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SEA LION PHASE 1 DEVELOPMENT

ENVIRONMENTAL IMPACT STATEMENT

NON-TECHNICAL SUMMARY



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INTRODUCTION

Premier Oil Exploration and Production Ltd (Premier) is proposing to develop the Sea Lion Field in the North Falkland Basin (NFB) with a view to the long-term production and export of oil. The first phase of this field development is referred to as 'Phase 1'.

Premier will conduct all operations in compliance with its Health, Safety, Environmental and Security (HSES) Policy, which requires that Premier do all that is reasonably practicable to prevent major accidents and minimise environmental impacts.

In line with Falkland Islands legislation and its HSES Policy and Management System (MS), Premier has conducted a full Environmental Impact Assessment (EIA) of the Phase 1 Development.

The EIA was carried out in line with:

- Falkland Islands Government (FIG) Environmental Planning Department (EPD) Hydrocarbons Environmental Impact Assessment Guidance Note (FIG, 2015m).
- Corporate Premier Standard: Environmental and Social Impact Assessment (CP-BA-PMO-HS-SE-ST-0001).

The detailed outcomes of the EIA process are reported in the Environmental Impact Statement (EIS) and the key outcomes are précis in this Non-Technical Summary (NTS). Following submission to FIG (who have determined that the EIS is compliant with legislation), a copy of the full EIS is available on request from the Premier office in Stanley (sealion.enviro@premier-oil.com).

This version of the Sea Lion EIS reflects the Sea Lion Phase 1 Project at the end of the define stage and details a number of changes and optimisations from the project EIS that was submitted and consulted on in 2018 (see 'Scoping Consultation on page 12).

Purpose of the EIA

The main purpose of the EIA is to answer the following six questions:

- Q1 What is the context within which the proposed Development is being carried out?**

 - What do the regulations and the Premier HSES-MS require?
- Q2 What does the Phase 1 Development involve?**

 - What activities are involved in the proposed Development? In other words, what is the **'Phase 1 Development Description'**?
 - Are any mitigation measures built-in to the Development design to minimise interactions with the environment and the human population? In other words, what are the **'Base-Case Mitigations'**?
- Q3 What do the stakeholders think about the proposed Development?**

 - What do the Falkland Islands Government (FIG) and its consultees think? What do the Falkland Islands public think? The answers to these questions were invited during **'Scoping Consultations'** and the purpose of this **'Formal Consultation'** is to elicit further comment.
- Q4 What are the existing environmental and social attributes and sensitivities in the area?**

 - What is known about the local environment and the local human population? For example, what species of marine mammals or seabirds, are found in the area? When are they there? What are they doing there? How important is the population that could be impacted upon? Do they have international or local protected status? This is called the **'Environmental and Social Baseline'**.
- Q5 What are the environmental and social impacts and risks associated with the project activities?**

 - How might the Development interact with the environment and / or the human population? In other words, what are the associated **'Environmental and Social Aspects'**?
 - How are the impacts and risks assessed? In other words, what is the **'Impact and Risk Assessment Methodology'**?
 - What are the environmental and social impacts of these interactions? What impacts and risks are associated with the planned activities and accidental or unplanned events? Are the potential impacts and risks significant? What are the **'Key Findings of the EIA'**?
- Q6 What is Premier doing to reduce the potential impacts and risks?**

 - What if an impact or risk is considered to be significant despite compliance with legislation, the use of industry-standard practice and the 'base case' mitigation measures? Will additional actions be taken to remove, minimise or monitor the impact or risk?
 - All mitigations and monitoring commitments will be summarised in the **'Project-Specific Environmental Monitoring and Management Plan'** which will remain 'live' (be continually reviewed and updated) for the life of the field.

Numerous steps are involved in conducting an EIA and in answering the questions above. This NTS briefly outlines the planned Development and describes the key outcomes of the EIA.



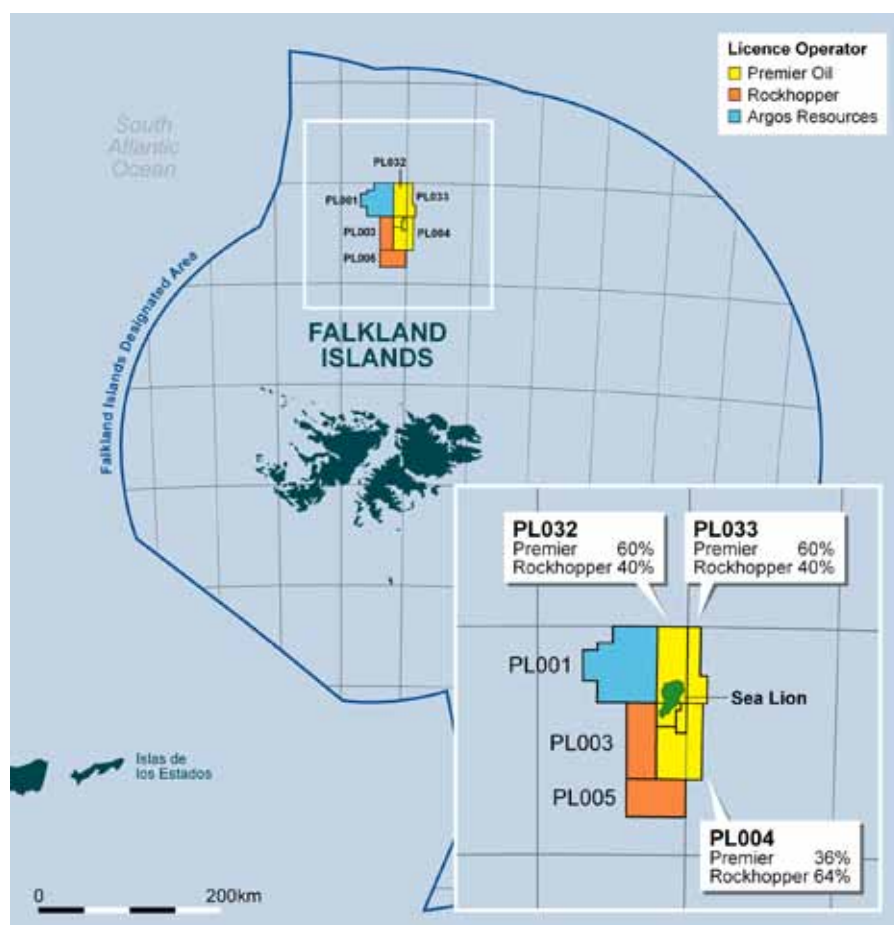
The Sea Lion Field

The Sea Lion Field is an oil field, oil and gas are trapped in underground sandstone rocks approximately 2.5 km below the seabed, in water depths of approximately 450 m. It is likely that there is a gas accumulation (or 'gas cap') overlying some of the oil. The existence of the gas cap will be determined during development drilling operations. The field is located approximately 220 km to the north of the Falkland Islands in Block 14 / 10. Premier propose the development of the Sea Lion Field in accordance with the Production Licence areas PL032 and PL004b granted by the Falkland Islands Government (Figure 1.1).

The Sea Lion Field is the first potentially commercially viable hydrocarbon discovery in the NFB and was discovered by Rockhopper Exploration plc in 2010. With regard to oil production, a field life of 20 years has been projected and it is estimated that the Phase 1 Development can recover approximately 250 million stock tank barrels of oil in this time.

The crude oil discovered in the Sea Lion Field has a high wax content such that it needs to be kept at an elevated temperature throughout the production and export process to ensure that it can flow.

Figure 1.1: Sea Lion Field and Licence Block Locations



250 mmbbls

Sea Lion Phase 1 (gross)

80 kboepd

Expected peak production (gross)

20 year

Projected field life

20

Oil production wells

8

Water Injection (WI) wells

2

Remote Gas Production / Injection (GPI) wells

EIA Context

Q1

To answer 'Question 1' above, the following information summarises FIG's regulatory requirements, and those of the Premier HSES-MS, both of which define the context within which the EIA was carried out. Full details on both is provided in Chapter 2 of the EIS.

Regulatory overview

The Falkland Islands is one of 14 UK Overseas Territories (UKOT) as defined under the British Overseas Territories Act 2002.

The Environmental Charter is a joint agreement between FIG and the UK Government that was signed in 2001. The Charter lists ten guiding principles and 11 commitments. All commitments are intended to ensure effective environmental management within the Islands.

Environmental legislation that applies to Oil and Gas (O&G) activities within the Falkland Islands is based upon the regulatory requirements for the United Kingdom Continental Shelf (UKCS). In early 2018, updated legislation in the form of the Maritime Ordinance (2017) and Harbours and Ports Ordinance (2017) came into effect. The Maritime Ordinance, which was amended in 2019, in particular contains new legislation relating to offshore oil pollution.

Legal compliance and the preparation of required consents will be based on current FIG legislation (where it exists) with reference to UK legislation and guidance. In the event that FIG legislation is enacted in the future, this will supersede UK legislation.

Existing Falkland Islands legislation relevant to the O&G industry is as follows:

- Offshore Minerals Ordinance 1994 (1997 and 2011 Amendments).
- Offshore Petroleum (Licensing) Regulations 1995 (2000, 2004 and 2009 Amendments).
- Petroleum Survey Licences (Model Clauses) Regulations 1992.
- Marine Environment (Protection) Ordinance 1995.
- Environmental Protection (Overseas Territories) (Amendment) Order 1997.
- Maritime Ordinance 2017 (as amended (2019)).
- Maritime (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 2019.
- Deposits in the Sea (Exemptions) Order 1995.
- Marine Mammals Ordinance 1992.
- Conservation of Wildlife and Nature Ordinance 1999.
- Fisheries (Conservation and Management) Ordinance 2005.
- Endangered Species Ordinance 2003.
- Planning Ordinance 1991.
- Planning (Environmental Impact Assessment) Regulations 2015.

- Falklands Interim Port And Storage System (FIPASS) Ordinance 1989.
- Harbours and Ports Ordinance 2017.
- Maritime (Registration of Ships) Regulations 2019.
- Merchant Shipping (Confirmation of Legislation) (Falkland Islands) Order 2018.
- Offshore Installations (Prevention of Fire, Explosion and Emergency Response) Order 2008.
- Offshore Installations (Safety Case) Order 2008.
- Oil in Territorial Waters Ordinance (1960).

Specific guidance on the Falkland Islands EIA process and the development of the EIS is provided in:

- FIG Environmental Planning Department (EPD) Hydrocarbons Environmental Impact Assessment Guidance Note (FIG, 2015m).

Premier Health, Safety and Environmental and Security Management System

As in all of its oil & gas activities, Premier will, as a minimum, adhere to its own corporate HSES Policy and HSES-MS Framework throughout the Phase 1 Development to ensure environmental management is considered at every stage.

In summary, and as a minimum, the Premier HSES-MS requires:

- Ongoing review of the environmental impacts and risks throughout the 'Define' (the detailed engineering phase) and 'Execute' (awarding contracts to start the work) project development processes to ensure that they have been reduced to, and remain, 'As Low As is Reasonably Practicable' (ALARP);
- Development of 'Specific, Measurable, Attainable, Relevant and Time-measured' (SMART) environmental objectives and targets to ensure continual improvement in the management of aspects and impacts where possible;
- Development and implementation of project-specific management plans where necessary;
- Development of operation controls based on a safe system of work;
- Training and competency of relevant personnel;
- Monitoring and measuring e.g. of emissions, discharges to sea, waste etc.;
- Internal and external environmental performance reporting;
- Internal, external and third party auditing during contractor selection and pre-mobilisation processes and throughout field life;
- Contractor selection strategy and management;
- Incident reporting and investigation;
- Emergency response; and
- Annual management reviews.

The HSES-MS will apply through all subsequent Phases of the development. Full details on the Premier HSES-MS are provided in Section 3.2 of the EIS.

Phase 1 Development Description

Q2

To answer 'Question 2' above, the following sections provide a summary of:

- The activities that will be required during the proposed Phase 1 Development to enable the production of oil from the Sea Lion Field; and
- The base case mitigations that are built-in to the basis of design.

The full Phase 1 Development Description is provided in Chapter 5 of the EIS.

