Shallow Water Absheron Peninsula (SWAP) Exploration Drilling Project

Environmental and Socio-Economic Impact Assessment

August 2020

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Non-Technical Summary

This Non-Technical Summary (NTS) presents a concise overview of the Environmental and Socio-Economic Impact Assessment (ESIA) prepared for the Shallow Water Absheron Peninsula (SWAP) Exploration Drilling Project (hereafter denoted the "Project") to be undertaken in the SWAP Contract Area. It is intended to provide a summary of the project activities, the issues considered in the ESIA and the main conclusions on environmental and socio-economic impacts. Detailed technical description of modelling studies, proposed mitigation measures and monitoring activities are presented in the main sections of the ESIA.

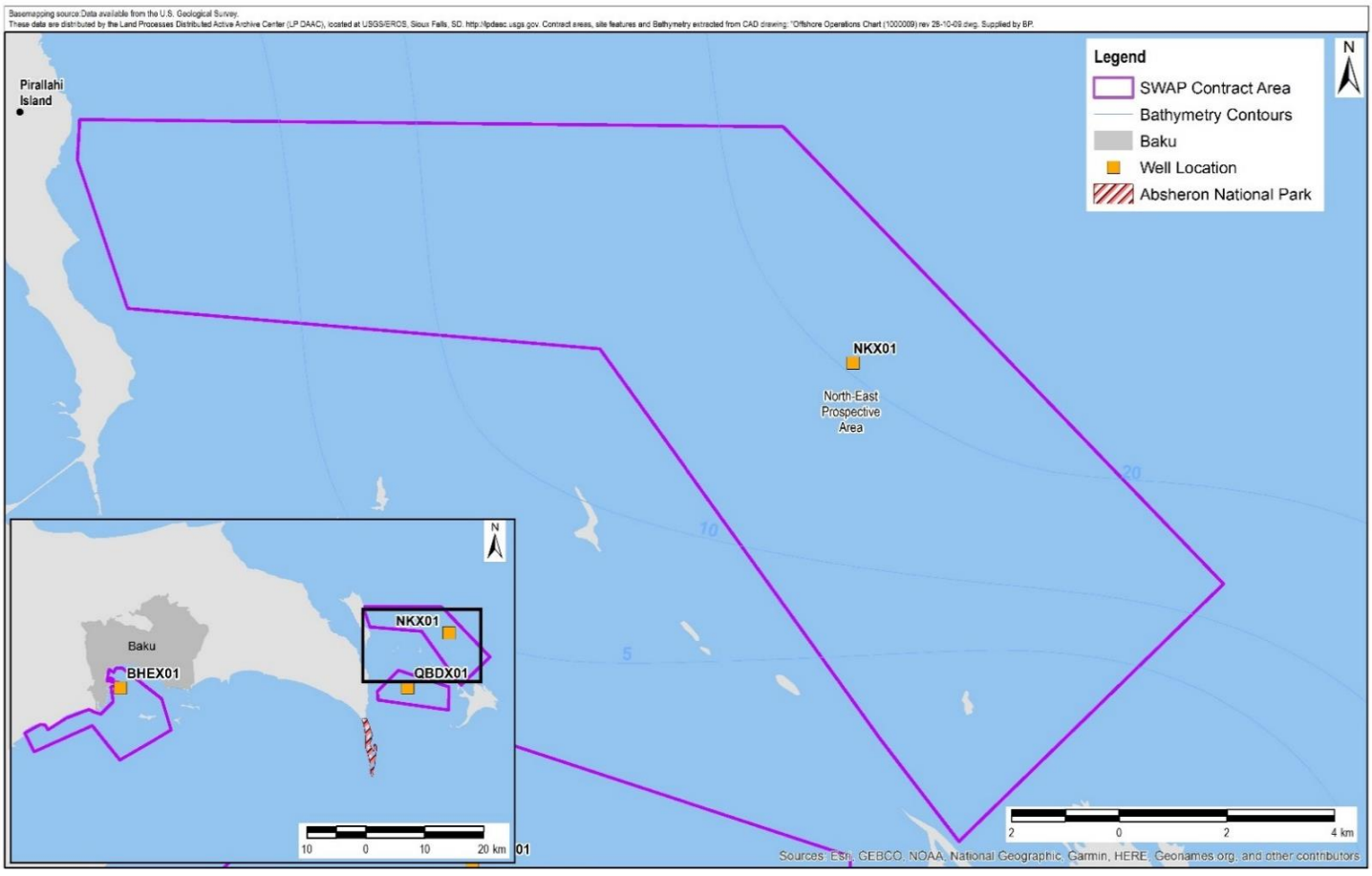
Introduction

The SWAP Contract Area comprises three Prospective Areas. It is planned to drill three SWAP exploration wells in total; one in each Prospective Area namely:

- North Khali (NKX01) exploration well in North East Prospective Area;
- Qarabatdag (QBDX01) exploration well in South East Prospective Area; and
- Bibiheybat (BHEX01) exploration well in West Prospective Area;

This ESIA Report has been prepared to identify and assess the potential impacts associated with the drilling activities for the NKX01 exploration well. The indicative location of the NKX01 well is shown in Figure E.1. Exploration drilling activities at BHEX01 and QBDX01 locations will be covered in addenda to this ESIA.

Figure E.1: Proposed NKX01 Exploration Well Location



Overview of the SWAP Exploration Drilling Project

In 2015, a 2D seismic survey was undertaken in the deeper waters of the SWAP Contract Area and surrounding area, followed by a 3D seismic survey in 2016 completed in shallower waters and in areas onshore. In addition, geohazard and bathymetry surveys have also been completed to understand soil stability and identify potential sub-surface hazards. The seismic, geohazard and bathymetry survey results were used to inform the decision making process regarding the exact exploration drilling locations and the definition of the associated revision of the SWAP Contract Area into three prospective areas.

The NKX01 exploration well is located within the North East Prospective Area as shown within Figure E.1, approximately 15km from the Azerbaijani mainland in a water depth of approximately 22m. It is proposed to commence drilling of theNKX01 exploration well in Q1 2021, and drilling activities are expected to take up to 90 days to complete, with the possibility of a further 30 days to complete sidetrack well, if required. The base case assumes that drilling activities will commence in January 2021 however, for contingency, should there be any delay for logistical or operational reasons, and based on prior experience and best estimates, a delay of up to 2 months may occur. The key objective of drilling the exploration well is to confirm the potential presence of hydrocarbon resources at the North East Prospective Area for future field development.

The well will be drilled using a jack-up rig, which will be positioned at the well location using three tug vessels. The well will be drilled using drilling muds (using water based mud for the conductor section and non-water based muds for the lower hole sections) with all mud and cuttings recovered to the jack-up rig and handled as waste. It is assumed the jack-up rig will be lit at night and operate 24 hours a day over the drilling programme. Preference will be given to source equipment and materials which meet the required Project specifications from Azerbaijan wherever possible. All supplies required during the drilling of the well will be transported from the existing BP Supply Base with drilling fluids provided from the Advanced Fluids Facilities (AFF).

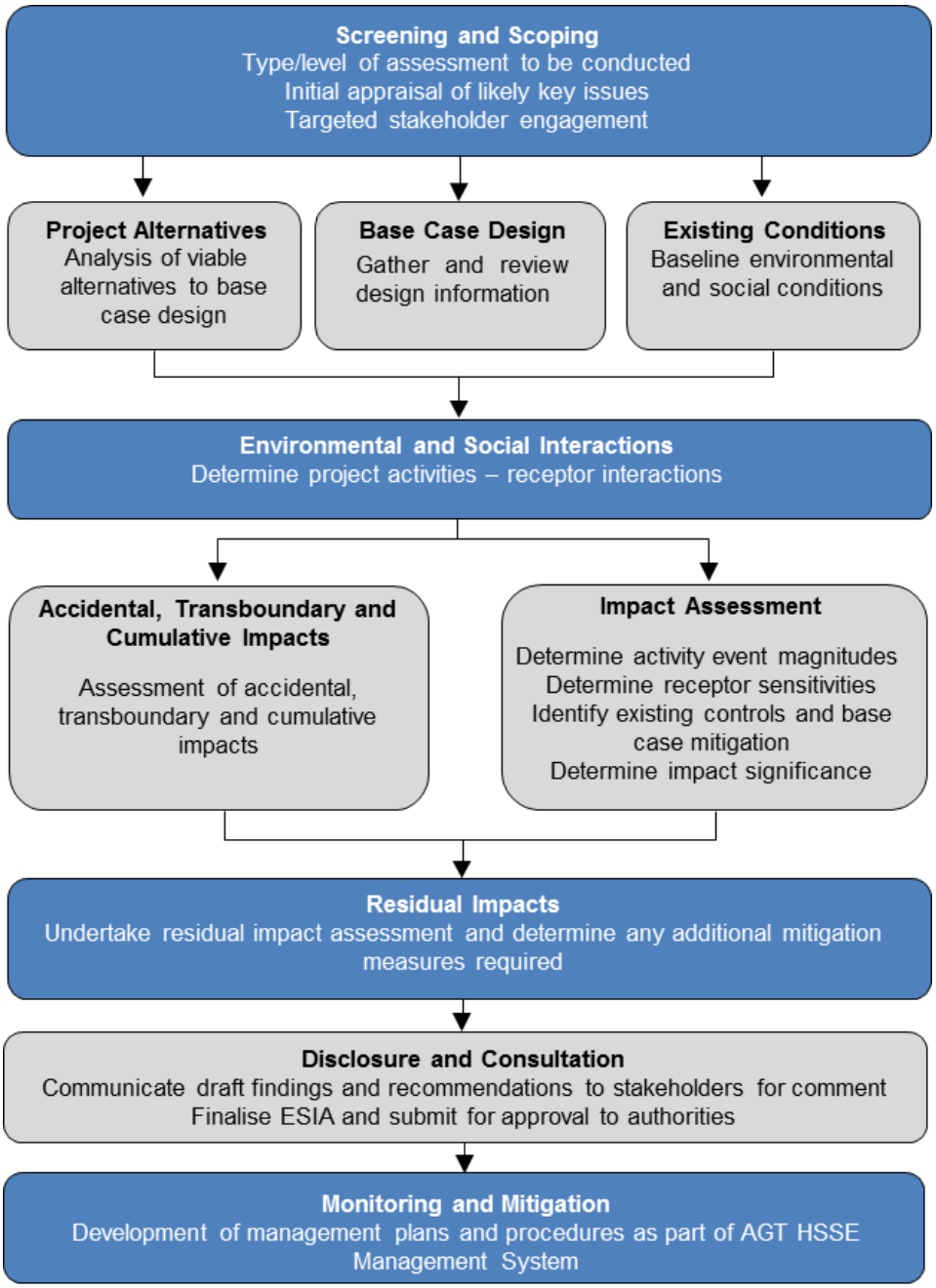
Alternatives Assessed

Several conceptual options were analysed for technical and commercial feasibility during the development stage of the Project. These included an option to install a permanent or semi-permanent steel jacket, the option to build an artificial island or the option to use a jack-up drilling rig. Given the relatively shallow water depth at the Project location, a jack up rig was selected as the most suitable option for the Project. The rig will be demobilised and will be removed once the well has been abandoned. The key advantage of the jack-up rig is that impacts are temporary and, compared to other options considered, this option is considered to result in the lowest potential impact on the environment.

