directly cause any changes to population or demographics in indigenous communities. The Project could potentially impact indigenous peoples in the Project AOI as a result of non-routine, unplanned events (i.e., oil spill or release).	<ul style="list-style-type: none"> • Non-routine, unplanned event (i.e., oil spill or release) 	As part of an ongoing study initiated prior to scoping for the Project EIA, coastal communities, including indigenous communities, in the Project AOI are being engaged with respect to characterizing coastal biodiversity and ecosystem services. As part of this effort, key informant interviews are being conducted and Traditional Cultural Knowledge is being leveraged to characterize socioeconomic conditions in communities, and their reliance on natural resources. Data from this effort will be used to aid in the assessment of impacts for the Project. Oil spill modeling will be used to simulate the trajectory of a hypothetical oil spill from the Project and to assess the potential for oil to contact lands and natural resources of coastal communities.

GEMSS = Generalized Environmental Modeling System for Surfacewaters; NABF = non-aqueous base fluid

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9.1. STAKEHOLDER ENGAGEMENT PROCESS

9.1.1. Scoping Engagement

Following the submittal of the Phase 2 Application for Environmental Authorisation, the EPA conducted a series of scoping consultation meetings to aid in the development of the ToR. The objectives of the meetings were to provide stakeholders with information about the Project and the potential environmental and socioeconomic effects of the Project, and to allow the public and government agencies to provide feedback on the scope of the ToR. This included feedback on the key issues to be addressed as part of the ToR development and eventual EIA process.

Meetings with the public were held in each of the six coastal regions, along with a separate meeting in Georgetown for the sector agencies. The meetings are listed in Table 9-2.

Table 9-2: Scoping Consultation Meetings

Meeting	Town	Location	Date
Sector Agencies	Georgetown	Pegasus Hotel	January 16, 2018
Region 1	Mabaruma	Learning Resource Centre	February 2, 2018
Region 2	Anna Regina	Cotton Field Secondary Public School	January 24, 2018
Region 2	Charity	Charity Office Site	January 25, 2018
Region 3	Leonora	Leonora Technical & Vocational Training Centre	January 26, 2018
Region 4	Georgetown	Marian Academy	February 5, 2018
Region 5	Hopetown	Multipurpose Cooperative Society	January 17, 2018
Region 6	No. 66 Village	Fishing Cooperative	January 18, 2018

The generalized themes of the questions and comments pertaining to the ToR obtained during the scoping process include, but are not limited to, the following:

- Project location, description, and schedule
- EIA process and procedures
- Non-routine, unplanned events (e.g., spill or release)
- Impacts to environmental resources
- Waste management
- Health and safety
- Employment and livelihoods
- Socioeconomic factors

The feedback from the scoping consultation meetings has been evaluated and integrated appropriately into the ToR. The information from these scoping consultation meetings, as well as additional consultations to supplement this information, will be used to assess the Project's potential socioeconomic impacts on coastal communities.

9.1.2. Ongoing Stakeholder Engagement

Stakeholder engagement will be ongoing to support development of the EIA and management plans in alignment with Guyana's regulatory requirements. In all cases where stakeholders are consulted during the development of the EIA, stakeholders will be provided with Project information, sufficient prior notice, and adequate consultation opportunities to allow them to be actively engaged in the EIA process and enable them to identify potential concerns to be addressed in the EIA and supporting documents.

Specifically, the objectives of Project stakeholder engagement activities are to:

- Promote the development of respectful and open relationships between stakeholders and EEPGL during the Project;
- Identify Project stakeholders and understand their interests and concerns in relation to Project activities, and incorporate such interests and concerns into the EIA and ESMP development processes;
- Provide stakeholders with timely information about the Project in ways that are appropriate to their interests and needs, and also appropriate to the level of expected risk and potential adverse impacts;
- Support alignment with regulatory and EEPGL expectations for stakeholder engagement; and
- Record feedback and resolve any grievances that may arise from Project-related activities through a formal feedback mechanism.

Project stakeholder engagement activities will be guided by a Stakeholder Engagement Plan, included in the ESMP, which will describe:

- Stakeholders identified for engagement;
- A conceptual program of engagement and communications activities, and their frequency throughout the Project life cycle;
- The dedicated feedback mechanism through which stakeholders can contact EEPGL to voice concerns, provide information, or ask questions about the Project life cycle and its activities; and
- Mechanisms through which EEPGL will monitor and report on external engagement and communications.