Activities associated with the Development

Drilling and installation of subsea infrastructure

The proposed Phase 1 Development base case is expected to consist of 29 clustered oil production and Water Injection (WI) wells drilled across three Drill Centres (DC, the Main, Eastern and Southern DCs), and a remote Gas Production / Injection (GPI) well. If the remote GPI well has insufficient gas flow an additional remote GPI well will be drilled in the south west flank of the field. In this case the development will comprise 30 wells in total. All wells will be drilled by a Mobile Offshore Drilling Unit (MODU). Whilst the base case comprises up to 30 wells, the final number of wells that will be drilled will depend upon the characteristics of each well that is drilled and could be less than 30. The MODU will be anchored to the seabed and surrounded by a 500 m exclusion zone, supported by up to two Multi-Role Support Vessels (MRSVs) and a Platform Support Vessel (PSV), which will also act as supply vessels and an Emergency Response and Rescue Vessel (ERRV). Figure 1.2 shows the layout of the Sea Lion Field with both the MODU and Floating Production, Storage and Offloading vessel (FPSO) present. An FPSO will be used to produce the fluids from the wells. The FPSO will be anchored to the seabed, surrounded by a 500 m exclusion zone. The FPSO will be located approximately 2.1 km from the main Drill Centre (DC), 3.0 km from the Southern DC, 1.6 km from the Eastern DC and approximately 6.0 km and 5.8 km from the remote GPI well(s) locations, respectively.

The GPI well(s), which access a different part of the underground reservoir, will be set apart as remote well(s). The first GPI well will be about 6.0 km to the southwest of the FPSO and the second, if required, will be located approximately 5.8 km further to the southwest (Figure 1.2).

The maximum well count (30 wells) will comprise:

- Twenty oil production wells;
- Eight Water Injection (WI) wells; and
- Up to two remote Gas Production / Injection (GPI) wells.

Up to four of these wells will be cleaned up, i.e. removal of debris from the well bore, by the MODU, where oil and gas will be brought to surface under controlled conditions. These hydrocarbons would then be flared offshore for approximately one day for each well. If the first four well clean ups demonstrate that the wells initially return volumes and/or types of debris that could damage the swivel system on the FPSO, then, as a worst case scenario, all oil and gas production wells would be cleaned up by flaring via the MODU– i.e. 22 in total. The decision to clean up the remaining eighteen wells would be performed in consultation with FIG and will require FIG approval. It is anticipated that a separate submission will be made to

FIG detailing the objectives of the clean-up(s) and the arrangements and control measures on the MODU, in line with UK practice. To support the Development, six subsea manifolds and an array of subsea pipelines, 'umbilicals' and 'risers' will be installed to connect the wells at the seabed with the FPSO at the surface. The six manifolds will comprise three WI manifolds and three production manifolds.

While drilling of the wells is underway, installation of the subsea production facilities will be undertaken by dedicated installation vessels. It is anticipated that up to four Large Transport Vessels (LTVs) will be anchored in an inshore sheltered location, expected to be Berkeley Sound, for a combined period of c. 12 months. However, a maximum of two LTVs will be present at any one time. These LTVs will act as 'floating storage barges' from which equipment will be collected and taken out to Sea Lion for installation.

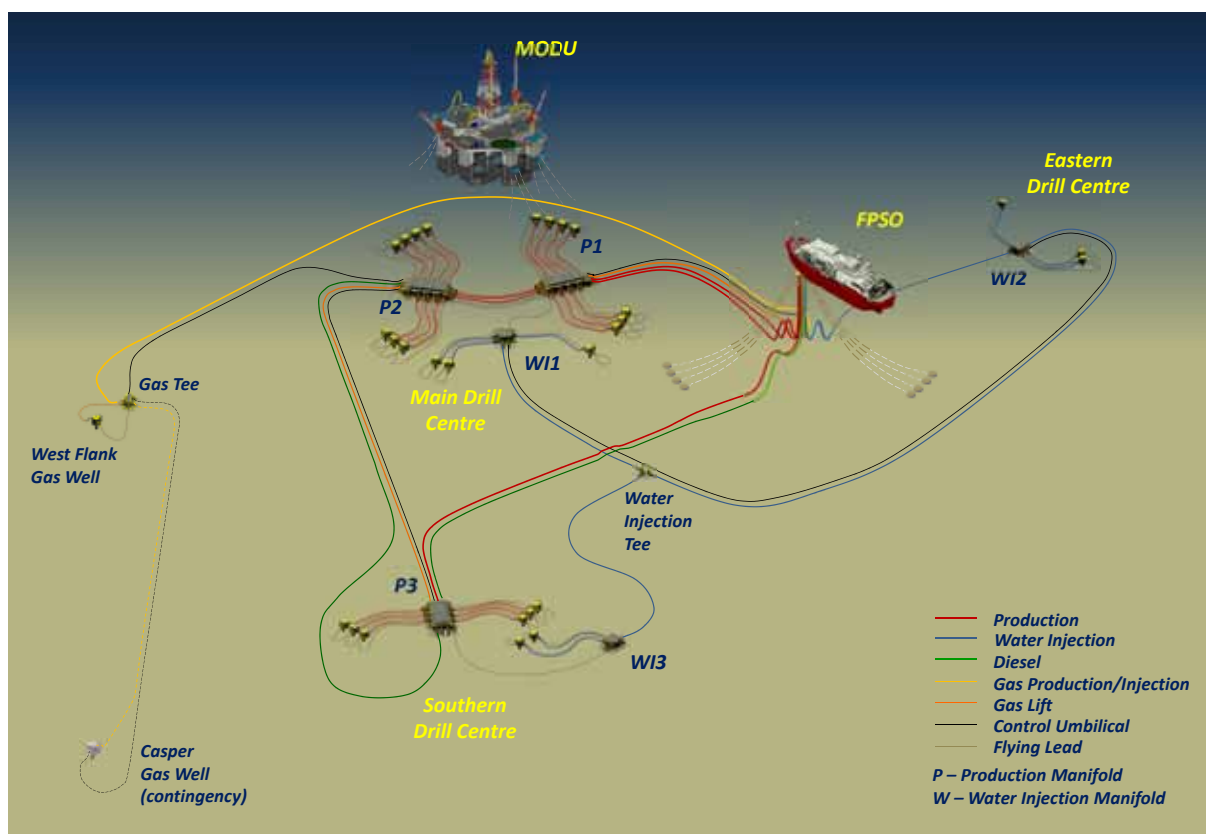
It is anticipated that drilling will start approximately 21 months after project sanction. When drilling starts, only the MODU, the supporting MRSVs and the installation vessels will be in the Field.

Hook up and commissioning of the Floating Production, Storage and Offloading (FPSO) vessel and first oil

Oil production and processing will be carried out from the FPSO ship-shaped vessel which will be anchored to the seabed and surrounded by a 1,275 m radius exclusion zone, which is effectively 500 m beyond the installation extremities (including the hose and tanker during crude oil offload). The term 'Hook Up and Commissioning' (HUC) refers to the process by which the FPSO is connected to the subsea wells, via the manifolds and the pipelines, umbilicals and risers (Figure 1.2).

Following HUC, it is expected that 'First Oil' will occur approximately 42 months after project sanction.

Figure 1.2: Graphic showing the Sea Lion Field in simultaneous operations mode with both MODU and FPSO present



Simultaneous operations

After 'First Oil' there will follow a period of Simultaneous Operations (SIMOPS) with the MODU continuing to drill the remaining wells while the FPSO produces from the wells which have already been drilled, see Figure 1.2 below. During SIMOPS, both the MODU and the FPSO will be supported by two MRSVs.

Once all the wells have been drilled, the MODU will leave the Sea Lion Field and only the FPSO and its support vessels (two MRSVs, with one acting as an ERRV) will remain.

Production

The oil production wells will produce reservoir fluids to the FPSO. The total produced fluids will consist of:

- Crude oil (the desired product);
- Associated hydrocarbon gas (arising from the gas cap in the reservoir, (if present) and gas dissolved in the oil which is liberated as the oil flows to surface i.e. the gas is 'associated' with the oil production); and
- Water (a by-product of the oil production which is referred to as 'produced water').
- These three products will be separated and treated on the FPSO:
- The oil will be stabilised (i.e. made ready for export) and transferred to storage tanks within the FPSO hull for subsequent offloading and export (see 'Oil export', below);
- The associated gas from the production wells will be used:
 - As fuel to heat and power the FPSO; and
 - For 'gas lift' in the oil production wells, which reduces the density of the oil enabling it to flow at higher production rates. Note: During normal operations any excess associated gas will be re-injected back into the reservoir via the remote GPI well(s). In the event of a deficit in associated gas, the required gas volumes will be supplemented with gas produced from the designated GPI well(s); and
- The produced water will be cleaned to remove dispersed oil and any solids (e.g. sand, if present). During normal operations, the base case is that, produced water will be re-injected via the WI wells (in combination with treated seawater) to maintain pressure in the reservoir, thereby optimising oil recovery.

Oil export

In the course of developing the current project details, Premier has considered two potential oil export options 1) Inshore Transfer which was considered the base case option, and 2) Direct Offtake as an alternative option requiring further study. The Inshore transfer option required a dedicated Offshore Loading Shuttle Tanker (OLST) to periodically 'off-take' crude from the FPSO and transport it to Berkeley Sound for transfer to a purchaser's Conventional Trading Tanker (CTT) within inshore waters. Following further review, Premier has confirmed the viability, reliability and feasibility of the alternative Direct Offtake oil export option for the Sea Lion Phase 1 development. With Direct Offtake, the crude will be directly offloaded from the FPSO to

a purchaser's CTT at the Sea Lion location and from there the crude will be exported to market. To ensure that the offloading operating conditions are maintained within strict limits, Direct Offtake will require an additional Offshore Support Vessel (OSV, i.e. a pull back tug) to attend the CTT offshore, in addition to the presence of the ERRV, which is always on standby. Previous versions of the development EIS included detailed descriptions of the inshore transfer option and mitigations (e.g. Mooring Buoy installed in Berkeley Sound, use of dedicated inshore oil spill response vessels, workboat, etc.) however, these are no longer included herein. As a consequence, the only planned Sea Lion operations in Berkeley Sound relate to logistics support for the subsea installation campaign(s). The Environmental and Social aspects of Berkeley Sound are therefore still described in Section 7 in order to allow assessment of the remaining (short-term) LTV activities in Berkeley Sound in support of the Phase 1 Subsea construction campaign.

Logistical support

The logistics and infrastructure support required by the Sea Lion Phase 1 project includes:

- Port facilities and onshore supply base: including the Temporary Dock Facility (TDF) already established in Stanley Harbour together with onshore laydown yards, storage bases and offices in the Gordon Lines area of East Stanley;
- Use of vessels: for the movement of materials and equipment, installation of the infrastructure and support;
- Personnel transportation facilities: including for fixed-wing flights, helicopters and land transportation; and
- Use of resources: e.g. accommodation, freshwater, electricity, fuel, roads and waste management / disposal facilities.

Decommissioning

At the end of field life, expected to be 20 years after commencement of production, the FPSO and all associated subsea infrastructure and pipelines, will be decommissioned and removed from the NFB in accordance with regulatory requirements in place at that time. Decommissioning will be subject to a separate EIA, submitted at a time to be agreed with FIG (most commonly a few years prior to the cessation of production).

Base-case mitigations

FIG legislation, Premier's corporate standards and industry standard practices will be followed to reduce the potential impacts associated with the above planned activities, and to minimise the likelihood and / or consequences of unplanned events or accidents. The legislation and industry standard practices relevant to each activity are detailed in the impact and risk assessment chapters of the EIS (Chapters 10, 11 and 12).

It is important to note that, where possible, a number of best-practice mitigations are built-in to the design of the facilities. These serve to minimise the impacts of the Development by reducing the outputs or activities that might lead to impacts in the first place (e.g. technologies to reduce the amount of gaseous emissions, measures to minimise anchoring of vessels). These are referred to as the base case mitigations and are summarised in Table 1.1.