Assessment Methodology

The ESIA process (illustrated in Figure E.2) constitutes a systematic approach to the evaluation of a project and its associated activities throughout the project lifecycle. The overall aim of the ESIA process is to identify, reduce and effectively manage potential negative environmental and socio-economic impacts arising from the Project activities.

Figure E.2 The ESIA Process



Assessment of the Project environmental and socio-economic impacts has been undertaken based on identified routine activities and accidental events that have the potential to interact with the environment. The impact significance considers receptor sensitivity and the magnitude of the impact and takes into account existing control measures embedded in the project design.

Policy, Regulatory and Administrative Framework

The Production Sharing Agreement (PSA) to jointly explore and develop potential prospects in the SWAP Contract Area was signed between BP and the State Oil Company of Azerbaijan Republic (SOCAR) in December 2014. The assessment has also included examination of how agreements, legislation, standards and guidelines apply to the project. The detailed legal regime for the joint development and production sharing of the SWAP Contract Area is set out within the PSA.

The PSA states that the *"Contractor shall apply safety and environmental protection standards and practices that take account of the specified environmental characteristics of the Caspian Sea and draw, as appropriate, on (i) international Petroleum industry standards and experience with their implementation in exploration and production operations in other parts of the world and (ii) existing Azerbaijan safety and environmental legislation. In compilation of such standards and practices account shall be taken of such matters as environmental quality objectives, technical feasibility and economic and commercial viability".*

The Project also takes account of a wide range of international and regional environmental conventions and commits to comply with the intent of current national legal requirements where those requirements are consistent with the provisions of the PSA, and do not contradict, or are otherwise incompatible with, international petroleum industry standards and practice. The Project will also adhere to the framework of environmental and social standards within the ESIA approved by the Ministry of Ecology and Natural Resources (MENR). The PSA also makes reference to international petroleum industry standards and practices with which the Project will comply.

Environmental Impact Assessment

Table E.1 summarises the outcome of impact assessment for the Activities associated with the Project.

Table E.1: Summary of Residual Environmental Impacts Associated with the SWAP Exploration Drilling Project

	Event/Activity	Significance Rating		
		Event Magnitude	Receptor Sensitivity	Impact Significance
Atmosphere	Jack-up Power Generation	Medium	Low	Minor Negative
	Support Vessel Engines	Medium	Low	Minor Negative
Marine Environment	Jack-up Rig Positioning	Medium	Low	Minor Negative
	Drilling (excluding conductor driving)	Medium	Low	Minor Negative
	Use of Support Vessels	Medium	Low	Minor Negative
	Conductor Driving	Medium	Low	Minor Negative
	VSP Airgun Operations	Medium	Low	Minor Negative
	Jack-up Rig Cooling Water Intake and Discharge to Sea	Medium	Low	Minor Negative
	Drainage Water Discharge	Low	Low	Negligible
	Support Vessel Treated Black Water Discharge	Medium	Low	Minor Negative
	Support Vessel Grey Water Discharge	Medium	Low	Minor Negative
	Support Vessel Galley Waste Discharge	Low	Low	Negligible
	Seabed Disturbance	Medium	Low	Minor Negative

Emissions to the atmosphere associated with jack-up rig power generation and support vessel engines will occur at the NKX01 location. Air quality dispersion modelling results demonstrated that, during routine drilling activities at the NKX01 well location, the predicted short term concentrations of nitrogen dioxide (NO_2) at the nearest onshore receptors are expected to be well below the applicable short-term limit value of 200µg/m^3. Emissions from vessels are expected to disperse rapidly and are not expected to result in measurable increases in NO_2 concentrations at onshore locations. As such the impact of atmospheric emissions due to jack-up rig power generation and support vessel activities to onshore communities was considered to be of minor negative significance.

Underwater sound is anticipated to arise from both continuous and impulsive sources during the Project:

- Continuous sound sources including vessels during jack-up rig positioning, drilling of the well and supply vessel movements; and

- Impulsive sound source including driving of the well conductor section and vertical seismic profiling (VSP) using airguns (with VSP comprising shallow VSP activities and potentially conventional VSP activities in the event the well is successful).

These activities have the potential to impact sensitive receptors within the marine environment; specifically, fish and the International Union for the Conservation of Nature (IUCN) endangered Caspian Seal. Seals are known to be present around the proposed Project location throughout the year with greatest numbers during the spring and autumn migrations, with spring being the period of greatest sensitivity. During this period (usually April and May) they are typically migrating south to feed from overwintering in the Northern Caspian and the islands of the Absheron Archipelago are an important haul out location, with large numbers typically gathering here or passing through. Outside of these periods, seals do not use the area exclusively and have been observed as individuals and in small numbers only.

To assess potential underwater sound impacts, for the continuous sound sources, propagation of underwater sound was calculated using a simplified geometric spreading model to estimate distances at which impacts may occur to fish and Caspian seals. Given the different characteristics and potential for greater risk to receptors from impulsive sound in the marine environment, a detailed sound propagation model was used to estimate these distances from conductor driving and the VSP airgun operations.

The geometric sound calculations completed for the continuous sources showed that, during the positioning of the jack-up rig with respect to seals:

- Permanent threshold shift (PTS)[1] may occur if they remain within a distance of 12m from the tugs positioning the rig for a period of 1 hour;
- Temporary threshold shift (TTS)[2] may occur if the seals remain within approximately 265m of the tug operations for a similar period; and
- Moderate behavioural reactions in seals, such as changes in swimming direction and speed, may occur at distances beyond approximately 610m. At distances beyond 2.8km the likelihood of any observable responses to sound is expected to be low.

With regard to jack-up rig positioning and impacts to fish:

- TTS may occur in high sensitivity fish[3] if they remain within approximately 130m of vessels for a period of 12 hours and
- Recoverable injury may occur if they remain in close proximity (within 10m) to the operations for a period of 48 hours.

In relation to vessel movements during the drilling programme, it was calculated that with regard to seals:

- PTS may occur in seals if they remain within a distance of approximately 60m from supply vessel movements or 10m of standby/crew vessels for a period of 1 hour;
- TTS may occur if the seals remain within 1.3km from cargo vessel movements or 23m of standby/crew vessels for a similar period; and
- Behavioural reactions in seals such as changes in swimming direction and speed were calculated to occur at distances up to 5km from the supply vessels in particular. At distances beyond 13km the likelihood of any observable responses to sound is was considered to be low.

With regard to vessel movements during the drilling programme and impacts to fish:

- TTS may occur if they remain within approximately 630m of vessels for a period of 12 hours; and

[1] A permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. This is considered to be auditory injury.
[2] A temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level.
[3] i.e. high hearing sensitivity fish, particularly herring and related species (Clupeidae), which involve the use of the swim bladder in hearing

- Recoverable injury was estimated to potentially occur to high sensitivity fish if they remain in close proximity (within 29m) to the cargo vessels for a period of 48 hours; although the likelihood is that they will move away from a disturbing sound source.

In comparison to the other continuous sound sources, sound emissions from drilling are relatively low with results showing PTS and TTS for both Caspian Seal and fish species occurring at less than 10m in distance from the source. It is understood that due to existing activity within the area (e.g. vessel movements), seals have been shown to be habituated to the sound generated by vessel movements and their typical behavioural response is to sense the sound from a distance and adjust their course away accordingly. In addition, most seals undertaking foraging dives in the vicinity of a vessel will be able to rapidly return to the surface or move away from the vessel. Seals are likely to be foraging where high abundance of fish will be found and fish are also expected to likely move away from the sound source, thus reducing the potential for seals to be present in the close vicinity of the vessel to feed. As such for the drilling and vessel related activities no significant impacts are anticipated from underwater sound.

During the driving of the conductor, the detailed modelling results showed the following:

- PTS may occur in seals if they remain within a distance of less than 1m from the operations for a period of 1 hour and TTS may occur if the seals remain within 2m of the operations for a similar period.
- Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 70m from the conductor driving operations.
- TTS may occur in fish if they remain within 4m for a period of 1 hour. Injury (recoverable or mortal) may only occur if they remain in close proximity (less than 1m) to the operations for a period of 1 hour.

During the VSP operations, provided that receptors are not located directly beneath the VSP source or within the main directivity of the source, the modelling estimated:

- PTS may occur in seals if they remain within a distance of 5m from the operations for a period of 1 hour.
- TTS may occur if the seals remain within 30m of the operations for a similar period.
- Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 8.5km from the VSP activities.
- TSS may occur in fish within 40m of the VSP source for a period of 1 hour with low level disturbance possibly occurring beyond 8.5km.