Project stakeholders have been identified through a combination of desktop research and in-country assessment and engagement, including engagement undertaken as part of the Liza Phase 1 Development Project EIA and other EEPGL-related environmental authorizations. Stakeholder categories include, but are not limited to, government officials; communities, including indigenous peoples; civil society, interest groups, and nongovernmental organizations; the private sector; media; academic and research institutions; and professional, business, and workers' associations. Table 9-3 provides a sample of identified potential stakeholders.

Table 9-3: Sample of Identified Potential Stakeholders

Stakeholder Category	Interest in Project	Potential Stakeholders
Regulatory /Government	National authorities have an interest in the EIA and permitting procedures and Guyanese resources. Local and regional authorities have a general interest in potential impacts and benefits to their respective communities, and may facilitate engagement with local communities. Provides permits for Project activities and operational licenses for onshore and offshore facilities.	President of Guyana; Ministry of Natural Resources; Sectoral Committee on Natural Resources; Members of Cabinet; Opposition Government leaders, Guyana Geology and Mines Commission; Environmental Protection Agency; Protected Areas Commission; Government Information Agency; Civil Defense Commission; Guyana Maritime Administration Department; leadership of Regions 1-10; Attorney General; Civil Aviation Authority; Guyana Defence Force; Transportation and Harbors Department; Pesticides and Toxic Chemicals Board; Hydrometeorological Service; Guyana Forestry Commission; Guyana Tourism Authority; Bureau of Statistics; National Trust of Guyana; Toashao's council
Community	Communities who may potentially be impacted positively or negatively by Project activities, or are concerned that they may be impacted.	Georgetown residents; coastal beach users/residents; indigenous people; commercial fisherfolk
Civil Society, Interest Groups, NGOs	Non-governmental or other organizations and entities that may be interested in a diverse set of issues including environmental protection, socioeconomic development and human rights.	NGOs focused on indigenous peoples' issues; Conservation International; World Wildlife Fund; Religious organizations; Guyana Marine Conservation Society; Mangrove Restoration Project; ECO1
Private Sector	Businesses of any scale that could be affected positively or negatively by the Project.	Fuel and Waste, SURF, Drilling, FPSO Shorebase Contractors, Subcontractors, and Suppliers
Media	News media outlets that may range from local to international in distribution.	Stabroek News, Kaieteur News, Guyana Chronicle, Guyana Times, www.demerarawaves.com , www.inewsguyana.com , www.newsroom.gy , www.newsoucegy.com , www.newsnow.gy , www.citizensreportgy.com , www.gnnonline.com , National Communications Network TV
Academic Institutions	Academic institutions or foundations that provide research on specific topics of interest.	National Agricultural Research and Extension Institute; Caribbean Agricultural Research and Development Institute; Universities and technical institutes
Professional, Business and Workers' Associations	General or industry-specific associations with interest in how Project activities may represent opportunities for the members or impacts to them.	Private Sector Commission; Guyana Oil & Gas Association, Guyana Manufacturing and Services Association; Guyana Association of Trawler Owners and Seafood Processors; Shipping Association of Guyana; Chambers of Commerce; Rotary Clubs; National Aquaculture Association of Guyana; Tourism and Hospitality Association of Guyana

Building on the stakeholder identification and mapping analysis, EEPGL's stakeholder engagement strategy identifies mechanisms and tools to facilitate stakeholder communications and public information sharing. As shown on Figure 9-1, these tools are divided into two tiers that interact to facilitate informed engagement. The first tier is information provision, which serves to offer Project information to stakeholders to support their understanding of what is proposed to occur. The second tier, consultation, is intended to support dialogue and active receipt of stakeholder feedback and input on what they have learned about the Project, and to

capture their opinions, concerns, and knowledge regarding the way the Project may interact with the natural and social environment.