Table 1.1: Summary of the mitigations built-in to the Phase 1 Development basis of design

Project activity	Mitigations built-in to the Phase 1 basis of design
General	<ul style="list-style-type: none"> All materials, fittings and system contents contained in the FPSO hull will be non-toxic, non-smoke emitting, fire retardant or 'low flame spread'.
Drilling and production	<p>The following will reduce the amount of atmospheric emissions:</p> <ul style="list-style-type: none"> The main fuel supply for the FPSO will be produced associated gas; Waste heat will be recovered for use to reduce fuel consumption / CO₂ emissions from generating heat; No planned flaring during normal production (notwithstanding the flare pilot light); Use of a Flare Recovery Package during normal operations; No venting from the FPSO during normal production; Use of Vapour Recovery Package during normal operations; Back-up inert gas generator for use as cargo tank 'gas blanket' in the event that the Vapour Recovery Package malfunctions to prevent venting of hydrocarbon gas; Use of Fluorinated-Gases with the lowest Global Warming Potential; Use of Marine Gas Oil instead of Intermediate Fuel Oil (i.e. a lighter fuel) when operating inshore; and Application of Best Available Techniques to the incineration process, if required, to ensure appropriate flue gas treatment that minimises emissions of pollutants to levels as low as reasonably practicable and that achieves the relevant standards of air quality. <p>The following will reduce the volumes of drilling discharges:</p> <ul style="list-style-type: none"> Use of seawater sweeps, bentonite and water based mud for tophole drilling; and Batch drilling to optimise drilling mud use. <p>The following will reduce the volumes of, or negate the need for, discharges of oil and chemicals to sea:</p> <ul style="list-style-type: none"> Produced Water Reinjection (PWRI) to alleviate the need to discharge produced water to sea during normal production operations; Diversion of produced water to dedicated 'off-spec' temporary storage tanks for later retreatment in the event that PWRI is unavailable and the water is not compliant with discharge specifications; Subsea and topside technical flow assurance measures, e.g. insulation and heating, will minimise the use of 'flow assurance' chemicals; and Oil in ballast tank detection on the FPSO. <p>The following will reduce the volume of oily waste returned to shore:</p> <ul style="list-style-type: none"> Use of a Thermomechanical Cuttings Cleaner during drilling which will clean-up drill cuttings on the rig so they may be discharged to sea, reducing the amount of oily waste sent to shore for treatment.

Project activity	Mitigations built-in to the Phase 1 basis of design
Drilling and production (continued)	<p>The following will reduce the volume of waste being returned to the UK for disposal:</p> <ul style="list-style-type: none"> • Use of the planned FIG Waste Management Facility to treat and dispose of project wastes, as available; or • In the event that the FIG Waste Management Facility is unavailable to project wastes, Premier may install a portable incinerator at the supply base for the burning of suitable waste streams. The resultant ash from the incineration process will be returned to the UK for disposal if a suitable disposal route cannot be established on the Falklands. <p>The following will reduce the competition for resources:</p> <ul style="list-style-type: none"> • Use of buffer storage water tanks at the TDF, the mud plant and potentially the at-shore bulk supply base to ensure management of peak water use requirements.
Oil spill prevention measures	<p>Note that many industry standard spill prevention measures must be built-in to the basis of design. Therefore, there are very few 'extra' base case mitigation options available as they are all required as standard. However, for the sake of completeness, it is important to describe these measures here.</p> <p>Spill prevention measures built-in to the FPSO include:</p> <ul style="list-style-type: none"> • The cargo and forward diesel tanks will be double-skinned; • Bunding of all liquid containing equipment and chemicals; • Hazardous and non-hazardous open drains to route any deck spills to a dedicated slop tank; • High level tank filling alarms and emergency shutdown of the process; • FPSO offloading quick-break hose connectors to prevent spills on unplanned disconnection; and Automatic Identification Systems (AIS) and Marine procedures to prevent collisions. <p>Spill prevention measures built-in to the well design include:</p> <ul style="list-style-type: none"> • Development of the appropriate, and peer reviewed, well design; • Use of appropriately weighted drilling muds; • The use of appropriate mud additives to ensure over-balanced drilling; and • Use of Blow-Out Preventers (BOP) and production X-mas trees. <p>Preventative measures built-in to the CTT nomination and selection include:</p> <ul style="list-style-type: none"> • Cargo tanks, and potentially the fuel tanks, of the vessel will be double-skinned; • Vetting and auditing prior to acceptance of the nominated vessel; • Premier personnel (including loading master and Pilot) on-board the CTT to manage the mooring and cargo transfer process; • Cargo tank high level and high-high level alarms to prevent overfilling; • Bunding of all liquid containing equipment and chemicals; and • Open deck drains to catch and collect spills to a dedicated slop tank. <p>Further detail on the industry standard preventative mitigations are described in section 12.1.5 of the main EIS.</p>

Scoping Consultation

Q3

To answer 'Question 3' above, the following section describes the scoping consultation processes, which were carried out to identify any concerns that the stakeholders (including the Falkland Islands public and consultees) had regarding the Phase 1 Development. The consultations were carried out in line with the FIG EPD EIA Guidance (2015m) and were intended to:

- Inform the stakeholders about the proposed Development;
- Identify stakeholder concerns; and
- Ensure that the EIA adequately addresses stakeholder concerns.

As advised by the FIG EPD EIA Guidance (2015m), the stakeholders consulted by Premier included:

- Local authorities;
- Conservation groups;
- Naturalists;
- Special interest groups;
- Other users of the sea; and
- The general public.

Scoping consultations for the proposed Phase 1 Development were carried out between 2014 and 2016, prior to formal submission of the EIS, and at various stages in the planning process. Details on the pre-submission scoping consultations and their outcomes, are provided in Chapter 6 of the EIS.

During scoping consultations, numerous questions were asked, and issues raised by the stakeholders. All representations were taken into account during the EIA process, and are recorded in the EIS. The issues that were identified as key areas of concern for stakeholders were:

- Control of vessels and general management in Berkeley Sound;
- Oil spill mitigations and clean-up;
- Onshore infrastructure;
- Environmental Offsetting;
- Decommissioning;
- The impact of this particular type of crude on the marine environment;
- Jobs, employment and numbers of people; and
- Standards and governance.

Note: following formal submission, the EIS will undergo a formal 42-day consultation process. The outcomes of this formal consultation, and Premier's responses to any representations, will be recorded in Chapter 17 of the final EIS.

Note: a previous version of this EIS (Premier, 2018) has already been through this process.





Environmental and Social Baseline Description

Q4

To answer 'Question 4' above, the following sections aim to summarise the current environmental and social baseline information. It is necessary to describe the baseline in sufficient detail to:

- Understand what is currently present, the 'baseline'. For example, what benthic (seabed) communities, fish, birds, marine mammals are in the area, what is the current condition of the seabed, what resources are available in the Falkland Islands, the local human populations and who else uses the offshore and inshore locations?;
- Understand the sensitivity of the receptors. For example, what are the population sizes of the species present, what are they doing there, are they vulnerable, are they protected, are they commercially important or important for other users, are stakeholders concerned?;
- To determine whether there are data gaps and if, or how, these could affect confidence in the impact assessment; and
- To provide a reference point of comparison for future monitoring that will be carried out by Premier to determine whether or not the Phase 1 Development has had any discernible environmental or social impacts and to validate the results of the EIA.

Key environmental sensitivities

Understanding the attributes of the NFB, the Sea Lion Field and Berkeley Sound area was informed by:

- Extensive literature reviews;
- Historical environmental surveys conducted in the area by various parties since the mid-1990's; and,
- Further surveys carried out by Rockhopper and Premier between 2012 and 2019.
 - Note: The Premier survey reports can be requested from sealion.enviro@premier-oil.com.

The Patagonian Shelf, on which the Falkland Islands archipelago is located, is one of the most biologically productive areas in the South Atlantic. Two marine ecosystems, the sub-Antarctic ecosystem and the southern temperate ecosystem, are separated by a transition zone, which runs through the Falkland Islands. Further, the area is dominated by two different oceanic currents.

The resulting mixing of water masses produces areas of high biological productivity, including one on the edge of the Continental Shelf to the south of the Sea Lion Field. This productivity supports high biomass of plankton in the NFB, which forms the basis of marine ecosystem food chains, on which many species of larger animals such as fish, seabirds and cetaceans depend.

The inshore area of Berkeley Sound is important given its regular use by the fishing and tourism industry, as well as wildlife. The Sound is used by a variety of protected marine mammals and protected birds. Moreover, the entrance to Berkeley Sound is flanked by two National Nature Reserves (Volunteer Point and Cow Bay, and the Kidney Island Group), which are also classified as Important Bird Areas (IBAs).

Potentially sensitive habitats identified within Berkeley Sound that are equivalent to those of conservation significance in the UK, as defined by the Offshore Marine Conservation of Habitats Regulations (which implement the EC Habitats Directive), include biogenic reefs (reefs created by living organisms), geogenic reefs (created by geological processes) and kelp forests.

The key biological sensitivities of the Falkland Islands offshore environment and Berkeley Sound are summarised in Table 1.2 and Table 1.3, respectively. In order to provide an overview of the environmental sensitivities, the tables indicate the relative importance of each month, regardless of the particular species, fishery or site that is driving the sensitivity.

Table 1.2: Summary of key environmental sensitivities in the Sea Lion Phase 1 Development area.

KEY				Low ¹		Medium ¹		High ¹			
Environmental baseline and sensitivity at Sea Lion											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plankton: Plankton comprises of small to microscopic plants (phytoplankton) and animals (zooplankton) that drift in the surface layers of the sea. Phytoplankton require sunlight, like all other plants, to survive, and zooplankton graze upon the phytoplankton or prey on other zooplankton. The oceanic fronts around the Falkland Islands result in nutrient rich waters which create an area of very high phytoplankton productivity immediately to the north of the Islands (and approx. 60 km to the south of the Sea Lion Field). This phytoplankton productivity is seasonal and in turn supports complex communities of zooplankton, which then support complex pelagic (in the water column) and demersal (near the seabed) ecosystems.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine flora: Not applicable to offshore location.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benthic fauna: Benthic fauna are those animals which live on, or below, the seabed. Overall, benthic fauna around the Sea Lion area is very uniform, with polychaetes (i.e. marine worms) and crustaceans (e.g. crabs) being the two most abundant groups present, followed by molluscs (e.g. clams).											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fish and shellfish: The convergence of the temperate and sub-Antarctic regions in the Falkland Islands archipelago results in the presence of species belonging to both. The six sub-Antarctic, and seven temperate, fish and squid species found in abundance in Falkland Islands' waters primarily utilise the NFB as feeding grounds, migrating in and out of the area as food availability changes and to follow seasonal spawning migrations. Other species feed in the area as juveniles and move to deeper waters as they mature and become adults. This results in seasonal changes in the fish assemblages across the ecosystem.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seabirds: Over 70 % of the global population of black-browed albatross breed on the Falkland Islands with a significant proportion of the global populations of gentoo and rockhopper penguins doing the same. The waters surrounding the Falklands also support numerous species that breed elsewhere. Of the species recorded in the Sea Lion area, the Atlantic petrel, grey-headed albatross, and northern royal albatross are all listed as 'Endangered' on the IUCN Red List, and the southern rockhopper penguin, white-chinned petrel, southern royal albatross and the wandering albatross are listed as 'Vulnerable'.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine mammals: Confirmed records indicate that 25 species of cetacean (whales, dolphins and porpoises) occur within Falkland Islands waters and three species of pinniped (seals) breed on the Islands. Many of the cetacean species are rare and inconspicuous and some are only known from stranded animals. Of these 25 cetacean species, two species are listed as 'Endangered' on the IUCN Red List, namely the sei whale, and one species, the sperm whale, are listed as 'Vulnerable'.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Conservation sites: There are no designated marine protected areas in Falkland Islands waters. However, work is ongoing to identify marine areas that support important aggregations of seabirds and other fauna. On land, a number of Important Bird Areas (IBAs) have been designated and the influence of these extends 15 miles into the surrounding marine environment. Additionally, a network of National Nature Reserves (NNR) and Important Plant Areas (IPAs) protect many of the most important seabird breeding sites and areas supporting native flora respectively.											

¹ Note that the terms Low, Medium and High in this context provide a guide only as to the general sensitivity / abundance as it is relevant to each receptor. Specific sensitivities of each receptor to each environmental impact are explored in full within the EIS.



Table 1.3: Summary of key environmental sensitivities in Berkeley Sound.