With regard to both conductor driving and VSP operations, the Project base case is to undertake these activities outside of the seal spring and autumn migration periods and to use soft start/ramp up procedures and visual monitoring prior to the start of the activities, delaying if a seal is observed within the defined Mitigation Buffer Zone will allow time for marine mammals and fish to move away from the activity. This will be completed in accordance with Joint Nature Conservation Committee (JNCC) Guidance assuming a pre-watch survey of 20 minutes within a defined 500m Mitigation Buffer Zone by a trained Marine Mammal Observer (MMO) or seal expert. Further mitigation embedded within the project design for contingency purposes comprises the following:

In the event a delay occurs in the drilling programme, causing the shallow VSP activity to be delayed to commencing no earlier than mid-March the following will apply:

- Develop a Caspian Seal Observation Protocol in liaison with a local seal expert, which will include the following:
    - Monitor available information relating to timing of the ice melt in the Northern Caspian (typically during March) and compare to previous years (particularly 2011 and 2014).
    - Gather available seal observations from the Northern Caspian to give an indication of when seal migration is expected to commence in Azerbaijani waters
    - Gather available seal observations from the Northern Azerbaijani waters (e.g. from fishermen located in the vicinity of Yalama and Mukhtahir) (approximately 100km north of the well location) to determine when the seals migration has reached Azerbaijani waters

and provide feedback to the rig operator on likely arrival of migrating seals in the NKX01 area.
    - Based on timing provided by the local seal expert using the information and observations collected, establish an observation point approximately 10km north of the well location and record seal observations such as to confirm the commencement of the spring migration at this location.

- Once spring migration has been confirmed at the observation point, the local seal expert will inform the jack-up rig operator to either immediately cease VSP activities in progress or prohibit commencing VSP activities.
- In the event VSP activities are not complete before the seal spring migration is complete, the local seal expert will continue to monitor the presence of the seals through the spring in the vicinity of the Absheron Peninsula. The VSP survey activities will be permitted to re-commence subject to existing controls once the seal expert has confirmed the spring migration has finished.

In the event the well is successful and the need for conventional VSP is identified further information will be provided to the MENR on the characteristics of the survey, timing, potential impacts and additional mitigation measures where required.

Based on the predicted event magnitude, receptor characteristics, observed sensitivities and embedded controls, the impact from underwater sound was assessed as being of minor negative significance.

With regard to ***discharges,*** with exception of deck drainage and cooling water (comprising lifted seawater, used for indirect cooling onboard the rig prior to being discharged), there are no planned discharges to the marine environment from the jack-up rig for the duration of the Project. All black water, grey water and galley waste generated on the rig will be contained and shipped to shore for disposal.

Modelling of the cooling water to be discharged from the rig showed that the temperature difference between the discharge plume and ambient conditions will return to zero well within 100m of the discharge location with an increase of 0.5-1°C occurring within the first few metres of the discharge point for both summer and winter conditions. The modelling results also indicated that cooling water discharge plume remains within the main water column i.e. does not reach the sea surface nor seabed. The assessment demonstrated that Minor Negative impacts to seals, fish, zooplankton and phytoplankton are predicted from cooling water discharge. Therefore, no additional mitigation beyond existing control measures is deemed to be necessary.

Discharges to sea from the support vessels used through the drilling programme (comprising treated black water, grey water, galley waste and deck drainage) are all small in volume and do not contain components of high environmental concern. These discharges, which are monitored in accordance with existing procedures to ensure applicable project standards are met, will be rapidly diluted and are all assessed as having a minor impact upon biological receptors in the water column.

No discharges of drilling muds or cuttings to sea are planned as a result of the NKX01 exploration drilling activities with all mud and cuttings recovered and sent to shore. This complies with the requirements of the PSA for the Contract Area.

Seabed disturbance from the positioning of the jack-up rig is expected to be short term and localised, occupying an area of less than 500m^2 for the duration of the drilling programme (approximately 3 to 4 months). The benthic environment in the Project location is considered to be relatively tolerant to disturbance with evidence showing that invertebrates, which are generally short-lived, reproduce rapidly and re-establish following disturbance. No rare, unique or endangered species have been recorded in the area. The physical disturbance is therefore considered minimal and no significant impacts are anticipated.

For all environmental impacts assessed it has been concluded that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures and no additional mitigation is required.

Cumulative, Transboundary and Accidental Events

Potential cumulative and transboundary impacts were assessed taking into account potential for inter project impacts as well as other potentially significant projects where the associated impacts may overlap geographically or temporally with SWAP Exploration Drilling Project impacts.

The potential Project impacts are expected to be both of a short duration and occurring within a few hundred metres to several kilometres of the NKX01 well location. Due to the localised nature of the Project's impacts and the absence of other development projects in the area, no cumulative or synergistic impacts are expected.

Greenhouse gases (GHG) have the potential to give rise to transboundary impacts. The estimated GHG emissions associated with the Project represent approximately 0.6% of the annual operational GHG emissions from BP's upstream activities in Azerbaijan based on BP GHG emissions data from 2018. The contribution from the Project to Azerbaijan's national GHG emissions is considered to be insignificant.

To support the assessment of unplanned events, modelling of potential hydrocarbon spill scenarios using Stiftelsen for Industriell og Teknisk Forskning (SINTEF)'s Oil Spill Contingency and Response (OSCAR) modelling software was undertaken to predict the behaviour of the spilled hydrocarbon in the marine environment and to estimate where and how much spilled hydrocarbon may come ashore. It must be noted that modelling has not taken into account any spill response mitigation measures, meaning that the results should only be interpreted as indication of theoretical spill consequences without implementation of the oil pollution prevention strategy. In reality, spill mitigation measures such as chemical dispersant application, containment, recovery and shoreline protection measures would be implemented to reduce adverse effects to marine and coastal resources.

The key accidental event scenarios modelled and assessed included:

- Scenario 1: Supply vessel inventory loss of 600m^3 of diesel; and
- Scenario 2: A surface blowout of crude oil (810,019 m^3) over 81 days duration.

Following the release of 600m^3 of diesel, initially the majority of the diesel is present on the sea surface, and over the first two days around 20% evaporates and an increasing percentage reaches the shore. Dispersion and dissolution into the upper water column takes place very close to the release point. The diesel is predicted to travel less than 50km from the point of release in both summer and winter conditions before it drops below the lowest recognised visible thickness under ideal viewing conditions of 0.04 micrometres (µm). During winter conditions, diesel is predicted to reach the shoreline within approximately 6 hours with up to 275 tonnes predicted to be on the shoreline, although the 50th percentile value[4] is 12.9 tonnes. A spill of diesel from a vessel located at the Project location will have a limited impact to the marine environment as the majority of spilled diesel evaporates, disperses or biodegrades relatively quickly. The probability of the spilled diesel reaching the coastline is low and is unlikely to directly impact designated areas with the exception of the Absheron National Park (5-30% probability of diesel reaching shore), however the concentration of diesel will quickly reduce below harmful levels.

Modelling for the blowout event was based on a worst case estimate that the release would continue for an estimated 81 days, which is the estimated time that would be required to mobilise a drilling rig and to drill a relief well. During this time, it was estimated that approximately 810,019m^3 of crude oil would be released. The modelling indicated that the majority of the oil would initially be present on the sea surface following the release, while 7% would evaporate almost immediately, 26% would biodegrade, 20% would remain in the water column, 38% would deposit in sediments, approximately 3% would reach the shoreline and a relatively high 6% would remain on the sea surface. The crude oil on the sea surface was predicted to travel around 400-500km before it drops below the lowest recognised visible thickness under ideal viewing conditions. Although the precise movement of the surface oil is dependent on the exact metocean conditions at the time, the analysis of over 100 different

[4] Means that in 50% of scenarios modelled, this value or less would result.

sets of metocean data suggest that the most likely locations to receive oil on shore are Azerbaijan, Russia and northern Iran.

The modelling predicts that a blowout under winter conditions could result is a worst case of up to 64684 tonnes of oil reaching the coastline and that this would mainly impact three coastal areas: southern Azerbaijan, northern Iran and the Absheron Peninsula. The modelling under summer conditions also predicts oil reaching the Russian coast. The eastern coastline of the Caspian Sea is unaffected. A mixture of areas of very light (less than 0.1mm), light (0.1-1mm), moderate (1-10mm) and heavy (>10mm) oil deposition are predicted in these areas.

In the event of a blowout, species in the immediate vicinity of the spill that cannot actively avoid the oil such as plankton, benthic invertebrates, birds and seals are likely to suffer the greatest impacts. Highly mobile species such as fish are anticipated to largely avoid the spilled oil areas. The modelling of the blowout predicts that a number of Important Bird Areas (IBAs) and Key Biodiversity Areas (KBAs), and associated bird species may be exposed to elevated hydrocarbon concentrations as a result of surface or dispersed / dissolved oil beaching on the shoreline. Given the persistence and volume of oil predicted to beach in some IBAs and KBAs the potential impact on IBAs and KBAs (and the birds present there) could be potentially significant, especially if the release occurs during the bird nesting period (April to July). The blowout scenario may also affect small scale fishing grounds along the coast, and commercial fishing.

The AGT Region Offshore Facilities Oil Spill Contingency Plan (OSCP) provides guidance and actions to be taken during a hydrocarbon spill incident associated with all Azeri Chirag Gunashli (ACG) and Shah Deniz (SD) offshore operations, which include mobile offshore drilling units, platforms, subsea pipelines and marine vessels. It is valid for spills that may occur during the commissioning, operation, and decommissioning of the systems. This plan will be updated to include activities within the SWAP Contract Area.

Environmental and Social Management

BP will have overall responsibility for managing the Project activities and will be monitoring and verifying the implementation of environmental and socio-economic mitigation measures detailed in this ESIA.

The Project specific environmental and social management plans will be developed by BP before the Project commences. The plans, procedures and reporting requirements for the jack-up rig and those relevant to drilling activities will be aligned to the existing BP and Operator's Health Safety and Environmental (HSE) Management System (MS), the Health Safety, Security and Environment (HSSE) Bridging Document and the BP Environmental Operating Procedure and associated Environmental Monitoring & Reporting Forms. The plans will cover the following topics:

- Environmental Management;
- Pollution Prevention Management;
- Waste Management; and
- Communication Management.