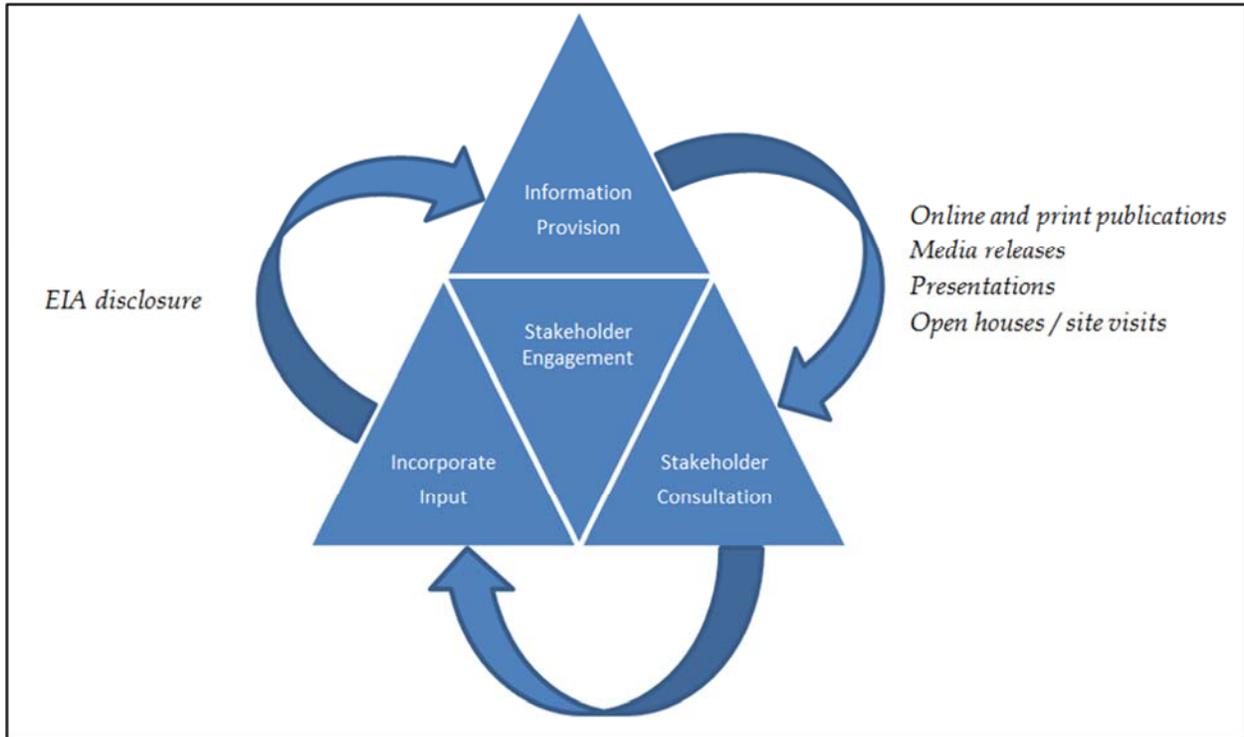


Figure 9-1: Stakeholder Engagement Strategy for EIA Development

The tools and mechanisms listed in italics on Figure 9-1 describe how the Project intends to provide information to stakeholders, consult with and solicit information from stakeholders, and report on the ways stakeholder input has been incorporated. The implementation and provision of the tools and activities described above will constitute EEPGL’s program of stakeholder engagement.

Information provision activities may include the dissemination of publications (both print and online) and media releases, as well as presentations and open houses. The intention of these types of activities is to provide information to a broad audience or group of stakeholders as efficiently as possible. Consultation or dialogue activities involving a two-way flow or exchange of information between stakeholders and the Project may include one-on-one and small group meetings, public meetings including a question and answer session, town hall meetings, and a feedback mechanism such as a webpage, email address and/or phone line. The intention of these activities is not only to facilitate a two-way exchange of information but also to provide a means for the Project to gather information concerning topics that are important to its stakeholders. These activities also give stakeholders an opportunity to ensure their comments and opinions are heard and their concerns are addressed.

Tools for engagement and information provision not specifically named above may include key messages, question-and-answer documents to prepare the Project for engagements with the public, and planning for outreach events such as informational open houses.

9.2. ADDITIONAL ANALYSES TO SUPPORT THE EIA

The EIA for the Project will leverage studies performed, data collected, impacts assessed, and related management planning that has been previously completed to support the current exploration drilling and Liza Phase 1 Development Project programs. This information will be utilized to inform the Project EIA. To supplement this prior information, a number of additional analyses will be conducted to support the EIA for the Project.