KEY					Low ¹		Medium ¹		High ¹		
Environmental baseline and sensitivity in Berkeley Sound											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plankton: Plankton comprises small to microscopic plants (phytoplankton) and animals (zooplankton) that drift in the surface layers of the sea. The most conspicuous component of the inshore zooplankton community is lobster krill, which is an important prey species for higher predators (such as penguins and whales).											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine flora: Marine plants are the major primary producers in the marine environment. The most common species of seaweed within the Falklands are the giant kelp and the tree kelp, which are found around the entire Falklands coastline. Kelp is a habitat forming species and is a very important part of the inshore ecology.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benthic fauna: Benthic fauna are those animals which live on, or below, the seabed. Berkeley Sound supports a wide range of benthic habitats (including biogenic and geogenic reefs), each supporting a characteristic range of species. Although none of the species found is rare or protected under any Falkland Islands legislation. Work is ongoing to identify important marine areas, and as such work develops, new designations can be incorporated in the ongoing management of the project via the EMMP and the 5-yearly review of the EIS.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fish and shellfish: The most conspicuous species found inshore off the east coast is loligo squid, which play a key role in the inshore ecology as predator and prey. In addition, loligo support the second largest fishery in the Falklands. Loligo are known to migrate inshore to spawn, although the key spawning sites remain unknown. Periods of 'high sensitivity' reflect the spawning periods of the two loligo cohorts. There are several species of shellfish found within Berkeley Sound that are commercially exploited elsewhere but not currently in the Falklands.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seabirds: Berkeley Sound encompasses significant breeding populations (>1% of the national population) of gentoo and rockhopper penguins and a far higher proportion of the national populations of king penguins, sooty shearwaters and white-chinned petrels. In addition to king and gentoo penguins, there are large resident populations of imperial and rock shags and Falklands steamer ducks, which are present year-round. Of the species breeding in Berkeley Sound the white-chinned petrel, southern rockhopper penguin and Cobb's wren are listed as 'Vulnerable' on the IUCN Red List.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine mammals: Berkeley Sound supports small breeding populations of South American sea lions (Diamond Cove), South American fur seals (Volunteer Rocks) and is likely to have breeding populations of Commerson's and Peale's dolphins. Conspicuous seasonal visitors include sei whales, which are most numerous in the late summer and autumn. Several other species of large whale have been recorded within Berkeley Sound including southern right and Antarctic minke whales. An unprecedented influx of southern right whales was recorded during the winter of 2017.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Conservation sites: The entrance to Berkeley Sound is flanked by two National Nature Reserves (Volunteer Point and Cow Bay, and the Kidney Island Group), which are also classed as Important Bird Areas.											

¹ Note that the terms Low, Medium and High in this context provide a guide only as to the general sensitivity / abundance as it is relevant to each receptor. Specific sensitivities of each receptor to each environmental impact are explored in full within the EIS.

Data gaps

The Gap Analyses Programme

The Falkland Islands Offshore Hydrocarbons Environmental Forum (FIOHEF) was established in 2011 to facilitate discussion of environmental issues relating to current and future hydrocarbon activities in the Falkland Islands. FIOHEF established a subcommittee, the Gap Analyses Group, to examine the data gaps that needed to be filled in order to better inform and monitor the potential environmental impacts from offshore hydrocarbon activities in the Falkland Islands.

Data gaps of most relevance to the development were identified and prioritised according to the urgency with which it was perceived that the data was required:

- Offshore benthic ecosystems with regard to collation of data, infauna sampling, sedimentology and chemistry;
- Oceanography in relation to oil spill modelling with regard to hydrographic dynamics, temporal and water column dynamics;
- Seabirds with regard to priority species and temporal movements; and
- Marine mammal (pinnipeds and cetaceans) with regard to populations and breeding activity, spatial and temporal distributions (described further in section 7.2.4.2 of the EIS).

Much of the data will take a number of years to collect and assimilate, and this is ongoing. There has however, been significant progress in many areas, e.g. oceanography, offshore benthos and marine mammal distribution. In the EIS, best available data has been used for the assessments including outputs from the Gap Analyses Programme (GAP) Project and parallel studies related to its recommendations.

Key data gaps relevant to the Sea Lion EIA

The GAP project is complete with most results available and it is considered necessary to acknowledge the outstanding and project-specific data gaps that have been identified during the Sea Lion EIA process.

The key data gaps of relevance to the Sea Lion EIA are:

- General:
 - Impact of sea lion crude on fur;
 - Predicting the likelihood of introducing invasive species;
 - Auditory sensitivity of penguins and marine mammals;
 - Quantifying the impact of bird strikes;
 - Impact of long-term noise and actual noise outputs from the operations; – Adhesion of Sea Lion crude oil on fur;
- Offshore environment (NFB and Sea Lion Field):
 - Inter-annual distribution and abundance of marine mammals in the NFB;
 - Seabird distributions;
 - Benthic habitats and fauna at the Sea Lion drill centre and flowline locations specifically;
- Inshore environment (Berkeley Sound):
 - Location(s) of loligo spawning grounds; and
 - Inter-annual distribution and abundance of marine mammals.

Management of data gaps within the Sea Lion EIA

Data gaps identified during the EIA process (those based on a total absence of data and those where the results from the GAP project are pending) are specified in the respective impact and risk assessment chapters in the EIS (Chapters 10, 11 and 12). While a precautionary approach was taken during all the impact and risk assessments, it is important to note that the identification of data gaps was pivotal in determining the level of confidence in the assessment, as is described in the EIA Methodology (Chapter 8 of the EIS).

Where data gaps had the potential to undermine assessments of the 'Sensitivity of Receptor' or the potential 'Severity of Effect' associated with an activity, the confidence

in the assessment was indicated to be either 'Probable' or 'Uncertain' (as opposed to 'Certain'). In turn, the level of confidence in the assessment was used to inform the monitoring requirements for each potential impact / risk (see again the EIA Methodology in Chapter 8 of the EIS).

To enable identification and agreement on reasonably practicable monitoring options, a workshop to consider the contents of an Environmental Monitoring and Management Plan (EMMP) to accompany the Sea Lion oil field Environmental Impact Statement (EIS) was held in Stanley, Falkland Islands on 23-25 April 2019. It was attended by 25 interested stakeholders, comprising FIG, PMO, industry bodies and NGOs. Consideration was given to eleven environmental impacts from the

Sea Lion development where there was potentially a need for further certainty as to the actual impact. The Summary EMMP tables are provided below (section 1.8; Chapter 15 in the full EIS). International researchers will continue to be engaged in the EMMP process through workshops and collaborative peer review so the work has international standing and transparency.

Key social sensitivities

As of the 2016 census, the permanent population of the Islands stands at 3,200. The majority of the population reside in the capital, Stanley, which is the main town on the Islands and is situated on East Falkland. The key social sensitivities of the Falkland Islands are summarised in Table 1.4.

Table 1.4: Summary of key social sensitivities in the Sea Lion Phase 1 Development area.

KEY						Low ¹		Medium ¹		High ¹	
Social baseline and sensitivity											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Commercial fisheries: The two most important fisheries within the Falklands Economic Exclusion Zone (EEZ) are the jig fishery for Argentine shortfin squid and the trawl fishery for Patagonian long-finned squid, which accounted for 54% and 20% of the 2012 – 2018 catch by weight respectively. There is also a fleet of trawlers that operate over the Falklands continental shelf that target a range of finfish species. Currently, the only other fishery in the Falklands EEZ is the longline fishery for Patagonian toothfish, which operates in deeper waters (> 600 m).											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tangible property and resources: There is a range of onshore infrastructure on the Falkland Islands that will be utilised during the Phase 1 Development, which could lead to competition for resources with other users of these facilities. The main areas of potential impact include the use of: port facilities, supply routes, airports and airlinks, the road network, accommodation, freshwater and electricity supply. During the austral summer period, accommodation, flight availability and freshwater may all be less available.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tourism: The majority of tourists visiting the Falkland Islands arrive on cruise ships. Many cruise ships visit locations in the west of the Islands to see wildlife and most vessels visit Stanley. Within Stanley, there are a number of businesses and individuals that support tourist excursions to locations within driving distance of the town. Many of these sites are important for the wildlife that they support; however, they are also important recreational sites for residents.											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine archaeology: The UK Hydrographic Office Wreck site database indicates that there are 177 wrecks recorded within Falkland Islands waters, with records dating from the 1800's to present day. There are six recorded wrecks within 100 nautical miles of the proposed drilling sites; the closest of these wrecks is located approximately 50 nautical miles from the nearest well site. Two wrecks were identified within the Berkeley Sound survey area: the trawler Ocean 8 to the northwest, and the Blakeney to the southeast.											

¹ Note that the terms Low, Medium and High in this context provide a guide only as to the general sensitivity as it is relevant to each receptor. Specific sensitivities of each receptor to each social impact are explored in full within the EIS.

Environmental and Social Impact and Risk Assessment

Q5

To answer 'Question 5' above, the following section provides:

- A description of how the activities associated with the proposed Phase 1 Development may interact with the environment e.g. the environmental and social aspects, impacts and risks;
- A brief summary of the EIA methodology;
- Key findings of the EIA including:
 - An overview of the overall EIA findings with regard to the initial and residual assessments; and
 - Narratives on the residual impacts (planned activities) and risks (unplanned / accidental activities) which remain of 'Moderate' significance or above.
- A summary of all residual impacts and risks from all activities.

Environmental and social aspects, impacts and risks

All of the activities that will be carried out in the proposed Development have the potential to interact with the environment and the human population. The ways in which the Development activities may interact, and the potential impacts and risks associated with these interactions, were identified during an ENVironmental Impact IDentification (ENVIID) workshop (see Chapter 9 of the EIS).

In summary, the ways in which the planned Phase 1 activities and unplanned / accidental activities may interact with the environment and the human population are as follows:

- Environmental aspects:
 - Artificial light;
 - Disturbance to wildlife from use of helicopters;
 - Disturbance to the seabed / placement and removal of objects on the seabed;
 - Underwater noise offshore;
 - Underwater noise inshore;
 - Drill cuttings and mud discharges to sea;
 - Operational discharges to sea;
 - Thermal discharges;
 - Atmospheric emissions;
 - Waste;
 - Collisions between vessels and marine mammals;
 - Introduction marine non-native species; and / or
 - Introduction of terrestrial non-native species.

- Social aspects:
 - Disturbance to other users of the sea offshore;
 - Disturbance to other users of the sea inshore;
 - Competition for resources:
 - Accommodation;
 - Freshwater;
 - Electricity;
 - Air-links; and
 - Use of roads network.
 - Disturbance to the human population through:
 - Light; and
 - Helicopters and noise.

Note: The EPD EIA Guidance notes that some socio-economic impacts, such as tax revenues, wages, land values, are unlikely to be relevant within the scope of an EIA, though the above impacts were considered to be 'in scope'.

- Accidental events offshore, inshore and at-shore:
 - Loss of control leading to oil / chemical spill;
 - Small spills contributing to chronic oil pollution; and / or
 - Fuel spill either from bunkering operations or from an accidental event.

Each activity carried out during the Development may lead to one or more of the aspects above and one or more associated impact or risk. For example, the use of vessels will result in the presence of artificial light, underwater noise, impacts to other users of the sea and atmospheric emissions whilst also carrying the risk of collisions. Therefore, the project activities, their associated environmental aspects and the environmental receptors on which they may impact upon are presented in Figure 1.3 overleaf.



Figure 1.3: Project activities and the identification of environmental aspects and the receptors, which they may impact upon

Development activities	Environmental aspects													Environmental receptors which may be impacted upon during planned activities and unplanned and accidental events		
	Environmental aspects															
	Artificial light	Helicopter use	Seabed disturbance	Underwater noise	Drill cuttings and mud discharges	Operational discharges	Thermal discharges	Atmospheric emissions	Waste	Marine mammal collision	Marine invasive species	Terrestrial invasive species	Disturbance to other sea users		Competition for onshore resource	Nuisance factors ¹
Drilling operations	✓															✓
Subsea works ²	✓	✓														✓
FPSO HUC ³	✓															✓
SIMOPS ⁴	✓		✓	✓	✓	✓	✓	✓	✓							✓
Production	✓			✓												✓
Offloading from FPSO to CTT	✓			✓											✓	
Use of the onshore supply base	✓															
Use of the TDF	✓															
Use of resources ⁵																
Fixed-wing flights																
Helicopter use	✓	✓		✓												✓
Vessel use	✓			✓												✓
Decommissioning ⁶																

↑

Environmental receptors which may be impacted upon during planned activities and unplanned and accidental events

Environmental aspects	Environmental receptors which may be impacted upon during planned activities and unplanned and accidental events																
	Physical					Biological					Social						
	Seabed (and soil)	Water quality	Regional air quality	Global atmosphere	Marine flora	Plankton	Benthos	Fish / cephalopods	Seabirds	Marine mammals	Designated sites	Biosecurity	Land / seascape	Human population	Other sea users	Tangible property / resources	Archaeological
	✓				✓	✓	✓	✓	✓	✓			✓	✓			✓
	✓	✓	✓				✓		✓					✓			
	✓				✓		✓	✓	✓								
	✓				✓	✓	✓	✓	✓								
	✓	✓															
	✓	✓															
	✓	✓															
	✓	✓															
	✓	✓															
	✓	✓															
	✓	✓															
	✓	✓															

Onshore light, noise, odours and visual disturbance

Installation of subsea infrastructure

Hook-up and commissioning

Simultaneous drilling and production operations

Accommodation, freshwater, airlinks, electricity, roads network

¹ Onshore light, noise, odours and visual disturbance
² Installation of subsea infrastructure
³ Hook-up and commissioning
⁴ Simultaneous drilling and production operations
⁵ Accommodation, freshwater, airlinks, electricity, roads network



Impact and risk assessment methodology

To understand the impact and risk assessment process and the summary results presented below, it is necessary to appreciate that:

- **Impacts** to the environmental and human population may result from planned activities; and
- Each activity carries the **risk** of impacts occurring during unplanned and / or accidental events.