The plans will identify key criteria (e.g. waste volumes, discharge parameters, marine mammal observations, communication frequency, etc.) that will be used to measure environmental and social performance.

BP will verify that mitigation measures and commitments set out in this ESIA are implemented. This will be achieved through periodical environmental checks and reviews, the results of which will be documented within "Site Inspection Reports". An action-tracking system will be maintained to monitor close-out actions and the effectiveness of actions taken in response to findings.

ESIA Consultation and Disclosure

The scope of the ESIA was agreed with the MENR at a scoping meeting held on 28th January 2019. Key issues raised by the MENR, which have subsequently been addressed within the ESIA, include the requirement to:

- Inclusion of information regarding geotechnical and geohazard surveys in support of the well location selection;
- Consider the drilling programme schedule such as to avoid potential impacts to migrating Caspian seals and birds in the vicinity of the Project;
- Include information of generated waste forecast including waste streams and likely volumes; and
- Consideration of the physical impact and disturbance to the seabed from the exploration drilling activities.

Public consultation and a disclosure meeting will be planned following the submission of this ESIA.

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Appendices

Units and Abbreviations

Units

%	Percent
% vol.	percentage by volume
μg/g	Micrograms per gram
μg/l	Micrograms per litre
$\mu g/m^3$	Micrograms per cubic meter
μm	Micrometer
μPa	Micro Pascal
˚C	Degrees Celsius
˚	Degrees
“	Inches
+/-	Plus/minus
<	Less than
>	Greater than
bbl	Barrel (6.2898 barrels = 1 m3)
cm	Centimetre
cm/year	Centimetres per year
dB	Decibel
dB(A)	A weighted unit of sound intensity weighted in favour of frequencies audible to the human ear
dB L_{AEQ}	Sound pressure level
dBrms	Root mean square sound pressure
g/l	Grams per litre
ha	Hectare
hr	Hour
Hz	Hertz
in	Inches
kg	Kilograms
km	Kilometre
km²	Square kilometre
Knots	Measurement of wind speed (1 Knot = 0.514 m/s)
kW	Kilowatt
LC_{50}	Lethal Concentration 50. The concentration of a chemical which kills 50% of a sample population.
l/h	Litres per hour
l/MMscfd	Litres per million standard cubic feet per day
l/m^2	Litres/square meter
m	Metres
m²	Square metres
m³	Cubic metres
m^3/day	Cubic metres per day
m^3/hr	Cubic metres per hour
m^3/person/day	Cubic metres per person per day
m/s	Metres per second
mbd	Thousand barrels per day
mg/kg	Milligrams per kilogram
mg/l	Milligrams per litre
mg/Nm3	Milligrams per cubic meter (at normal conditions)
ml	Millilitres
mm	Millimetres
mm/year	Millimetres per year
MPN	Most Probable Number
MPN/100ml	Most Probable Number per 100 millilitres

ng/g	Nanogram per gram
pH	-log 10 [H+] (Measure of acidity or alkalinity)
PM_{10}	Particulate matter measuring 10µm or less in diameter
ppb	Parts per billion
ppbv	Parts per billion by volume
ppm	Parts per million
ppm/m^3	Parts per million per cubic metre
ppmv	Parts per million by volume
ppmw	Parts per million by weight
PSU	Practical saline unit
dB_{PEAK} re. 1 µPa	Peak decibels relative to one micropascal
dB re. 1 µPa	Decibels relative to one micropascal
2D	Two dimensional
3D	Three dimensional
1Q	Quarter one (of year)
2Q	Quarter two (of year)
3Q	Quarter three (of year)
4Q	Quarter four (of year)

Chemical Elements and Compounds

As	Arsenic
Ba	Barium
BTEX	Benzene, toluene, ethylbenzene, xylene
Cd	Cadmium
CH_4	Methane
Co	Cobalt
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Cr	Chromium
Cu	Copper
H_2S	Hydrogen Sulphide
Hg	Mercury
HNO_3	Nitric Acid
KCl	Potassium Chloride
MEG	Mono Ethylene Glycol
Mn	Manganese
NaCl	Sodium Chloride
Ni	Nickle
NH4	Ammonium
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NMVOC	Non-methane volatile organic compounds
NPD	Naphthalenes, phenanthrenes and dibenzothiophenes
P	Phosphorous
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyls
PHB	Pre Hydrated Bentonite
PO4	Phosphates
SiO2	Silicates
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides
Zn	Zinc

Abbreviations

2D	Two Dimensional
3D	Three Dimensional
ACE	Azeri Central East
ACG	Azeri Chirag Gunashli
AFF	Advanced Fluids Facilities
AGT	Azerbaijan Georgia Turkey
AZE	Alliance for Zero Extinction
AzRDB	Azerbaijan Red Data Book
BOD	Biological Oxygen Demand
BOP	Blow Out Preventer
BRT	Below rotary table
BS	British Standard
C&C	Capping and Containment
CDV	Canine Distemper Virus
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard Assessment and Risk Management
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COD	Chemical Oxygen Demand
DCB	Drill Cutting Boxes
DDT	Dichlorodiphenyltrichloroethane
DPRAB	Department on the Protection and Reproduction of Aquatic Bioresources
DREAM	Dose-related Risk Effects Assessment Model
E&P Forum	Exploration and Production Forum
EBS	Environmental Baseline Survey
EBSA	Ecologically & Biologically Significant Areas
EIA	Environmental Impact Assessment
EN	Endangered (IUCN Red List)
ENP	European Neighbourhood Policy
ERA	Environmental Risk Assessment
ESIA	Environmental and Socio-Economic Impact Assessment
ESTN	Environmental and Socio-Economic Technical Note
ETN	Environmental Technical Note
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIWA	Global International Waters Assessment
GNI	Gross National Income
HS	Hearing Specialist
HSE	Health, Safety & Environment
HSE MS	Health, Safety & Environmental Management System
HSSE	Health Safety Security and Environment
IADC	International Association of Drilling Contractors
IAGC	International Association of Geophysical Contractors
IBAs	Important Bird Areas
IFC	International Finance Corporation
IOGP	International Association of Oil and Gas Producers
IUCN	International Union for the Conservation of Nature
IPA	Important Plant Areas
ISO	International Standards Organisation
JNCC	Joint Nature Conservation Committee
KBAs	Key Biodiversity Areas
LC	Least concern (IUCN Red List)
LCM	Loss Control Materials
LDCB	Large Drill Cuttings Boxes
LTMOBM	Low Toxic Mineral Oil Based Mud
LV	Low Vulnerability (IUCN Red List)

LWD	Logging While Drilling
MAC	Maximum Allowable Concentration
MARPOL	International Convention for the Pollution of Prevention by Ships, 1973, as modified by the Protocol of 1978
MBES	Multibeam Echo Sounder
MENR	Ministry of Ecology and Natural Resources
MEPC	Marine Environment Protection Committee
MES	Ministry of Emergency Situations
MMO	Marine Mammal Observer
MODU	Mobile Offshore Drilling Unit
MPN	Most Probable Number
MSDS	Material Safety Data Sheet
N	North
NGO	Non-Governmental Organisation
NKX01	North Khali Exploration Drilling Project
Non GHG	Non Greenhouse Gas
NOAA	National Oceanic Atmospheric Administration
NP	National Park
NTS	Non-Technical Summary
OCNS	Offshore Chemical Notification Scheme
OMS	Operating Management System
OSCAR	Oil Spill Contingency and Response
OSCP	Oil Spill Contingency Plan
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North East Atlantic
OSRL	Oil Spill Response (Ltd)
PCA	EU-Azerbaijan Partnership and Cooperation Agreement
PDF	Potential Dangerous Facilities
PHB	Pre Hydrated Bentonite
POB	Persons On Board
PTS	Permanent Threshold Shift
PSA	Production Sharing Agreement
PSU	Practical Saline Unit
RAMSAR	Convention on the, Protection of wetlands of international importance
RMS	Roof Mean Square
ROV	Remotely Operated Vehicle
SB	Swim Bladder (fish)
SBES	Single Beam Echo Sounder
SBS	State Border Service
SBP	Sub Bottom Profiler
SD	Shah Deniz
SDCB	Small Drill Cuttings Boxes
SEE	State Ecological Expertise
SEL	Sound Exposure Level
SELcum	Cumulative Sound Exposure Level
SINTEF	Stiftelsen for Industriell og Teknisk Forskning
SMA	State Maritime Administration
SOBM	Synthetic Oil Based Mud
SOCAR	State Oil Company of Azerbaijan Republic
SPL	Sound Pressure Level
SSS	Side Scan Sonar
SST	Sea Surface Temperature
STP	Sewage Treatment Plant/Package
SWRP	Subsea Well Response Project
SWAP	Shallow Water Absheron Peninsula
TD	Target Depth
THC	Total Hydrocarbon Content
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids

TTS	Temporary Threshold Shift
TVD	True Vertical Depth
UCM	Unresolved Complex Mixture
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
V	Vulnerable (IUCN Red List)
VOC	Volatile Organic Compounds
VSP	Vertical Seismic Profile
WBM	Water Based Mud
WHO	Word Health Organisation
WTNs	Waste Transfer Notes
WTP	Water Transport Police