9.2.1. Oil Spill Modeling

EEPGL has previously performed oil spill modeling for the exploration drilling and Liza Phase 1 development programs. EEPGL will perform additional oil spill modeling of Project-specific FPSO/SURF production operations-related scenarios to help inform the EIA, as well as to aid in oil spill response planning. Modeling scenarios will include a major loss of well control incident of credible magnitude/duration, as well as the assessment of potential impacts from this type of rare, unplanned event. In addition to simulating release conditions representative of the Project (e.g., specific FPSO and Phase 2 well locations, etc.), EEPGL will update the model basis as needed to reflect the current understanding of the Liza reservoir properties and the updated metocean data set. The oil spill modeling will be used to inform the assessment of potential impacts to resources and receptors, as summarized in Table 9-1.

9.2.2. Offshore Discharge Modeling

Project activities will involve several types of discharges to offshore surface waters, including drill cuttings, hydrostatic test water and other commissioning fluids, ballast water, cooling water, produced water, and brines. Potential environmental impacts related to planned, localized discharges of drill cuttings and drilling fluids will be assessed for typical discharges anticipated during development drilling operations. Modeling will simulate releases near the seafloor from the riserless drilling sections. For drilling performed in deeper sections that will be drilled with a riser in place, the model will simulate overboard discharges of cuttings that contain adhered fluids. Estimated discharges from the two drill centers will address seasonal variability in the assessment. Potential impacts will be assessed in terms of the total thickness of deposits on the seafloor at the end of the simulation, the maximum total suspended solids at any time in the simulation, and the mass of hydrocarbons per unit area deposited on the seafloor.

Modeling will estimate the localized plume trajectory and patterns of dilution of the cooling water plume from the FPSO. Incremental changes to ambient water temperature over distance from the cooling water discharge point will be assessed, as will concentrations of biofouling inhibitors such as chlorine. A similar approach will be used to estimate the plume size and dilution patterns related to localized installation and commissioning-related discharges (hydrostatic test water and hydrate control fluids) and other production-related discharges

(produced water and brines). In the cases when specific design parameters are not yet known, multiple locations and discharge rates will be modeled to appropriately bracket the potential discharge plumes and related potential impacts.

Additionally, a scenario simulating an unplanned release of untreated wastewater from the FPSO will be modeled, and the potential impacts of this unplanned event will be discussed in the unplanned events chapter of the EIA.

9.2.3. Air Emissions Dispersion Modeling

Air emissions dispersion modeling will be carried out to assess air quality impacts for onshore human receptors. The modeling will predict the maximum predicted pollutant concentrations generated by the Project across the onshore portion of the Project AOI (where potential receptors are located). These maximum predicted concentrations will then be compared to concentrations that may potentially result in impacts.

The criteria that will be used for the assessment of impacts on air quality are those established by the World Health Organization (WHO) (see Table 9-4). These criteria are included in the guidelines that were published in *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide* (WHO 2005) except for CO and H₂S, which were published in WHO's *Air Quality Guidelines for Europe* (WHO 2000).

Table 9-4: WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	Guideline Concentration (µg/m ³)
NO ₂	1-hour	200
	Annual	40
SO ₂	10-minute	500
	24-hour	20
PM ₁₀	24-hour	50
	Annual	20
PM _{2.5}	24-hour	25
	Annual	10
CO	1-hour	30,000
	8-hour	10,000
H ₂ S	30-minute	7

Source WHO 2000; WHO 2005

10. STRUCTURAL ORGANIZATION OF THE EIA

The EIA Report will contain the following major components:

- **Environmental Impact Statement:** The Environmental Impact Statement will provide a concise account of the most important results of the impact assessment, a description of the potential adverse impacts of significance, a description of the proposed key mitigation and

management measures to be implemented, and an overview of the proposed management and monitoring strategy.