As shown in Figure 1.4, the **impact** is assessed by considering the 'Sensitivity of the Receptor' and the 'Severity of Effect' on that receptor. This then leads to an overall impact significance rating ranging from '**Very Low**' to '**High**'. Impacts of unplanned or accidental events are assessed in the same way while the **Risks** associated with these events take account of the 'Likelihood' of the event occurring. Taking account of the impact and the 'Likelihood of Occurrence' the significance of risk is then rated, again ranging from '**Very Low**' to '**High**'.

Figure 1.4: Illustration of the impact assessment for planned events and the risk assessment for unplanned and accidental events

Impact	=	Sensitivity of the Receptor	x	Severity of the Effect
Risk	=	Impact	x	The likelihood that an unplanned or accidental event will occur

When carrying out the EIA, the impact and risk assessments are each conducted twice:

- The first assessment takes account of the legal requirements and industry standard practices as well as the mitigations which are built-in to the base case. The latter are included as these are already in place and are often included to minimise outputs e.g. emissions, discharges etc. This assessment describes the significance of the initial impact or risk (i.e. 'Very Low' to 'High').
- The **second** assessment takes account of any additional project-specific mitigations which are considered reasonably practical to further reduce the initial impacts and risks which were considered to be significant (i.e. 'Moderate' or above). Project-specific mitigations are those which are used in addition to any mitigations required by legislation either in the Falklands or the UK and / or are currently considered to be standard industry practice in the Falklands. This second assessment describes the significance of the **residual** impacts and risks.

All residual impacts and risks will be reduced to a level that is 'As Low As is Reasonably Practicable' (ALARP) throughout the EIA process and throughout the life of the Development.

The mitigation measures and commitments are listed in the Environmental Monitoring and Management Plan (EMMP).

Offsetting

The Offshore Minerals Ordinance states that ‘EISs must contain a description of offsetting.’ Exco paper 124/16 (FIG, 2016d) details FIG’s recommendations for developing offsetting guidance. This in turn has led to the development of Appendix 2 to the Hydrocarbons Environmental Impact Assessment Guidance Note (EPD, 2015).

The Exco paper states that ‘hydrocarbon development should seek meaningful offsetting of any impacts which cannot be avoided or mitigated, specifically in relation to greenhouse gas emissions and biodiversity’ (FIG, 2016d). The options for offsetting of these impacts include:

- Direct offsetting, i.e. the operator develops local projects to offset, like-for-like, the impacts arising from the development that cannot be avoided or mitigated; or
- An environmental fund whereby the operator contributes to a fund with a non-governmental panel to direct, manage and oversee various offsetting projects.

Following elimination and / or reduction of all the impacts and risks identified for the Sea Lion Field, Premier conclude that only tangible significant impacts / risks (impacts / risks assessed as ‘Moderate’ or above) may be offset.

Premier has reviewed the significant residual impacts and risks associated with the Development activities, and explored practicable, effective and locally beneficial direct offsetting measures in relation to these. In all instances, it has not been possible to identify appropriate direct offsetting projects that will benefit the local environment, and that are practicable for Premier to implement. Consequently, Premier will not pursue direct, like-for-like, offsetting for the significant residual impacts / risks associated with the Sea Lion Development.

Premier has also reviewed indirect offsetting. Indirect offsetting refers to implementing measures that do not directly compensate for the impacts / risks identified above but may provide opportunities to achieve environmental benefits in the Falklands in the longer-term. Such measures do not attempt to attain carbon neutrality nor seek to provide net gains in biodiversity.

Premier is not best placed to identify and endorse suitable indirect offsetting projects. The Exco paper acknowledges that operators “do not always have the knowledge, resources, or inclination to take such projects on” (FIG, 2016d). As such, Premier will not pursue indirect offsetting for the significant residual impacts / risks associated with the Sea Lion Development.

A third option available is to make a contribution to an environmental fund. FIG Policy allows for operators to contribute to an Environment Fund to achieve carbon and biodiversity offsetting and environmental legacy benefits. The fund would promote enhanced stewardship of the environment and aim to build wider eco-system resilience and knowledge to create a lasting Falkland Islands environmental legacy. The fund would be managed and governed by a trustee board including environmental stakeholders and industry to award grants and oversee general administration (FIG, 2016d).

Premier considered the significant residual impacts predicted to arise from the Sea Lion project in order to explore the opportunity for a formula or methodology to calculate a financial payment commensurate with the predicted impacts. However, given the difficulties in developing such a methodology, Premier proposed a level of contribution to the Fund following review / consideration of:

- Premier’s support for environmental legacy projects in other areas in which it operates;
- The scale of costs of environmental projects past and present in the Falklands, which are similar to those it is envisaged the fund will support;



- Other operators' environmental legacy projects around the world; and
- Economic context, both in terms of the project itself and the wider Falklands economy.

This analysis enabled a proposed annual contribution to be agreed with FIG. Contributions to the fund will commence from Stage 1 (production drilling) and will continue for all following stages of the project. However, Premier will review this approach and level of contribution every five years, in line with the EIS review, to ensure it remains the most effective way to achieve offsetting.

Key findings of the EIA

Overview of EIA findings with regard to the initial and residual assessments

During the initial assessment:

- 69 % of the impacts and risks assessed were considered to be **Very Low** or **Low**. While no additional, project-specific, mitigations were considered necessary for these impacts and risks, all will be subject to ongoing reviews to ensure that they remain ALARP;
- 25 % of the impacts and risks were considered to be of **Moderate** significance;
- 3 % were **Upper Moderate**;
- 1 % were **High**; and
- 1 % were considered **Beneficial**.

Where initial impacts and risks were considered to be **Moderate** or above, project-specific mitigations were identified and those that were considered to be 'reasonably practicable' were factored into the *residual* assessment to reduce all the impacts / risks to ALARP. This resulted in an overall reduction in the number of **Moderate**, **Upper Moderate** and **High** impacts and risks.

Based on the residual assessment:

- The number of **Very Low** and **Low** impacts / risks increased to 75 %;
- The number of **Moderate** impact / risks was reduced to 21 %;
- The number of **Upper Moderate** impacts / risks remained the same at 3 %;
- None of the residual impacts or risks were deemed to be High; and
- 1 % were considered **Beneficial**.

A summary of the impacts and risks that were **Moderate** or above during the initial assessment and were reduced to **Low** or **Very Low** in the residual assessment due to the project-specific mitigation commitments is provided in Table 1.5. A summary table showing *all* the *residual* impacts and risks to all the receptors is provided in Table 1.7 on page 38.

The impacts and risks, which *remained* significant despite the use of industry standard mitigations and the commitment to reasonably practical project-specific mitigations, are described further below.

Table 1.5: A summary of the impacts and risks that were initially identified as being of Moderate significance or above and which were reduced following commitment to reasonably practical project-specific mitigations.

Impact / risk	Initial assessment ¹	Key project-specific mitigation summary	Residual assessment ²
Risk of injury to marine mammals via collisions with vessels <i>en route</i> between Stanley and the Sea Lion Field	Moderate	Increased awareness and vigilance of vessel's crew and voluntary speed limit while transiting inshore waters	Low
Competition with domestic energy needs during the night	Moderate	Use of vessel generators to prevent need for shore-power hook-up by vessels (and monitoring of generator noise levels)	Low
Disturbance to the human population from operations noise at the TDF and supply base	Moderate	Activity restrictions and minimising noise at night	Very Low
Risk of impacts of inshore MGO fuel oil spills (10-3,700 tonnes) to fishing grounds, seabirds and marine mammals	Moderate	Vetting of vessels, Vessel Traffic Management System, use of exclusion zones, and onsite oil spill response capability	Low
Risk of impacts of a 1,526 tonne Intermediate Fuel Oil (IFO) spill inshore on benthos, fishing grounds, seabirds and marine mammals and coastal habitats	Moderate		Moderate
Risk of day-to-day small leaks and spills at-shore	Moderate	On site oil spill response equipment	Low

¹ Taking account of regulatory requirements, industry standard practices and base case mitigations

² Taking account of reasonably practicable project-specific mitigations



Significant residual impacts and risks

The significant *residual* impacts and risks are summarised in Table 1.6. The full EIS describes the initial and residual assessment outcomes for *all* the environmental and social aspects (Chapters 10, 11 and 12). The sections below summarise only the *residual* impacts and risks that remained significant following project-specific mitigation.

Significant residual impacts and risks are those that have been reduced to ALARP but are still considered to be '**Moderate**' or '**Upper Moderate**', primarily because of:

- The limited options for effective and reasonably practicable project-specific mitigations; and / or
- The use of a precautionary approach during the assessment when faced with data gaps, which leads to higher levels of uncertainty.

In each summary below, only the highest impact or risk is presented. For example, where underwater noise may affect diving seabirds and marine mammals, only the impact to marine mammals is described in the sections below as this was assessed as the greatest potential impact.

Table 1.6: A summary of the residual impacts and risks that, while considered to be ALARP, remain significant

Impact / risk	Residual assessment ¹
Impacts and risks associated with planned activities	
Risk of bird-strikes due to artificial light Moderate	Moderate
Impact on and behavioural disturbance to marine mammals from underwater noise offshore	Moderate
Impacts of drill cuttings discharge on benthos including burial of benthic fauna, modification of habitat, toxicity and oxygen depletion	Moderate
Impacts from atmospheric emissions	Moderate
Impact of waste disposal to the UK	Moderate
Risk of injury to marine mammals via collision in Berkeley Sound	Moderate
Risk of introducing marine invasive species in Premier managed vessels	Moderate
Risk of introducing marine invasive species from Premier chartered coaster vessels and LTVs in Berkeley Sound	Moderate
Risk of introducing marine non-native species from third party vessels (i.e. vessels not directly managed by Premier) which are associated with Premier activities	Upper Moderate
Risk associated with non-native species arriving on air freight	Upper Moderate
Competition for freshwater resources	Upper Moderate
Competition with domestic electricity needs during the day	Upper Moderate
Competition for use of road network	Moderate
Disturbance to the human population from light inshore and onshore	Moderate
Risks associated with accidental events	
Accidental releases of oil or diesel to sea offshore	Moderate
Accidental release of Intermediate Fuel Oil (IFO) inshore	Moderate

¹ Taking account of regulatory requirements, industry standard practices, base case mitigations and reasonably practicable project-specific mitigations.

Artificial lights offshore and inshore



Throughout the Phase 1 Development, installations and vessels will add to the existing levels of artificial light both offshore and inshore, and this was raised as a concern by stakeholders during consultations in 2014, 2015 and 2016 (see EIS Chapter 6). Further, while flaring is not expected to occur during normal operations, a pilot light will be permanently lit, and flaring may be necessary during planned or unplanned equipment outages. Flaring during well tests and well clean up may also be required for all production wells.

During the hours of darkness, artificial light will attract plankton, fish and squid but the impact upon seabirds is considered to be of greatest concern. Lights will attract and / or disorientate seabirds (small petrels) and there is the potential for these birds to collide with the lights or vessel superstructures. This phenomenon is known as 'bird-strike'.

Bird-strikes may result in mortality through direct collision. Birds may suffer injuries or hypothermia, should feathers become contaminated with residues on the deck of a vessel. The occurrence of seabird collisions will depend upon a combination of factors including the species and abundance of birds in the area at the time, and local weather conditions. Small nocturnally active petrels are most susceptible during periods of poor visibility.

Taking account of the sensitivity of bird species which may be susceptible, the potential severity of effect of multiple bird-strikes, the fact that artificial lighting on vessels and installations cannot be reduced or altered without compromising safety, and adopting a precautionary approach, the residual risk of bird-strikes is considered to be '**Moderate**' (see EIS section 10.1).

Underwater noise offshore

Underwater noise will be generated by the use of vessels throughout the Phase 1 Development and will be continuous throughout the life of the project. Noise pollution and its effects on sensitive receptors was raised as a concern by stakeholders during consultations in 2014 and 2015 (see EIS Chapter 6). While underwater vessel noise may impact upon fish, squid and diving birds, it is most likely to have a consequential impact upon marine mammals, through disturbance and / or changes in behaviour.

When assessing the impact of sound on any animal, it is necessary to compare the sounds being made with the thresholds above which the animal may exhibit behavioural reactions to disturbance or experience hearing loss / injury. It is also necessary to consider how close the animal needs to be to the source of the noise for it to experience the sound at levels above the disturbance and injury thresholds.