1 Introduction

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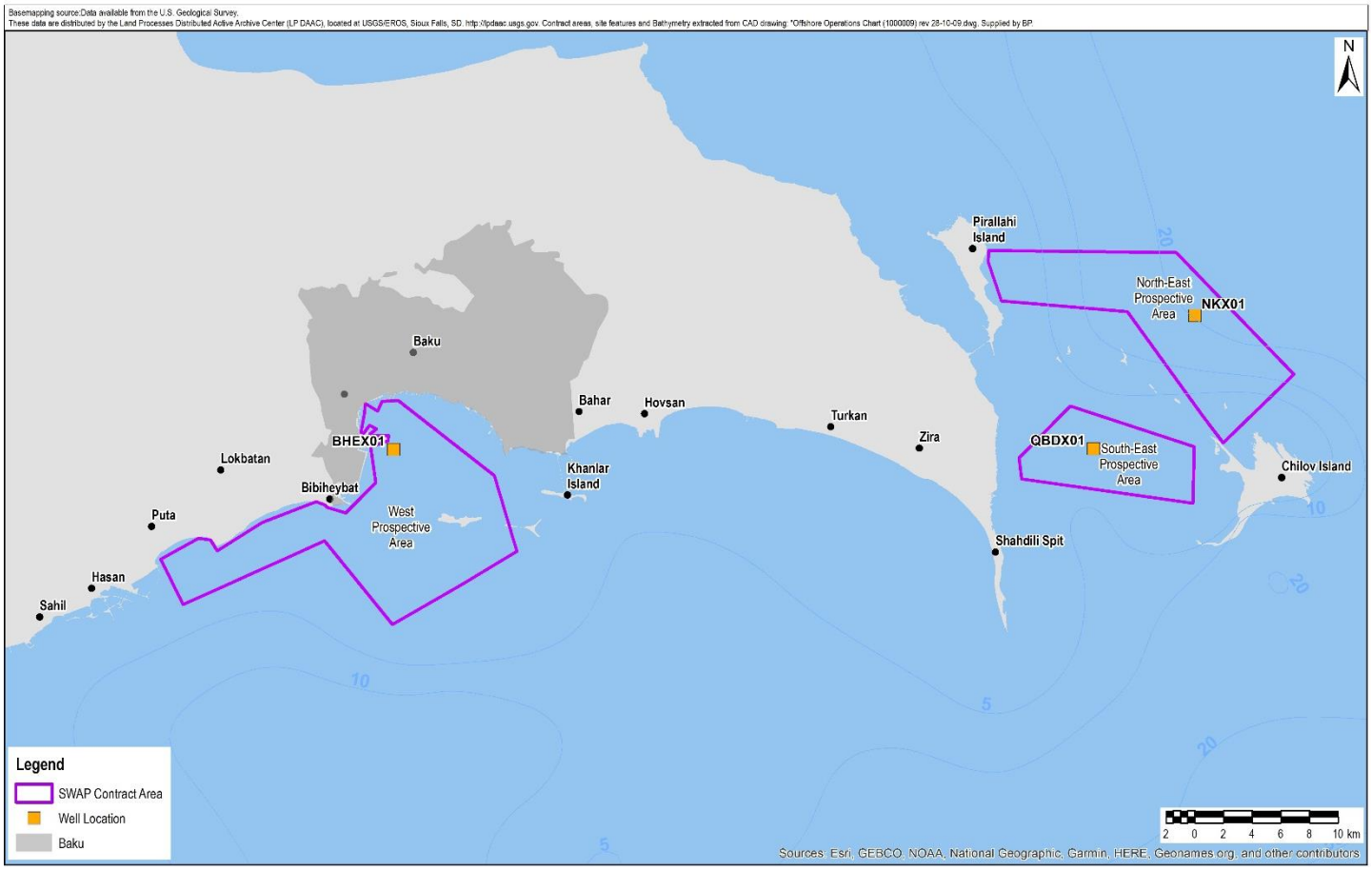
1.1 Introduction

This Environmental and Socio-Economic Impact Assessment (ESIA) has been prepared for the Shallow Water Absheron Peninsula (SWAP) Exploration Drilling Project. The SWAP Contract Area comprises three Prospective Areas as shown in Figure 1.1. It is planned to drill three SWAP exploration wells in total; one in each Prospective Area namely:

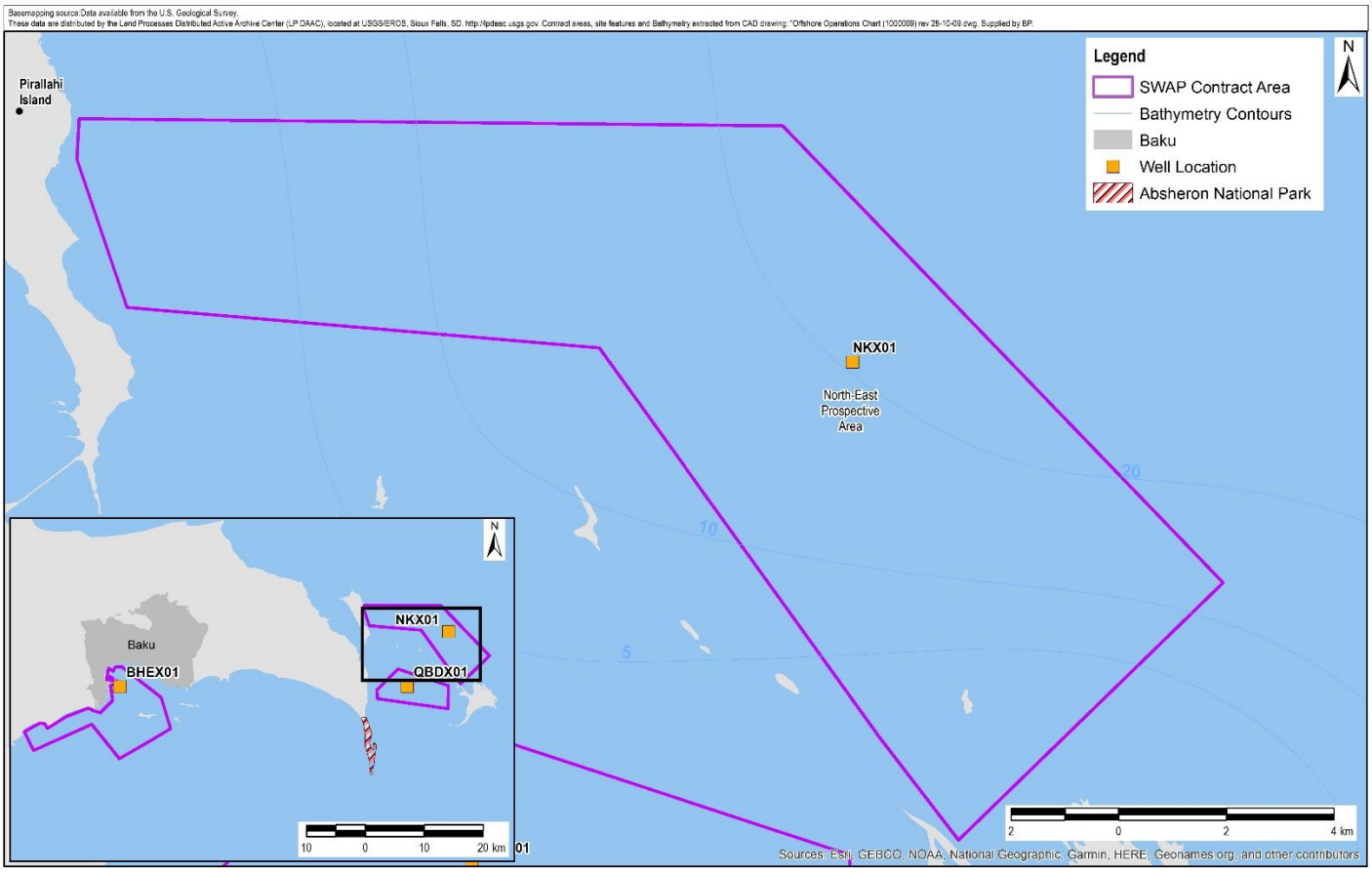
- North Khali (NKX01) exploration well in North East Prospective Area;
- Qarabatdag (QBDX01) exploration well in South East Prospective Area; and
- Bibiheybat (BHEX01) exploration well in West Prospective Area;

Figure 1.1: SWAP Prospective Areas and Proposed Exploration Well Locations



This ESIA Report has been prepared to identify and assess the potential impacts associated with the drilling activities for the North Khali (NKX01) well (hereafter referred to as the "Project"). The indicative location of the NKX01 exploration well is shown in Figure 1.2.

Figure 1.2: NKX01 Exploration Well Location



Exploration drilling activities at BHEX01 and QBDX01 locations will be covered in addenda to this ESIA Report.

1.1.1 SWAP Activities Undertaken to Date

The Production Sharing Agreement (PSA)[5] to jointly explore and develop potential prospects in the SWAP Contract Area was signed between BP and the State Oil Company of Azerbaijan Republic (SOCAR) in December 2014. BP Absheron Limited holds a 50% participating interest in the PSA, with the remaining 50% held by SOCAR Oil Affiliate.

Initial geological studies indicated that there are potential hydrocarbon reservoirs within the SWAP Contract Area at depths of 3,000 to 5,000m and at shallower depths of 1200m**.** To characterise the subsurface geology and these potential reservoirs within the Contract Area, two seismic surveys were undertaken:

- A two dimensional (2D) seismic survey within the deeper waters of the SWAP Contract Area and the surrounding areas at water depths greater than approximately 10m (undertaken in 2015); and
- A three-dimensional (3D) seismic survey within the shallower waters (less than approximately 25m water depth) of the SWAP Contract Area and the surrounding nearshore and onshore areas (undertaken in 2016).

[5] Specifically, *Agreement on the Exploration, Development And Production Sharing For the Shallow Water Area around the Absheron Peninsula in the Azerbaijan Sector of the Caspian Sea.*

Prior to undertaking the surveys, two ESIA reports were prepared to assess the survey activities and potential impacts and provide relevant mitigation and monitoring measures. Following the completion of the 3D Seismic Survey ESIA report, a number of changes to the survey timing and the survey area was made; these changes were assessed within the SWAP 3D Seismic Survey Environmental and Socio-Economic Risk Assessment of Changes document.

In September 2017 BP informed the Ministry of Ecology and Natural Resources (MENR) about plans to undertake a number of geo-hazard surveys (single beam echo sounder (SBES), multibeam echo sounder (MBES), side scan sonar (SSS), sub bottom profiler (SBP) and magnetic) within each of the three Prospective Areas of the SWAP Contract Area (refer to Figure 1.1). The surveys were undertaken in November and December 2017.