- **Project Description:** The description of the Project will provide a detailed overview of the Project development plan proposed by EEPGL, including a description of its various components and a description of the various stages of the Project life cycle. The Project description will be prepared in a manner that is sufficiently detailed (consistent with the current level of Project definition) to allow rigorous review by technical experts, while being accessible and understandable by persons with non-technical backgrounds. The Project description will have sufficient detail to facilitate a comprehensive and detailed identification of the potential interactions between Project activities and resources/receptors in the Project AOI and the potential adverse impacts that could result from such interactions.
- **Administrative Framework:** The administrative framework will summarize the legislation, policies, and standards with environmental and socioeconomic aspects potentially relevant to the Project. It will include laws that apply to environmental or socioeconomic issues in general, laws with a narrower focus on specific environmental or socioeconomic sensitivities, a discussion of national environmental policies as they relate to the oil and gas industry, and international and regional conventions and protocols that could be relevant to the Project and to which Guyana has acceded or is a signatory.
- **Methodology for Preparing the EIA:** This section will describe the approach and methodology used to assess the potential impacts associated with the Project and the process used to conduct the EIA as a whole.
- **Scope of the EIA:** This section will describe the various Project components that will be assessed, the resources/receptors with which these Project components may interact, the potential impacts that could result from these interactions, the studies and analyses conducted to support the assessment of these impacts, and the Direct and Indirect AOIs.
- **Description of Existing Conditions and Assessment of Potential Impacts:** This section will follow a “modular” format, organized by specific environmental and socioeconomic resources and receptors. Although the exact organizational structure of the section has yet to be determined, it is expected that modules will be included for at least the resources and receptors listed in Table 9-1. Each resource/receptor-specific discussion will contain the following components:
 - A discussion of how the specific legislation and regulations identified in the Administrative Framework apply to the resource/receptor or the predicted impacts thereon.
 - A description of the existing conditions in the Project AOI relevant to the resource/receptor, based on available information and data collected as part of the EIA.
 - An assessment of each of the potential Project impacts on the resource/receptor, as identified in Section 9. The impact assessment will be conducted according to the methodology described in Section 6, Methodology for Preparing the EIA. In this section, the EIA will rate the significance of the predicted impacts without consideration of

management and mitigation measures, propose management and mitigation measures to reduce significance as warranted, and rate the significance of the residual impacts (i.e., assuming implementation of the proposed management and mitigation measures). Where concerns about potential impacts have been raised through the scoping process (e.g., seismic hazards caused by oilfield development activities) but no reasonably foreseeable mechanism for such impacts exist, the EIA will discuss the reasons why such impacts do not pose a credible risk.

- A description of resource/receptor- or media-specific management (i.e., avoidance, minimization, and/or mitigation) measures recommended to address the predicted impacts.
- **Cumulative Impact Assessment:** This section will describe the methodology and results of an assessment of the cumulative impacts that could arise as a result of Project-related impacts on a resource/receptor interacting with impacts on that same resource/receptor from other non-Project activities. The cumulative impact assessment will consider interaction between potential impacts from the Project and impacts of other non-Project activities, relevant existing activities, or sufficiently approved/planned activities that are considered reasonably foreseeable.
- **Environmental and Socioeconomic Management and Monitoring Plan:** The environmental and socioeconomic management strategy will be based on a mitigation hierarchy that emphasizes avoiding impacts as the preferred management approach, followed by minimizing unavoidable impacts and remedying impacts that cannot be avoided or minimized further. This section will describe the framework for implementation of management measures that are included in the resource/receptor-specific discussions, as well as measures not included in the resource/receptor-specific sections. As described in Section 7.3, Scope of the Environmental and Social Management and Monitoring Plan, the latter category would include affiliate-level management plans, plans that affect numerous environmental media simultaneously, and plans developed to manage specific contingencies that are reasonably foreseeable but are not part of the proposed Project. With respect to a marine oil spill, the EIA will summarize the scientific literature on dispersant impacts, and how use of dispersants could impact wildlife in event of an oil spill. The OSRP, to be submitted as part of the EIA, will describe the types of dispersants that could be utilized, the methods in which they would be applied, and the procedures by which EPA approval would be obtained for the use of such dispersants.
- **Conclusions and Summary of Impacts:** This section will summarize the residual significance ratings for potential environmental and socioeconomic impacts of the Project resulting from planned activities and potential unplanned events, as well the Project's contributions to cumulative impacts on important resources and receptors.
- **References:** This section will include reports, scientific literature, technical texts, websites, and other sources of information used to prepare the EIA.

- **Supplementary Information:** Appendices, supplements, attachments, and any other information that is considered necessary to support the findings of the EIA, but cannot be integrated into the body of the documents, will be included as supplements to the EIA.

11. PROJECT TEAM

The group of ERM, an international environmental and social consulting firm with a local registration in Guyana, and the Guyanese consultancies EMC and GSEC (collectively, the Consultants) has been selected by EEPGL and approved by EPA to prepare the EIA.