Modelling was carried out to assess the impact of different sound sources on the different receptors e.g. fish, seabirds, marine mammals, at different distances. Based on the modelling results and available information, the worst case impact of underwater noise is that of a stationary source of vessel noise at the Phase 1 Development site (e.g. from the dynamically positioned OSV) and its potential long-term effect on marine mammals.

Given the conservation status of the whale species that may be affected, data gaps in marine mammal distribution in the NFB, lack of knowledge of the long-term impact of continuous noise and difficulties

in effectively mitigating this impact, the precautionary approach dictates that the residual impact rating remains '**Moderate**' (see EIS section 10.4).

Discharge of drill cuttings

Drilling of the development wells will result in the discharge of drilling muds and rock cuttings in the proximity of the well. Water Based Mud (WBM) and cuttings will be discharged directly to seabed. Whilst drilling the top sections of the wells, cleaned Oil Based Mud (OBM) cuttings will be discharged from the bottom sections of each well. Prior to discharge, OBM cuttings will be returned to the MODU where they will be cleaned by a Thermo-mechanical Cuttings Cleaner. The cuttings will be cleaned to ensure there is <0.5 % oil (by weight on dry cuttings) remaining, following which the cuttings will be discharged to sea.

Whilst the discharge of cuttings may impact water quality, plankton, fish and squid, the greatest impact will be to the benthic community in the area. These impacts can arise from smothering, changes to habitat, reduction in oxygen availability and the toxic effects of residues associated with the cuttings.

Modelling was carried out to determine the extent of the impacts of the cuttings in the vicinity of the wells. Although there are no known species of conservation importance in the area, the specific location of the Sea Lion Development has not yet been surveyed such that there are minor data gaps and thus a precautionary approach was taken. Using a precautionary approach, and due to the extent and duration of the impacts, the residual impact to benthic fauna is considered to be '**Moderate**' (see EIS section 10.6).

Atmospheric emissions (climatic factors)

Nearly all activities associated with the Phase 1 Development will result in atmospheric emissions and this was raised as a concern by stakeholders during consultations in 2015 and 2016 (see EIS Chapter 6). Emissions will result from power generation on the MODU and FPSO, well

clean-ups, the flare pilot light on the FPSO and the use of all vessels, fixed-wing flights and helicopters.

Atmospheric emissions include gases which lead to global warming and ocean acidification, the best known of which is Carbon Dioxide (CO₂).

A number of emissions reduction measures are built-in to the Phase 1 base case, as shown in Table 1.1 on pages 10 and 11. Moreover, in line with its HSES Policy, Premier will endeavour to minimise emissions, where possible, through operational control measures, monitoring and reporting and periodic reviews to determine whether or not the emissions remain ALARP.

Nonetheless, while the percentage contribution of emissions is minimal when compared to UK emissions, and the new development has been designed with efficiency in mind, owing to the sensitivity of the global environment as a receptor, the residual impacts of the contribution of atmospheric emissions to both global warming and ocean acidification are considered to be '**Moderate**' (see EIS section 10.9).

Waste management

Waste by-products will result from nearly every activity carried out during the Phase 1 Development and waste management was raised as a concern by stakeholders during consultations in 2015 and 2016 (see EIS Chapter 6). Waste from the Development will include domestic and marine wastes, solid wastes, produced water, drainage water, ballast water, domestic waste water, food, sewage discharges and drill cuttings. Some of these wastes are hazardous, some are non-hazardous and some may be legally discharged to sea provided they undergo proper treatment. Produced water, drainage water, ballast water and drill cuttings are all described in separate chapters. With the exception of drill cuttings (see above) the associated impacts were 'Low' such that they are not detailed in this NTS beyond their inclusion in Table 1.7 on page 38.

Of greater significance, is the generation of solid operational wastes, all of which will be returned to shore for treatment at the FIG waste management facility or, in the event that the municipal facility is not available, for incineration at the supply base or deposition to landfill in the UK. To ensure the responsible management of waste, and compliance with Premier's Duty of Care obligations, Premier will develop and implement a project-specific Waste Management Plan (WMP) prior to the start of drilling operations.

Given that there are currently insufficient waste management facilities in the Falkland Islands, the following commitments are made by Premier:

- The planned FIG Waste Management Facility will be used to treat and dispose of project wastes, if available; or
- In the event that the FIG Waste Management Facility is unavailable, Premier may install a portable Incinerator at the supply base for the burning of suitable waste streams. The resultant ash from the incineration process will be returned to the UK for disposal if a suitable disposal route cannot be established on the Falklands.
- There will be no uncontrolled landfill of wastes to the Eliza Cove or Mary Hill Quarry sites;
- Premier will only export wastes in compliance with all applicable international and national regulations; and
- Throughout the Development the 'Waste Hierarchy' will be utilised and annual waste targets will be set, to maximise waste reduction and recovery.

Waste facilities in the Falkland Islands are currently very limited. Plans approved by the Falkland Islands Government (FIG) should deliver a new municipal integrated waste facility that is capable of receiving the waste from the Sea Lion Phase 1 project. Although it is not Premier's preferred option for the disposal of wastes, should the municipal facilities not be ready when

the project starts, some waste will need to be sent to landfill in the UK. Landfill is an unsustainable practice and therefore, although the quantities of waste are comparatively small, landfill space in the UK remains limited such that the worst case residual impact of waste generation is considered to be '**Upper Moderate**' (see EIS section 10.10).

Risk of injury to marine mammals via collisions inshore

There is a risk of vessel collision with marine mammals (as raised as a concern by stakeholders in the 2016 scoping consultations, see EIS Chapter 6). Some of the vessels involved in the Construction phase (e.g. the LTVs) will be considerably larger than vessels employed in other aspects of the project. These vessels are required to transit to, and moor in, Berkeley Sound where there is a seasonally high likelihood of encountering large whales e.g. sei whales (IUCN 'Endangered') and southern right whales.

Vessel speed in the vicinity of Berkeley Sound will be limited to a maximum of eight knots. All vessels will be in a state of heightened awareness due to the risks associated with mooring operations, which will aid early detection of hazards to navigation, such as non-project vessels or cetaceans. Further, the relatively slow vessel speed will reduce the likelihood of collisions and the energy behind any impacts, thus reducing the potential for lethal injury.

While the use of industry standard guidelines, reduced vessel speeds and the use of Marine Mammal Observers will all lessen the likelihood and impact of collisions, the sensitivity of the whale species that may be affected (e.g. sei whales), the limited manoeuvrability of very large whales (e.g. right whales), the unpredictable nature of cetacean behaviour in general and data gaps in the knowledge of whale distribution mean that while the risk has been reduced to ALARP, the residual risk remains '**Moderate**' for Inshore vessels (see EIS section 10.11).

Risk of introducing marine invasive species

The arrival of vessels into Falkland Islands waters from elsewhere in the world may lead to the introduction of non-native marine species and biosecurity was raised as a concern by stakeholders during consultations in 2014, 2015 and 2016 (see EIS Chapter 6). The introduction of non-native species can result from discharged ballast waters or from biofouling present in the 'nooks and crannies' of a ship's hull. In the event that non-native species are introduced, there is then the potential that they may become established and spread. If this occurs, they are referred to as 'invasive species' and can dramatically alter the local ecosystem and / or outcompete native species altogether, negatively impacting the local biodiversity. Once established, marine invasive species are virtually impossible to eradicate.

The likelihood of such a species being introduced, and then becoming invasive, depends upon numerous factors e.g. whether the species comes from a similar climate and ecosystem, whether the ship passed through different climates en route (e.g. the Tropics) and whether or not the vessel is repeatedly 'new' to the Falkland Islands.

Industry standard and project-specific mitigation measures regarding ballast water management and antifouling of vessels go a long way to reducing the likelihood of species introduction, which may or may not then become invasive. However, the greatest risk comes from third party vessels such as the purchaser's CTT over which Premier does not have full control. On balance, given that species invasion can be difficult to detect in the short-term and can have severe effects on biodiversity which are almost impossible to reverse, the worst case residual risk of marine species invasion is considered to be 'Upper Moderate' (see EIS section 10.12).

Risk associated with non-native species arriving on freight

Bringing freight into the Islands to support Premier's operations carries the risk of introducing nonnative, potentially invasive species in the cargo. As with marine

invasives, If invasive species were introduced during the Phase 1 Development the impact on the ecology of the Islands through parasites, disease, competitors or predators may not be immediately evident but may have long-term implications. Initially the impact would be felt locally, however, once established invasive species may spread 'naturally' or with anthropogenic assistance to other parts of the Falklands archipelago. If found, potentially invasive species can be removed but they can be very difficult to detect and then eradicate. Vessels and charter flights will be arriving in Stanley throughout the life of the Development and a large amount of cargo will be taken onshore. The transportation of invasive species to the Falklands has happened in recent years, and the introduction of invasive species has occurred in the oil and gas (O&G) industry elsewhere in the world, such that the risk is considered possible during the Phase 1 Development. A Biosecurity Management Plan will be implemented during the Phase 1 Development to help prevent non-native, potentially invasive species being introduced. However, due to the potential impacts of invasive species and the fact that invasives have been introduced in the past, the risk of non-native species introduction is considered 'Upper Moderate' (see EIS Section 10.13).

Competition for freshwater resources

Onshore infrastructure associated with the Development (e.g. the onshore supply base and the TDF) will require connection to the existing Stanley water utilities. In addition, the onshore water supply will be required to support a proportion of water use by offshore assets including vessels, the MODU and drilling requirements for muds, cements, brines and domestic use.

The FIG owned Stanley water filtration plant is the single water supplier and has a fixed capacity which is limited by the existing utility infrastructure. Water is therefore considered a limited resource. Any use of water by the Development activities or assets which is above the current baseline Stanley usage has the potential to lead to competition with the local users in Stanley.

Competition for water resources will be particularly high during the drilling stages of the Phase 1 Development and in the event that demands during these stages exceed supply, impacts upon volume will be immediately apparent to consumers and businesses. The Stanley water supply is already near capacity and, to accommodate the Development, the existing system may need to operate at a temporary deficit for short durations if no changes are made to the current FIG work practices and hours of operation.

Throughout the project, the water supply to Stanley will always be prioritised over that provided to the TDF such that the impacts of any water shortage will be felt by the Phase 1 Development rather than the Stanley users. Nonetheless, the overall significance of the impact of water competition on the human population is '**Upper Moderate**' (see EIS section 11.4).

All additional project-specific mitigation measures, including planning and logistics to reduce water use during the drilling phases, will be discussed further with FIG.

Competition for electricity

Onshore and at-shore infrastructure in support of the Phase 1 Development will require connection to the existing electrical power grid of Stanley. FIG is the single energy utility supplier and has a fixed power capacity from a finite number of generators at the Stanley power station and wind turbines located a few miles out of town.

Electricity is an essential utility upon which almost all daily activity depends in an increasingly electronic age. Stanley's current baseline capacity is such that it may be unable to sustain peak demand spikes in the short-term and therefore must be considered a finite resource. The use of electricity by Premier therefore has the potential to be unsustainable in the immediate term. During the Phase 1 Development, peak daytime power demands could reach the threshold where the standby generator capacity is required. In such a situation, power demand would still be within overall capacity,

however, the operation of the power grid system using stand-by generators increases the vulnerability of the system to generator drop out.

Premier will liaise closely with FIG in preparation for 'oil readiness' to ensure that energy supply and demand are in balance. These discussions will include those based on future FIG development of power capacity.

Nevertheless, while future improvements to the FIG power station may alter the impact assessment by altering the baseline capacity against which usage is compared, these changes are currently out with Premier's control and cannot be used as a mitigation within this assessment. Therefore, the impact of competition for electrical energy on the human population of the Falkland Islands is considered to be '**Upper Moderate**' (see EIS section 11.5).

Competition for use of road network



All stages of the Sea Lion Phase 1 Development will require the use of the existing road network for the movement of personnel to, from and within Stanley, for the haulage of equipment, and transport of supplies and waste between a range of different locations. Whilst road capacity and use cannot be accurately quantified, increased utilisation may be detrimental to the road surfaces and may also result in increased necessity for remedial repairs.

Further, additional traffic, congestion and vehicles seeking parking may also create a nuisance to the local population and the issue of road use was raised as a concern during scoping consultations (see EIS Chapter 6).

An increase in traffic of up to 21 % in Stage 1, 18 % in Stage 2 and 14 % in Stage 3 (up to 20 years) is predicted, which could result in some degree of congestion at peak times and lessen parking availability which may cause inconvenience to other road users.