Further to the geo-hazard surveys, an Environmental and Socio-economic Technical Note (ESTN) was prepared and submitted to the MENR on 17th January 2017 to undertake a number of geotechnical surveys and conduct further seismic surveys in the Prospective Areas. The surveys were planned to further assess soil stability and identify subsurface hazards to allow the selection of potential locations for exploration drilling. Approval from the MENR was received in February 2018 and the surveys implemented throughout 2018 with the drilling locations subsequently selected.

1.1.2 SWAP Exploration Drilling Project

The NKX01 exploration well is located within the North East Prospective Area as shown within Figure 1.2, approximately 15km from the Azerbaijani mainland in a water depth of approximately 22m. It is proposed to commence drilling of the Project exploration well in Q1 2021. This will be followed by drilling at the second well location (BHEX01) in Q2 2021 and drilling of the third well (QBDX01) is planned to commence in Q4 2021.

The NKX01 exploration well is planned to target hydrocarbons approximately 2,500m below the seabed surface and drilling activities are expected to take up to 90 days to complete. During this period, assistance to the drilling rig will be provided by support vessels. Drilling of the exploration well will be carried out, taking into account applicable national and international legal requirements and in accordance with the requirements of the SWAP PSA.

The key objective of drilling the exploration well is to confirm the presence of hydrocarbons prior to the potential future development of the Contract Area.

1.2 Scope of the SWAP Exploration Drilling Project ESIA

The overall objective of the ESIA process is to identify potential adverse or beneficial environmental or socio-economic impacts arising from the proposed drilling activities associated with the NKX01 well and ensure adverse impacts are minimised and effectively managed.

The purpose of the ESIA is to:

- Ensure that environmental and socio-economic considerations are integrated into the Project;
- Ensure that previous relevant experience is acknowledged and where appropriate, integrated into the Project;
- Ensure that environmental and socio-economic impacts are identified, quantified and assessed and appropriate mitigation measures proposed;
- Ensure that a high standard of environmental performance is planned and achieved for the Project;
- Ensure that applicable legal, operator and PSA requirements and expectations are addressed;
- Consult with project stakeholders throughout the ESIA process and address their concerns; and
- Demonstrate that the Project will be implemented with due regard to environmental and socio-economic considerations.

Within the impact assessment, the Project activities and potential receptor interactions are evaluated against existing environmental and socio-economic conditions and sensitivities, and the potential impacts are ranked. The assessment of potential impacts takes account of existing and planned controls

and monitoring and mitigation measures which form part of the Project plan, typically developed from previous shallow water drilling projects undertaken within the Caspian region and BP's wider global experience.

1.3 Approach to the ESIA and Structure

This ESIA Report, which covers the activities associated with drilling of the NKX01 exploration well, has been prepared by AECOM on behalf of BP for submission to the MENR. As agreed during the Scoping Meeting (refer to Chapter 3) with the MENR, BP will submit supplementary information for the planned BHEX01 and QBDX01 exploration wells. It is anticipated this will comprise one or more ESIA Addenda setting out a detailed description of the proposed drilling activities, baseline conditions specific to the well locations and an assessment of the impacts associated with the drilling of each well.

Table 1.1 presents a summary of this ESIA Report structure and the anticipated scope of the Addenda to be prepared for the QBDX01 and BHEX01 exploration wells. It is anticipated the first ESIA Addenda will be prepared and submitted during Q4 2020/Q1 2021 as the exploration programme is further defined.

Table 1-1: Structure and Content of SWAP Exploration Drilling Project ESIA Report and Addenda

Chapter	Summary of Content	
	SWAP Exploration Drilling Project ESIA	ESIA Addenda
Executive Summary	A summary of the ESIA.	n/a
Units and Abbreviations	A list of the units and abbreviations used in the ESIA.	n/a
Glossary	A glossary of terms.	n/a
1 - Introduction	An overview of NKX01 exploration well; background and purpose; the ESIA objectives; details of ESIA team members and ESIA Report structure.	An overview of the QBDX01 and BHEX01 exploration wells.
2 - Policy, Regulatory and Administrative Framework	A summary of applicable legislative requirements including those associated with the SWAP PSA, ratified international conventions, International Petroleum Industry Standards and Practices and applicable national legislation and guidance.	n/a - the Addenda will cross reference to Chapter 2 and Chapter 3 presented in this ESIA Report
3 - Impact Assessment Methodology	A description of the methods used to conduct the ESIA and an overview of the consultation undertaken during the ESIA programme.	
4 - Project Description	A detailed description of the NKX01 exploration well activities.	A detailed description of the QBDX01 and BHEX01 exploration wells activities.
5 - Environmental Description	A description of the environmental and socio-economic baseline conditions in the vicinity of the NKX01 exploration well.	A description of the environmental and socio-economic baseline conditions in the vicinity of the QBDX01 and BHEX01 exploration wells.
6 - Environmental and Socio-economic Impact Assessment, Monitoring and Mitigation	An assessment of the potential environmental and socio-economic impacts associated with the NKX01 exploration well activities, including any necessary mitigation and monitoring.	An assessment of the potential environmental and socio-economic impacts associated with the QBDX01 and BHEX01 exploration wells activities, including any necessary mitigation and monitoring.
7 - Cumulative, Transboundary and Accidental Events	An assessment of the potential cumulative and transboundary impacts and accidental events associated with the NKX01 exploration well activities.	An assessment of the potential cumulative and transboundary impacts and accidental events associated with the QBDX01 and BHEX01 exploration wells activities.
8 - Environmental and Socio-Economic Management	A summary of the environmental and social management system associated with the NKX01 exploration well activities.	A summary of the environmental and social management system associated with the QBDX01 and BHEX01 exploration well activities.
9 - Residual Impacts and Conclusions	A summary of the residual impacts and conclusions arising from the ESIA process.	A summary of the residual impacts and conclusions arising from the ESIA process.
Appendices	Supporting technical information.	Supporting technical information.

1.4 ESIA Team

The details of the ESIA Team is provided in Table 1.2.

Table 1-2: SWAP Exploration Drilling Project ESIA Team

Team Member	Role
AECOM	ESIA Project Manager and Lead Authors
	Air Quality Assessment
	Noise and Vibration Assessment
	Spill Assessment
	Marine Ecology Assessment
	Socio-economic Assessment
	Marine Archaeology Assessment
Award Environmental Consultants Ltd	Underwater Sound Assessment
Brian Roddie	Marine Ecology Expert
Mehman M. Akhundov	Local Fish and Fisheries Specialist
Grigory Palatnikov	Local Fish and Fisheries Specialist
Tariel Eybatov	Local Caspian Seal Specialist
Ilyas Babayev	Local Bird Specialist
Synergetics	Local Socio-Economic Specialists
More Energy	Spill and Discharge Modelling Specialist
BP	SWAP Contract Area PSA Technical Operator on behalf of SWAP PSA Partners

2 Policy, Regulatory and Administrative Framework

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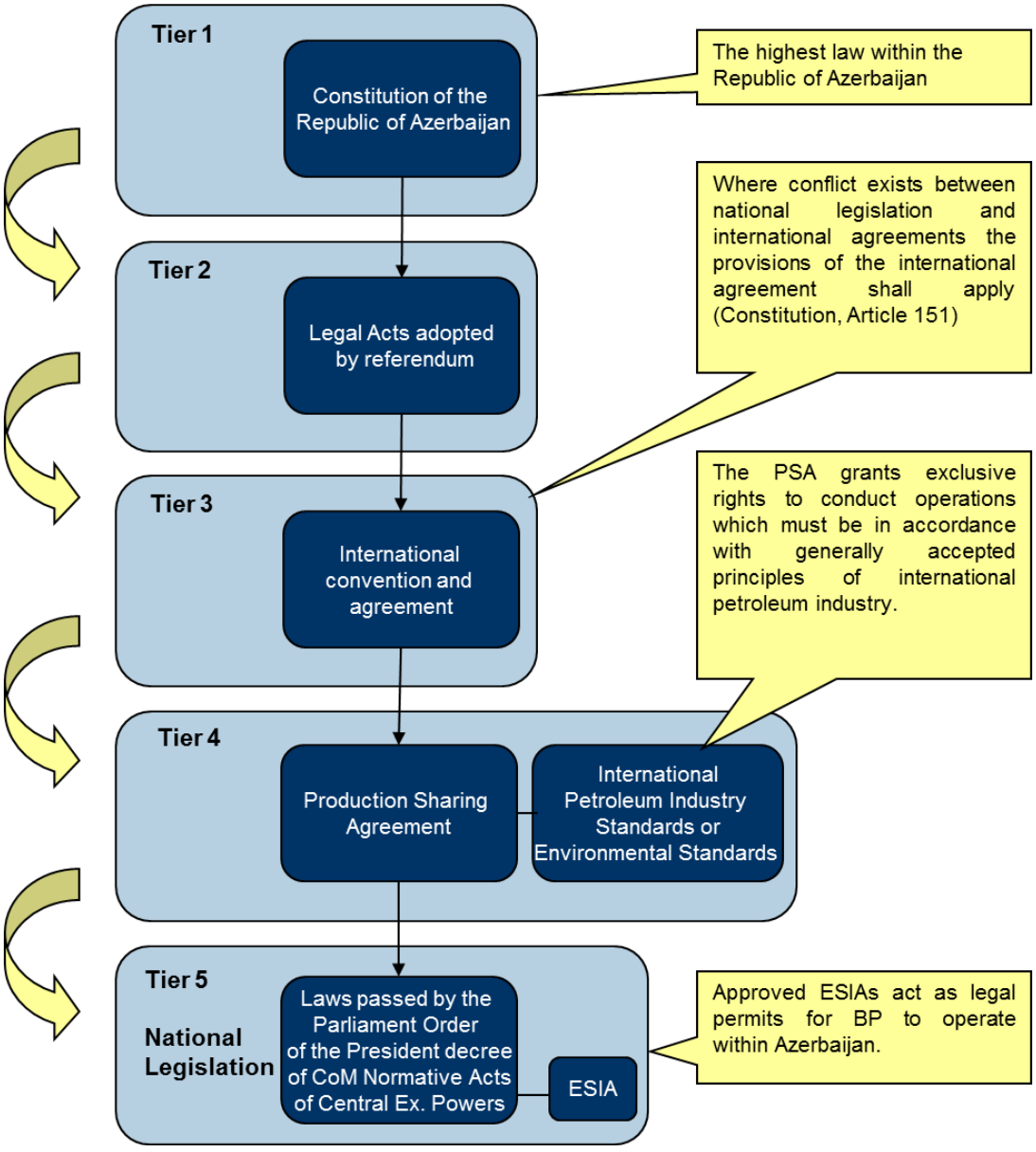
2.1 Introduction

This Chapter of the Environmental and Socio-Economic Impact Assessment (ESIA) provides an overview of the agreements, legislation, standards and guidelines which are applicable to the Project including the following:

- SWAP Production Sharing Agreement (referred to herein as the "PSA");
- Applicable national legislation and guidance;
- Applicable requirements of international and regional conventions ratified by the Azerbaijan government;
- Regional processes; and
- International petroleum industry standards and practices.