Table 11-1 identifies the primary members of the Consultant team and their envisioned roles in preparing the Project EIA. Full resumes for each of these team members are included in Appendix A.

Table 11-1: Project Team

Member	Company and Position	Role
David Blaha	ERM: Program Lead	Strategic input on scope, assessment approach, and regulatory engagement
Todd Hall	ERM: Partner-in-Charge	Overall accountability for regulatory engagement, EIA process execution and deliverable production
Jason Willey	ERM: Project Manager, Biological Resource Specialist	Team leader, day-to-day management of execution for EIA process
Matt Erbe	ERM: Project Controls Lead	Scheduling, resource management and project accounting
Kris Hiatt	ERM: Document Production Manager	Document coordination, technical editing
Noam Raffel	ERM: Senior GIS Analyst	GIS data analysis and EIA imagery development
Karin Nunan	ERM: Socioeconomic and Stakeholder Engagement Lead; Ecosystems Services Specialist	Technical lead for socioeconomic assessment and stakeholder engagement aspects
Julia Tims	ERM: Biological Environment Lead, Avian and Terrestrial Wildlife Specialist	Technical lead for biological environment-related aspects
Rick Osa	ERM: Air Quality Monitoring Lead	Technical lead for air quality monitoring
Greg Lockard	ERM: Cultural Heritage Assessment Lead	Assessment of impacts on cultural resources
Benjamin Sussman	ERM: Transportation Assessment Lead	Assessment of impacts on marine and onshore transportation
Mark Garrison	ERM: Air Emission Dispersion Modeling Lead	Technical lead for air quality dispersion modeling
Shwet Prakash	ERM: Water Quality Assessment Lead	Technical lead for surface water quality impact assessment and oil spill modeling, and overall technical lead for physical resources section of EIA
Mike Fichera	ERM: Senior Water Quality Specialist	Assessment of impacts on surface water quality
Melinda Todorov	ERM: Senior Marine Scientist	Assessment of impacts on marine benthos

Member	Company and Position	Role
Peyun Kok	ERM: Socioeconomic and Community Health Specialist	Assessment of impacts on socioeconomic and community health resources
Dusty Insley	ERM: Geological Resource Specialist	Assessment of impacts on marine sediments and geology
Jon Connelly	ERM: Biological Resource Specialist	Assessment of impacts on biological resources
Charles Ceres	Ground Structures Engineering Consulting: Project Director	Strategic input for regulatory and stakeholder engagement
Hance Thompson	Ground Structures Engineering Consulting: Senior Specialist	Stakeholder engagement; administrative framework, physical components of baseline and impact assessment
Raeburn Jones	Ground Structures Engineering Consulting: Biological Resource Specialist	Assessment of impacts on coastal habitats
Patrick Williams	Ground Structures Engineering Consulting: GIS Analyst	GIS data analysis and EIA imagery development
Shyam Nokta	Environmental Management Consultants: Principal and Environmental Management Specialist	Strategic input for regulatory and stakeholder engagement
Khalid Alladin	Environmental Management Consultants: Project Manager	Stakeholder engagement, administrative framework, biodiversity and socioeconomic components of baseline and impact assessment
Richard Persaud	Environmental Management Consultants: Community Resources Specialist	Assessment of impacts on marine use and transportation, onshore transportation, social infrastructure, and ecosystem services
Romeo De Freitas	Environmental Management Consultants: Biological Resource Specialist	Assessment of impacts on biological resources and ecosystem services

12. MANAGEMENT OF THE EIA PROCESS

The Consultants will manage and execute the overall EIA process and will be responsible for the study and the compilation and presentation of the EIA Report. The Consultants will plan, coordinate, and execute all activities of the EIA process, and will provide updates to EEPGL and the EPA, and other government agencies on the EIA process as needed and appropriate.

13. EIA SUBMISSION

The Consultants will provide an electronic copy and three signed hardcopies of the EIA Report to the EPA.

14. REFERENCES

- Environmental Protection Agency (EPA). 2000. *Integrated Coastal Zone Management Action Plan*. Accessed: February 14, 2018. Retrieved from: <http://www.mangrovesgy.org/home/images/stories/Documents/ICZM%20Action%20Plan.pdf>
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- National Development Strategy (NDS). 1997. Guyana’s National Development Strategy. Accessed: February 9, 2018. Retrieved from: <http://www.guyana.org/NDS/NDS.htm>