A Traffic Management Plan (TMP) will be put in place for operations, as was done for the exploration campaigns, to minimise the impacts from operational road use in this area. The TMP will highlight operating hours, signage, allowable routes, warning devices, clothing and pedestrian precautions for Premier staff and contractors. However, owing to the sensitivity of the receptor and the extent and duration of traffic increases, the residual significance of the impact of road use on the human population is still considered to be **'Moderate'** (see EIS section 11.7).

Disturbance to the human population from light

Throughout the Phase 1 Development the onshore supply base and port facilities in Stanley, as well as the vessels in Berkeley Sound, will create artificial light. All of these sources have the potential to create light pollution and a nuisance to local residents. It was noted during previous scoping consultations that light from the TDF, vessels and yard is noticeable to Stanley residents (see EIS Chapter 6).

To ensure a safe operation, minimum levels of lighting are required on the TDF and at the supply base as well as in Berkeley Sound on the LTV storage vessels. In compliance with safety legislation, the light levels may not be reduced below that minimum. However, mitigation measures are proposed to ensure all lights are facing inwards and to reduce light pollution both by directionally blocking lights and turning them off when not required.

Nonetheless, due to the sensitivity of the receptor (the residents of Stanley and Berkeley Sound), the longevity of the potential disturbance in Stanley and the fact that proposed mitigation measures have not proven to be fully effective during previous campaigns, the residual impact of light pollution and nuisance to the human population is considered to be **'Moderate'** (see EIS section 11.8).

Disturbance to the human population from noise

Throughout the Phase 1 Development, the use of helicopters, the onshore supply base, and the port facilities in Stanley all have the potential to create a noise nuisance for the local residents. Noise was noted during the scoping consultations in 2016 as a potential issue in Berkeley Sound relating to the use of a foghorn (see EIS Chapter 6) however, this is no longer part of the project scope. It was also mentioned that the existing activities in Berkeley Sound (e.g. off-loading of fish catches by reefer vessels) can already be heard by local residents.

Vessel noise from the Inshore LTV operation in Berkeley Sound is unlikely to pose a nuisance to residents. The significance of the LTV vessel noise is considered to be **'Low'** (see EIS section 11.9).

Significant residual risks associated with accidental events

Accidental releases of oil or diesel to sea offshore

All offshore O&G operations carry the risk of oil spills and this was raised as a concern by stakeholders during consultations in 2014, 2015 and 2016 (see EIS Chapter 6). The impacts of any given spill depend upon the type of the oil, the size and source of the spill, the prevailing winds and currents, water depth, proximity to the shoreline or to concentrations of receptors offshore, and numerous other factors. Depending upon these factors, the spill may impact upon physical, biological and social environmental receptors.



Lessons learned from oil spill events around the world have led to stringent industry standard practices that are required to minimise both the likelihood of occurrence of an oil spill and the consequences of such an event should it occur. Many of these preventative industry standard practices are built-in to the design of the facilities (see 'Base case mitigations' on page 9) and were therefore taken into account during the initial risk assessment.

With regard to the wells, industry standard oil spill prevention measures range from the way the wells are designed to the use of blow-out preventers, operational control procedures and manuals which ensure that due process is followed in all activities that could carry the risk of a large or small spill (section 1.4.2 above). Further, the well designs must be peer reviewed by an independent well examiner and the UK Health and Safety Executive (HSE) to ensure that the risk of an uncontrolled release is minimised.

With regard to the FPSO, the industry standard preventative requirements built-in to the design range from double-skinned and double-bottomed cargo and fuel tanks to the use of AIS and marine procedures intended to prevent collisions (see 'Base case mitigations' on page 9).

A range of different offshore oil spill scenarios were modelled to determine the behaviour of spills that could occur if the above preventative mitigation measures fail. The modelled scenarios included spills of reservoir oil from a well blow-out, loss of the FPSO cargo tank inventory, and spills of diesel during bunkering operations. The results of these models were used to inform the impact and risk assessments with regard to the 'Severity of Effect' of a spill.

The measures intended to minimise the consequences of an oil spill are based upon the outcomes of the spill models, as well as

industry standard practice, and are written into the project-specific Offshore Oil Spill Strategy. An Oil Spill Contingency Plan (OSCP) that covers the offshore operations will be submitted to FIG before operations commence and will detail the organisational responsibilities, immediate and long-term actions, reporting requirements and resources available to ensure the effective and timely management of any spills. The Sea Lion OSCP will be compatible with the FIG National OSCP. Resources available, and described within the OSCP, will range from equipment held on-site by Premier to international resources which can be brought in to track and monitor spill trajectories and / or equipment that will be deployed to stem the release of oil if necessary.

Mitigation measures to prevent the occurrence of spills and to minimise the consequences are designed based on the outcomes of the modelled oil spill scenarios, the full details of which are provided in section 12.1 of the EIS.

Taking account of the predicted fate of Sea Lion crude and diesel in the event of a release (as indicated by the models), the worst case potential impacts of an oil spill would be to fish, seabirds, marine mammals, fisheries and the human population (in terms of potential impact upon tourism through public perception of a spill, even if none were to reach the shore). The sensitivity of each of these receptors to an oil spill was assessed during the EIA and ranged from **High** to **Very High** (see EIS section 12.1).

The **impact** of spills (i.e. the 'Sensitivity of Receptors' x 'Severity of Effect') on all the potential receptors was assessed for each spill scenario. The large volume crude spills (e.g. well blow-out, crude inventory loss) and spills that create a 'sheen' on the water (e.g. fuel spills) resulted in **impacts** of '**Upper Moderate**' and '**High**' significance to the more sensitive receptors.

As described in section 1.7.2, the *risk* assessment process applies the *likelihood* of a spill occurring to the *impacts* associated with the spill. In the case of offshore spills, the 'Likelihood of Occurrence' was estimated based on statistical information on the frequency of incidents as well as specific Quantitative Risk Assessments (QRA) for the Sea Lion Field activities. Based on these statistics, the likelihood of offshore spills ranges from '**Very Unlikely**' (e.g. for full loss of the FPSO crude inventory) to '**Possible**' (e.g. for a spill during transfer of crude from the FPSO to the CTT). Therefore, the *risk* assessment results in a worst case residual risk of '**Moderate**' (see EIS section 12.1).

Accidental releases of fuel oil to sea inshore

The risk of oil spill in Berkeley Sound was raised by stakeholders during consultations in 2014, 2015 and 2016 (see EIS Chapter 6). Given the elimination of the Inshore transfer oil export option, the remaining inshore spill sources include the anchored LTVs, intermittent visits to the LTVS (c. 14 trips in total) by Subsea Construction Vessel, and non-Premier third party vessels. As a result the events that may result in an inshore fuel oil spill in Berkeley Sound include fuel bunkering incidents, potential vessel collisions, and vessel grounding events. With regard to mitigation, industry standard collision prevention measures including Automatic Identification Systems (AIS) and marine procedures will be used (section 1.4.2 above). Also, Premier will 'vet' all vessels prior to their use for project activities. Full details of what will be vetted / audited for the nominated CTT are provided in section 5.10 of the EIS and, in summary, will include:

- Verification of compliance with all relevant MARPOL Annex requirements and other IMO requirements;
- Verification of compliance with mandatory shipping requirements e.g. Ship Inspection Report Programme (SIRE), International Association of Classification Societies (IACS) etc.;
- Verification of the Shipboard Oil Pollution Emergency Plan (SOPEP); and
- Specific checks to ensure the vessel's equipment is suitable for the operation with regard to risk management and insurance requirements.

A range of inshore oil spill scenarios were modelled to determine the behaviour of spills that could occur if the above preventative mitigation measures fail. The modelled scenarios include spills of Marine Gas Oil (MGO) and IFO and from bunkering incidents, vessel collisions and vessel grounding incidents. The results of the modelling were used to inform the impact assessment with regard to the 'Severity of Effect' of a spill.

An OSCP that covers the inshore operations will be submitted to FIG before operations commence.

Mitigation measures to prevent the occurrence of spills and to minimise the consequences are designed based on the outcomes of the modelled oil spill scenarios and full details are provided in section 12.2 of the EIS. Taking account of the predicted fate of fuel oil in the event of a release in the Sound (as indicated by the models), the worst case potential impacts of oil spills are to fish and squid, fisheries, seabirds, marine mammals, coastal ecology and the human population (in terms of potential impact upon tourism). The sensitivity of each receptor within Berkeley Sound was assessed during the EIA, and ranged from '**High**' to '**Very High**'.

The impact (i.e. the 'Sensitivity of Receptor' x 'Severity of Effect') on all the potential receptors in and around Berkeley Sound was assessed for each spill scenario. The larger volume spills resulted in residual impacts of '**High**' and '**Upper Moderate**' significance to the more sensitive receptors.

Estimation of the 'Likelihood of Occurrence' of inshore spills was based on statistical information on the frequency of incidents. The assessment of the worst case residual risk was '**Low**' and '**Very Low**' for the majority of spills and '**Moderate**' for a spill of fuel oil (see EIS section 12.2).

EIA outcomes summary

Table 1.7 overleaf shows the significance of the worst case residual impacts and risks associated with all activities on all receptors. The overall significance of impacts associated with each activity is based upon the greatest impact / risk. In other words, if an oil spill is identified as having a greater impact on seabirds than on the benthos, then the impact to

seabirds dictates the overall significance of oil spills.

Table 1.7 also indicates which of the aspects were initially raised as a concern by stakeholders during the scoping consultations (EIS Chapter 6) to enable easier review by stakeholders of the EIA outcomes for their particular area of concern.



Table 1.7: Summary of the worst case residual impacts / risks to each receptor for all Development activities, and an indication of whether they were raised as a concern by stakeholders during informal scoping consultations (definitions of impact and risk categories can be found at the foot of the table)

KEY	Very Low	Low	Moderate	Upper Moderate	High																	
Activity	Residual Environmental Impact / Risk																Worst case Residual Impact / Risk	Raised by stakeholder during scoping consultation				
	Physical								Biological										Social			
	Seabed (and soil)	Water quality	Regional air quality	Global atmosphere	Marine flora	Plankton	Benthos	Fish / cephalopods	Seabirds	Marine mammals	Designated sites	Biosecurity	Land / seascape	Human population	Other sea users	Tangible property / resources			Archaeological			
	Environmental impacts and risks associated with planned activities and unplanned events																					
Artificial light and the risk of bird-strikes inshore and offshore																		Orange	✓			
Disturbance to wildlife from helicopter use																		Yellow	✓			
Disturbance to seabed	Green						Yellow											Yellow				
Seabed disturbance - risk of dropped objects	Green																	Green				
Underwater noise offshore																		Orange	✓			
Underwater noise inshore																		Yellow	✓			
Discharge of drilling mud and cuttings	Green	Green				Green	Orange											Orange	✓			
Operational discharges		Green			Yellow	Yellow	Yellow	Yellow	Yellow									Yellow	✓			
Operational discharges – risk of PWR/ malfunction		Green			Green	Green	Green	Green	Green									Green	✓			
Thermal discharges	Green	Green			Green	Green	Green	Green										Green	✓			
Atmospheric emissions (climatic factors)	Yellow	Orange		Orange														Orange	✓			
Atmospheric emissions – risk of blowdown / venting / release of F-Gas	Yellow	Yellow		Yellow														Yellow	✓			
Waste generation																	Orange	Orange	✓			

[illegible]

Significance Level		Impact / Risk Definition
Unacceptable	High	Action required to eliminate impact or risk via project design or to reduce it to an acceptable level via additional mitigation measures and controls which aim to minimise consequence where feasible, effective and reasonably practicable. If impact cannot be reduced, the project cannot proceed.
ALARP Region (Impact tolerable if demonstrably ALARP)	Upper Moderate	Impacts assessed as “Upper moderate” may not be tolerable. Action is required to eliminate or reduce impact via project design and / or additional mitigation measures and controls, which aim to minimise consequence where feasible, effective and reasonably practicable. Impacts remaining within this category are considered to be within the upper reaches of tolerability and are placed here owing to the combination of a precautionary approach based upon data gaps and / or a lack of further reasonable mitigation options. Where the impact is ALARP and remains within this category, regular reviews (at a minimum of annually) will be held to determine whether the impact can be further reduced based upon the availability of new data and / or new technology. If the impact cannot be further reduced, consideration may also be given to offsetting of the impact (see section 8.9 of the EIS).
	Moderate	Impacts assessed as “Moderate” require action to identify opportunities for improvement via project design, additional mitigation measures and controls which aim to minimise consequence where feasible, effective and reasonably practicable. Where the impact is ALARP and remains within this category, it will be subject to regular ALARP reviews as described above.
	Low	Impacts assessed as low are with the levels of existing natural environmental variability. No project-specific mitigations will be implemented over and above industry-standard measures and controls unless it is stated as a requirement in conditions to approval or Falkland Islands Legislation and / or approved policy. Nonetheless, impacts shall be regularly reviewed to ensure that suitable controls remain in place and shall be subject to continuous improvement where opportunities exist.
Broadly acceptable	Very Low	Impact barely detectable. No additional actions required beyond industry standard measures and controls. Nonetheless, impacts shall be periodically reviewed to ensure that suitable controls remain in place and shall be subject to continuous improvement where opportunities exist.
	Beneficial	Has a positive effect

Note: Assessment of the Impact Significance is based on the EIA undertaken to date and detailed in this EIS. Initial views of key stakeholders were sought during the scoping consultation process (Chapter 6 of the EIS) and those of wider stakeholders will be sought through the formal communication and consultation process. Thereafter, the EIA / EIS will be updated wherever applicable in response to comments / information received as detailed in Chapter 17.