The legal hierarchy applicable to the Project is illustrated in Figure 2.1.

Figure 2.1: Azerbaijan Legal Hierarchy



In addition to the applicable legal requirements, the SWAP Exploration Drilling Project will be undertaken in accordance with BP Group, Segment and Regional standards.

2.2 Regulatory Agencies

The **Ministry of Ecology and Natural Resources (MENR)** has primary responsibility for environmental regulation. The MENR's statutes were adopted by presidential decree in 2001, making this body responsible for:

- Development of draft environmental legislation for submission to the Azerbaijan Parliament (Milli Mejlis[6]);
- Implementation of environmental policy;
- Enforcement of standards and requirements for environmental protection;
- Suspension or termination of activities not meeting set standards;
- Advising on environmental issues;
- Expert review and approval of environmental documentation, including Environmental Impact Assessment (EIA) and Environmental and Social Impact Assessment (ESIA); and
- Implementation of the requirements set out in international conventions ratified by the Azerbaijan Republic (within its competence).

Other ministries and committees have functions that relate to environmental regulation including:

- **Ministry of Emergency Situations (MES)** - responsible for the management of natural disasters and industrial accidents and the implementation of safety rules in construction, mining and industry. MES (along with the State Oil Company of the Azerbaijan Republic (SOCAR), MENR and other appropriate Ministries) require prompt notification in the event of an emergency, or accident;
- **Ministry of Health** - state institution controlling the sanitary-epidemiological situation in the country and regulation of health protection in the work place; and
- **Ministry of Energy** - responsible for oil and gas activities, the sale of oil and gas products, and the efficient utilisation of Azerbaijan's energy resources.

2.3 The Constitution

The Constitution is the highest law in the Republic of Azerbaijan and prevails over national legislation and international agreements. The following Articles help determine the applicability of national and international requirements to the proposed SWAP Exploration Drilling Project:

- **Article 148.II** - International agreements acceded to by the Republic of Azerbaijan become an integral part of the legislative system of Azerbaijan; and
- **Article 151** - If any conflicts arise between the normative-legal acts which constitute the legislative system of Azerbaijan (except for the Constitution and the acts adopted via referendum) and the international agreements acceded to by the Republic of Azerbaijan, the provisions of the international agreements shall apply.

The Constitution (Article 39) also stipulates the basic rights of people to live in a healthy environment, to have access to information on the state of the environment and to obtain compensation for damage suffered as the result of a violation of environmental legislation.

2.4 Production Sharing Agreement

The PSA[7] is the legally binding agreement between SOCAR and BP and was enacted into Azerbaijani law on 14th April 2015. The SWAP Exploration Drilling Project will be managed by BP in the capacity of the Contractor under the PSA.

[6] Milli Mejlis is the name of the National Parliament of the Republic of Azerbaijan.
7 Specifically, Agreement on the Exploration, Development And Production Sharing For the Shallow Water Area around the Absheron Peninsula in the Azerbaijan Sector of the Caspian Sea.

Article 26.1 of the PSA states:

"*Contractor shall apply safety and environmental protection standards and practices that take account of the specified environmental characteristics of the Caspian Sea and draw, as appropriate, on (i) international Petroleum industry standards and experience with their implementation in exploration and production operations in other parts of the world and (ii) existing Azerbaijan safety and environmental legislation. In compilation of such standards and practices account shall be taken of such matters as environmental quality objectives, technical feasibility and economic and commercial viability*".

Article 26.1 also requires that in developing relevant standards and practices, environmental quality objectives, technical feasibility and economic and commercial viability must also be taken into account and further states:

"*Subject to the first sentence of Article 26.4 the standards, which shall apply to Petroleum Operations from Effective Date shall be the standards and practices set out in Part II of Appendix 9 until substituted by new safety and environmental protection standards devised and agreed between Contractor, SOCAR and MENR. Such substitution shall take effect following the appropriate written agreement between Contractor, SOCAR and MENR on a date agreed between the Parties and MENR and from such date such agreed standards and practices shall have the force of law as if set out in full in this Agreement*."

Article 26.2 of the PSA states:

"*Contractor shall conduct the Petroleum Operations in a diligent, safe and efficient manner in accordance with the Environmental Standards to minimise any potential disturbance to the general environment, including without limitation the surface, subsurface, sea, air, lakes, rivers, animal life, plant life, crops, other natural resources and property*".

Article 26.4 of the PSA requires "Contractor" to: " …*comply with present and future Azerbaijani laws or regulations of general applicability with respect to public health, safety and the protection and restoration of the environment, to the extent that such laws and regulations are no more stringent than the Environmental Standards set out in Part II of Appendix 9*".

Appendix 9, Section I, Article A1 of the PSA restricts the release of drilling discharges:

"*There shall be no discharge to the environment of waste oil, produced water and sand, drilling fluids, drill cuttings, chemical substances used in drilling and other processes or other wastes from exploration and production sites except in accordance with the following guidelines*."

Appendix 9, Section II, Article 3(a) of the PSA requires the Project to adhere to the specific European Union (EU) Council Directive related to the discharge of sanitary and states the following:

"*Sanitary waste (black and grey water) may be discharged into the sea from a certified bio-treatment unit following treatment in accordance with the requirements of the EU Council Directive 91/271/EEC (transportation onshore not being excluded). No floating solids shall be observed on water surface*."

Until the written agreement, on entrance into legal force of the Production Standards, has been signed by all of the parties, the standards and practices set out in part II of Appendix 9 to the PSA shall continue to apply to petroleum operations.

2.5 International and Regional Environmental Conventions

Azerbaijan is signatory to numerous international and regional conventions that oblige the government to prevent pollution and protect specified habitats, flora and fauna. Those of relevance to the SWAP Exploration Drilling Project are listed in Tables 2.1 and 2.2.

Table 2-1: Summary of International Conventions

Convention	Purpose	Status
Bern Convention	Conservation of wild flora and fauna and their natural habitats.	In force in Azerbaijan since 2002.
UNESCO Convention on Wetlands of International Importance especially as Waterfowl Habitat / RAMSAR Convention	Promote conservation of wetlands and waterfowl. In addition, certain wetlands are designated as Wetlands of International Importance and receive additional protection.	Azerbaijan signed the Ramsar Convention in 2001.
International Convention for the Prevention of Pollution from Ships/ Vessels (MARPOL), 1973 as amended by the protocol, 1978	The legislation giving effect to MARPOL 73/78 in Azerbaijan is the Protection of the Sea (Prevention of Pollution from Ships) Act 1983. Preventing and minimising pollution of the marine environment from ships - both accidental pollution and that from routine operations.	Azerbaijan acceded in 2004.
UN Convention on the Protection of the Ozone Layer (Vienna Convention)	Framework for directing international effort to protect the ozone layer, including legally binding requirements limiting the production and use of ozone depleting substances as defined in the Montreal Protocol to the Convention. Supported by the Montreal Protocol and amendments (see below).	Azerbaijan acceded in 1996.
Montreal Protocol on Substances that Deplete the Ozone Layer, 1987	Specific requirements for reductions in emissions of gases that deplete the ozone layer. Amended four times: London 1990, Copenhagen 1992, Montreal 1997 and Beijing 1999.	Azerbaijan acceded in 1996.
United Nations Framework Convention on Climate Change, 1992	Seeks to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, within a sufficient time frame to allow ecosystem to adapt naturally, protect food production and enable sustainable economic development.	Azerbaijan acceded in 1992 and not formally required to meet specific targets.
Kyoto Protocol, 1997	Follow on from the Framework Convention on Climate Change.	Azerbaijan acceded in 2000.
UN Convention on Biological Diversity, 1992	Conservation of biological diversity including the sustainable use of its components and the fair and equitable sharing of benefits.	Azerbaijan became party to the Convention in 2000.
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990	Seeks to develop further measures to prevent pollution from ships.	Azerbaijan acceded in 2004.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Controls trade in selected species of plant and animals.	Entered into force in Azerbaijan in 1999.
Convention for the Protection of the Archaeological Heritage of Europe	Requires each state party to support archaeological research financially and promote archaeology, using public or private funding.	Azerbaijan ratified in 2000.
Basel Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals	Seeks to control and reduce transboundary movements of hazardous wastes, minimise the hazardous wastes generated, ensure environmentally sound waste management and recovery practices and assist developing countries in improving waste management systems.	Azerbaijan ratified in 2001.
UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions	Promotes participants' right to formulate and implement their cultural policies and to adopt measures to protect and promote the diversity of cultural expressions and to strengthen international cooperation.	Azerbaijan acceded in 2010.
Stockholm Convention on Persistent Organic Pollutants	Reduction in releases of dioxins, furans, hexachlorobenzene and PCBs with the aim of minimisation or elimination.	Azerbaijan acceded in 2004