Environmental Monitoring and Management

Q6

To answer 'Question 6' above, the following sections describe what Premier propose with regard to mitigating, monitoring and managing, the potentially significant impacts and risks associated with the Phase 1 Development throughout the life of the project.

In support of the EIS submission, Premier has, to date, developed an:

- Oil Spill Strategies;
- Oiled Wildlife Strategy (incorporated into the Inshore Oil Spill Strategy);
- Waste Management Strategy; and
- Preliminary Environmental Monitoring and Management Plan (EMMP) (Chapter 15).

These documents will be available for public consultation and will be used to develop more detailed project-specific management plans following approval and sanction of the project, and before operations commence.

The following project-specific management plans will be in place by the time operations commence and are under development:

- EMMP (see below);
- Bird Strike Management Plan (BSMP);
- Waste Management Plan (WMP);
- Harbour Management Plan (HMP);
- Biosecurity Management Plan (BMP);
- Traffic Management Plan;
- Oil Spill Contingency Plan (OSCP);
- Wildlife Response Plan (WRP); and
- Iceberg Management Plan (IMP).

Environmental Monitoring and Management Plan

Throughout the 'Define' and EIA phases of the project, various commitments have been made by Premier which aim to reduce the residual environmental impacts and risks. These commitments are detailed in the impact and risk assessment chapters of the EIS (Chapters 10, 11 and 12), and will be recorded in the overarching EMMP.

These commitments are in addition to the mitigation measures built-in to the design of the facilities (see 'Base case mitigations' on page 9) and the industry standard and legislative requirements (detailed within the EIS) all of which are considered to be a 'given'.

The specific purpose of the EMMP is to detail the actions / plans required to:

- Measure and monitor the impacts (primarily the 'Severity of Effect') of the Development;
- Check the efficacy of the project-specific mitigations in place;
- Apply adaptive management options to further reduce impacts; and
- Fill spatial / temporal data gaps, where needed, to increase the level of confidence in the impact / risk assessment outcomes.

Should the monitoring of impacts indicate that the significance of the impacts and risks predicted in the EIS are not appropriate, and / or that mitigation is not effective, a revised mitigation measure and / or monitoring regime will be required.

EMMP Workshop

As described under 'Management of data gaps within the Sea Lion EIA' on pages 18 and 19, a workshop to consider the contents of an Environmental Monitoring and Management Plan (EMMP) to accompany the Sea Lion oil field Environmental Impact Statement (EIS) was held in Stanley, Falkland Islands on 23-25 April 2019. It was attended by 25 interested stakeholders, comprising FIG, PMO, industry bodies and NGOs.

The key aims of the EMMP workshop were to agree:

- Priorities for monitoring;
- Planned surveys, monitoring and data collection;
- Regularity of surveys, monitoring and data collection;
- Methods for surveys, monitoring and data collection;
- Reporting of data;
- Intervention thresholds and the associated adaptive management options; and
- Governance (who will oversee the work).

At the Workshop, consideration was given to eleven environmental and social impacts from the Sea Lion development where there was potentially a need for further certainty as to the actual impact. Due to the change in planned nearshore activities (the elimination of inshore ship-to-ship transfer of crude oil) the following four impacts were considered by the workshop to be out of scope for the EMMP:

- Oil spill effects on inshore seabirds;
- Effects of underwater noise on marine mammals inshore;
- Effects on squid spawning grounds; and,
- Effects on intertidal/nearshore benthic habitats.

The Summary EMMP tables are provided in section 1.8 and Chapter 15.2 in the full EIS.

Once the Development has been approved and sanctioned, the EMMP will be transferred into a live document, which will provide details on:

- Specific roles and responsibilities;
- Timelines, deadlines and 'frequency of execution' for actions identified; and
- Progress and completion for use throughout the life of the field.

Preliminary EMMP

While the EMMP will ultimately be a live document throughout the life of the Development, Table 1.8 provides a summary of the commitments made by Premier which were identified during the EIA process. As described above, a full copy of the EMMP will be made available prior to commencement of the project, upon request from Premier (Sealion.enviro@premier-oil.com).

Information arising from the EMMP commitments will be reported to the EMMP group via agreed reporting protocols. Where necessary, amendments will be discussed and the EMMP actions updated accordingly.

Table 1.8: Summary of environmental monitoring and management commitments

Environmental Aspect	Key monitoring and management commitments
Environmental impacts and risks associated with planned activities and unplanned events	
Physical presence - artificial light	<ul style="list-style-type: none"> Investigate use of alternative spectrum ('green') lighting; and Development and implementation of the Bird-Strike Management Plan (BSMP).
Physical presence - helicopter use	<ul style="list-style-type: none"> Monitor regularity of complaints received.
Physical presence - Disturbance to seabed	<ul style="list-style-type: none"> Marine growth and seabed surveys prior to and throughout the development
Underwater noise	<ul style="list-style-type: none"> Ground truthing of noise levels once into production; and Marine Mammal Observers (MMOs) on board specific vessels and during certain activities.
Discharge of drilling mud and cuttings	<ul style="list-style-type: none"> Pre-drilling benthic survey; Post-drilling benthic survey; Post-drilling cuttings pile analysis; and Use and discharge of muds will be monitored on board throughout drilling.
Operational discharges	<ul style="list-style-type: none"> Monitoring of all chemical discharges; Oil in produced water (not normally discharged) concentrations included in environmental Key Performance Indicators (KPIs); and Produced water re-injection uptime included in environmental KPIs.
Waste generation	<ul style="list-style-type: none"> Work collaboratively with FIG on the potential for development of improved waste facilities in the Falkland Islands; Compliance with the specific requirements of the Phase 1 Waste Management Plan Education of offshore and onshore personnel e.g. inclusion in all personnel inductions; Education of all personnel on the consequences for wildlife and landscape that can result from loss of waste to sea and inclusion of this in all FPSO and MODU inductions; Use of educational posters about the potential consequence of loss of waste; Potential for litter pick-up drives / incentives for local beauty spots and protected sites; and Periodic reviews on whether or not impacts of waste remains ALARP
Atmospheric emissions	<ul style="list-style-type: none"> Recording and monitoring of all emissions and fuel use; and Uptime of gas re-injection included in environmental KPIs.

Environmental Aspect	Key monitoring and management commitments
Environmental impacts and risks associated with planned activities and unplanned events	
Marine mammal collision	<ul style="list-style-type: none"> • MMOs regularly on board project vessels; and • Education and awareness for mariners. All collisions will be report to FIG and the IWC via: www.iwc.int/ship-strikes or shipstrikes@iwc.int.
Introduction of non-native marine species	<ul style="list-style-type: none"> • Specific inclusion of each vessel's ballast water management system, exchange plan, record book and biofouling management plan (BFMP) and logbook in selection and pre-mobilisation HSES audits; • Ballast water sampling programme for project vessels entering the Falklands nearshore environment; • Non-native species monitoring programme; and • Water sampling, shoreline sampling, pathways analysis and ballast water modelling.
Introduction of non-native terrestrial species	<ul style="list-style-type: none"> • Implementation of the Biosecurity Management Plan (BMP).
Social impacts and risks associated with planned activities and unplanned events	
Physical presence - Increased vessel presence	<ul style="list-style-type: none"> • AIS based survey to confirm the shipping traffic pattern; and • Monitoring of vessel movements in Berkeley Sound, under jurisdiction of the Harbour Master.
Competition for resources	<ul style="list-style-type: none"> • Monitoring of accommodation use and socio-economic impact on the rental market; • Use of onshore water supply will be monitored at all infrastructure locations; • Energy use will be monitored onshore and at the TDF; • Any incidental usage of existing air-links will be recorded; and • Off peak power utilisation.
Disturbance to the human population	<ul style="list-style-type: none"> • Monitor regularity of complaints received from local residents; • Noise monitoring during operations to validate predictions and inform ongoing practices; • Baseline levels of noise, and light to be better established. • Routine sampling and quality tests will be undertaken on all fuel supplies as part of procurement processes and audits; • Monitoring of air quality parameters will be conducted over the seasons to establish baseline levels; and • Air quality monitoring during operations to validate predictions and inform ongoing practices.
Risks associated with accidental events	
Oil spills	<ul style="list-style-type: none"> • Further research into the effect of Sea Lion crude on fur; • Regular oil spill response equipment exercises to be conducted; • An oiled wildlife response workshop will be held with all relevant stakeholders to help steer the response plan, methods, funding and governance; • Efficacy tests of oil spill response equipment; • Further research to improve knowledge of species distributions, especially seabirds, marine mammals, coastal flora and fauna especially in temporal scales; and • Regular monitoring of indicator species and habitats in coastal areas.

Overall Conclusion

The use of vessels, fossil fuels and onshore resources (e.g. water and electricity) is necessary to carry out any O&G operation and the generation of some waste, which cannot be re-used, recycled or converted to energy is unavoidable. Similarly, the use of third-party vessels from elsewhere in the world will always carry some risk of non-native species introduction and all oil production and export operations carry the risk of oil spill events. It is, therefore, not possible to carry out O&G operations without some degree of environmental and / or social risk and impact.

In summary following the EIA process, and the adoption of ALARP mitigations, thirteen residual impacts and risks have been assessed as significant:

Impacts - Planned activities:

- 1) Artificial light offshore and inshore Moderate ●
- 2) Underwater vessel noise offshore..... Moderate ●
- 3) Drill cuttings discharges Moderate ●
- 4) Atmospheric emissions (climatic factors) Moderate ●
- 5) Waste management (contingent export to UK with
unrecoverable waste going to UK landfill) Moderate ●
- 6) Collisions with marine mammals inshore Moderate ●
- 7) Introduction of marine invasive species..... Upper Moderate ●
- 8) Introduction of terrestrial invasive species..... Upper Moderate ●
- 9 Competition for freshwater resources Upper Moderate ●
- 10) Competition for energy resources..... Upper Moderate ●
- 11) Competition for use of roads Moderate ●
- 12) Disturbance to the human population from light Moderate ●

Risks - Unplanned / accidental events:

- 13) Oil spill offshore and inshore..... Moderate ●

Premier believe that:

- All impacts and risks associated with the Sea Lion Development have been identified and robustly assessed;
- Impacts and risks which are ALARP and are considered to be of low significance are sufficiently controlled; and
- Impacts and risks that are currently ALARP but remain significant will be further reduced wherever practicable throughout the life of the Development.

Premier will continue to do all that is reasonably practicable with regard to monitoring and management to minimise environmental impacts / risks during both the 'Define' and 'Execute' stages of the Phase 1 Development.

All impact and risk assessments will be periodically reviewed to ensure that the controls remain in place and that activities leading to potentially significant impacts and risks are subject to continuous improvement where opportunities exist.



Formal Stakeholder Consultation

Representations by stakeholders

Following review by the FIG EPD / DMR, and confirmation by the Executive Council that the EIS complies with the Schedule 4 of the FIG Offshore Minerals Ordinance, the EIS was formally submitted. Following submission, the following are now available for review by statutory consultees and the public during the formal 42-day consultation period:

- The Non-Technical Summary;
- The EIS; and
- Documents supporting the EIS (e.g. the Oil Spill response strategies etc.).

During this time, copies of the above could be requested from the Premier Stanley office (Sealion.enviro@premier-oil.com).

Responses by Premier

Following the 42-day consultation, all material representations will be provided to Premier by DMR and recorded within this EIS (Chapter 17). This chapter will, where necessary, indicate what changes have been made to the EIA / EIS in response to material stakeholder concerns.

This booklet is based on the following version of the Sea Lion Phase 1 Development Environmental Impact Statement

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