Table 2-2: Summary of Regional Conventions

Convention	Purpose	Status
Aarhus Convention*	To guarantee the rights of access to information, public participation in decision-making and access to justice in environmental matters.	Azerbaijan acceded in 2000.
Espoo Convention*	To promote environmentally sound and sustainable development through the application of ESIA, especially as a preventive measure against transboundary environmental degradation.	Azerbaijan acceded in 1999 and at the time of writing, Azerbaijan had not signed a related protocol on Strategic Environmental Assessment.
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention)*	To prevent, control or reduce transboundary impact resulting from the pollution of transboundary waters by human activity.	Azerbaijan acceded in 2002.
UN Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals	Regulates the transboundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.	Azerbaijan ratified in 2001.
Protocol on Water and Health*	To protect human health and well-being by better water management and by preventing, controlling and reducing water-related diseases.	Azerbaijan acceded in 2003.
UNECE Geneva Convention on Long-range Transboundary Air Pollution*	Provides a framework for controlling and reducing transboundary air pollution.	Entered into force in Azerbaijan in 2002. Has been extended by 8 protocols, none of which at the time of writing have been ratified by Azerbaijan.
International Carriage of Dangerous Goods by Road*	Provides requirements for the packaging and labelling of dangerous goods and the construction, equipment and operations of transportation vehicles. Annexes provide detailed technical requirements.	Entered into force in Azerbaijan in 2000.
Convention on the Transboundary Effects of Industrial Accidents*	To prevent industrial accidents that may have transboundary effects and to prepare for and respond to such events.	Azerbaijan acceded in 2004.
Tehran-Caspian Framework Convention	Ratified by all five littoral states and entered into force in 2006. Requires member states to take a number of generic measures to control pollution of the Caspian Sea. Three protocols have been adopted and therefore form the basis for national legislation and regulations. One protocol, namely Environment Impact Assessment in a Transboundary Context, has been drafted and was not adopted at the time of writing.	Convention is ratified, and the following protocols have been adopted: The Protocol Concerning Regional Preparedness, Response and Co-operation in Combating Oil Pollution Incidents ("Aktau Protocol") (August 2011); The Protocol for the Protection of the Caspian Sea against Pollution from Land-based Sources and Activities ("Moscow Protocol") (December 2012); and The Protocol for the Conservation of Biological Diversity ("Ashgabat Protocol") (May 2014).
* A UNECE agreement; Azerbaijan became a member of the UNECE in 1993. The major aim of the UNECE is to promote pan-European integration through the establishment of norms, standards and conventions.		

2.6 National Environmental and Social Legislation

The Azerbaijan Government has committed to a process to align national environmental legislation with the principles of internationally recognised legislation, based on EU environmental legislation. As this process is on-going, the proposed SWAP Exploration Drilling Project will comply with the intent of current national legal requirements of general applicability with respect to public health, safety and the protection and restoration of the environment, to the extent that such laws and regulations are no more stringent than the international petroleum industry standards and practice.

The framework for national environmental legislation in Azerbaijan is provided by the Law on the Protection of the Environment (1999), which addresses the following issues:

- The rights and responsibilities of the State, the citizens, public associations and local authorities;
- The use of natural resources;
- Monitoring, standardisation and certification;
- Economic regulation of environmental protection;
- State Ecological Expertise (SEE);
- Ecological requirements for economic activities;
- Education, scientific research, statistics and information;
- Ecological emergencies and ecological disaster zones;
- Control of environmental protection;
- Ecological auditing;
- Responsibility for the violation of environmental legislation; and
- International cooperation.

According to Article 54.2 of the Law on Protection of the Environment, EIAs are subject to SEE, which means that the environmental authority (the MENR) is responsible for the review and approval of EIA reports submitted by developers. The Law establishes the basis for the SEE procedure, which can be seen as a “stand-alone” check of compliance of the proposed project with the relevant environmental standards (e.g. for pollution levels, discharges and noise). In addition, the law determines that projects cannot be implemented without a positive SEE resolution.

The SEE approach requires state authorities to formally verify all submitted developments for their potential environmental impacts. Current internationally recognised practice emphasises a proportionate, consultative and publicly accountable approach to assessing impacts.

As of 12th June 2018, Azerbaijan introduced a law on Environmental Impact Assessment (Ref.1) which establishes a legal, economic and organisation framework for assessment of impacts on natural environment and human health associated with economic activities proposed by public and private developers. The objectives and principles of this law, and how it interacts with existing guidance are outlined in Section 2.6.1.

Table 2.3 provides a summary of the key national environmental and social laws.

Table 2-3: Key National Environmental and Social Laws[8]

Subject	Title	Description / Relevance to SWAP Exploration Drilling Project
General	Law of Azerbaijan Republic on Environmental Impact Assessment (EIA) No. 1175-VQ.	Determines the legal framework for the Environmental Impact Assessment process in Azerbaijan and outlines the objectives and principles of EIA. It also introduces a list of mandatory activities that require an EIA and identifies the rights and responsibilities of all parties involved in its' preparation, approval and communication.
	Law of Azerbaijan Republic on the Protection of the Environment No. 678-IQ.	Establishes the main environmental protection principles and the rights and obligations of the State, public associations and citizens regarding environmental protection (described above).
	Law of Azerbaijan Republic on Ecological Safety No. 677-IQ.	One of two keystone laws of the country's environmental legislation (along with the *Law on the Protection of the Environment*). Its purpose is to establish a legal basis for the protection of life and health, society, the environment, including atmospheric air, space, water bodies, mineral resources, natural landscapes, plants and animals from natural and anthropogenic dangers. The Law assigns the rights and responsibilities of the State, citizens and public associations in ecological safety, including information and liability. The Law also deals with the regulation of economic activity, territorial zoning and the alleviation of the consequences of environmental disasters.
Ecosystems	Law of the Azerbaijan Republic on Specially Protected Natural Territories and Objects No. 840-IQ.	Determines the legal basis for protected natural areas and objects in Azerbaijan.
	Law of Azerbaijan Republic on Fauna No. 675-IQ.	Defines the animal world, property rights over fauna and legal relationships between parties. It also describes issues of State inventory and monitoring, and economic and punitive regulations.
Water	Water Code of Azerbaijan Republic (approved by Law No. 418-IQ).	Regulates the use of water bodies, sets property rights and covers issues of inventory and monitoring. The Code regulates the use of water bodies for drinking and service water and for medical treatment, spas, recreation and sports, agricultural needs, industrial needs and hydro energy, transport, fishing and hunting, discharge of waste water, fire protection and specially protected water bodies. It provides for zoning, maximum allowable concentrations of harmful substances and basic rules of industry conduct.
	Rules of Referral of Specially Protected Water Objects to Individual Categories, Cabinet of Ministers Decree No. 77.	The Caspian Sea is a specially protected water body. This resolution requires special permits for disposal if there are no other options for wastewater discharge. The resolution allows for restrictions to be placed on the use of specially protected water bodies, and for further development of regulations related to these water bodies. It requires consent from MENR for activities that modify the natural conditions of specially protected water bodies, and includes provisions for permitting of any discharges to water that cannot be avoided. There are also special requirements for the protection of water bodies designated for recreational or sports use (which includes the Caspian).
	Rules for Protection of Surface Waters from Waste Water Pollution, State Committee of Ecology Decree No. 1.	Under this legislation the *Permitted Norms of Harmful Impact Upon Water Bodies of Importance to Fisheries* require discharges to meet several specified standards for designated water bodies in terms of suspended solids; floating matter; colour, smell and taste; temperature; dissolved oxygen; pH; Biological Oxygen Demand (BOD) and poisonous substances. Limits are based on Soviet era standards and are to be achieved at the boundary of the facility (specific "sanitary protection zone limits") rather than "end-of-pipe" limits. End of pipe limits are defined in facility-specific "eco-passports" and are established with the intent to ensure compliance with applicable ambient standards.
Air	Law of Azerbaijan Republic on Air Protection No. 109-IIQ.	Establishes the legal basis for the protection of air, thus implementing the constitutional right of the population to live in a healthy environment. It stipulates the rights and obligations of the authorities, legal and physical persons and non-governmental organisations (NGOs) in this respect, sets general requirements for air protection during economic activities, establishes norms for mitigating physical and chemical impacts to the atmosphere, establishes rules for the State inventory of harmful emissions and their sources and introduces general categories of breaches of the Law that will trigger punitive measures.

[8] This table is compiled from a variety of sources (Ref.2, 3 & 4)

Subject	Title	Description / Relevance to SWAP Exploration Drilling Project
	Methodology to Define Facilities' Hazards Categories Subject to Hazardous Substance Emissions Levels and Need to Develop Projects' Maximum Permissible Emissions.	Under this methodology the maximum permissible concentrations of harmful substances and their hazard classes are provided. Limits are based on Soviet era standards.
Waste	Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ.	Describes State policy in environmental protection from industrial and household waste including harmful gases, waste water and radioactive waste. It defines the rights and responsibilities of the State and other entities, sets requirements for the design and construction of waste-treatment installations, licensing of waste generating activities, and for the storage and transport of waste (including transboundary transportation). The Law also encourages the introduction of technologies for the minimisation of waste generation by industrial enterprises. There is a general description of responses to infringements. This law is specified by Resolutions of the Cabinet of Ministers on the rules of certification of hazardous wastes, state strategy on management of hazardous wastes in Azerbaijan and by Instructions on the Inventorisation Rules and Classification System of the Wastes generated by Industrial Processes and In the Field of Services approved by the MENR.
Subsurface	Law of the Azerbaijan Republic on Subsurface Resources No. 439-IQ.	Regulates the exploitation, rational use, safety and protection of subsurface resources and the Azerbaijani sector of the Caspian Sea. The Law lays down the principal property rights and responsibilities of users. It puts certain restrictions on the use of mineral resources, based on environmental protection considerations, public health and economic interests.
Information	Law of the Azerbaijan Republic on Access to Environmental Information No. 270-IIQ.	Establishes the classification of environmental information. If information is not explicitly classified "for restricted use" then it is available to the public. Procedures for the application of restrictions are described. Law aims to incorporate the provisions of the Aarhus Convention into Azerbaijani Law.
Health & Safety	Law on Sanitary-Epidemiological Services (authorised by Presidential Decree No. 371).	Establishes sanitary and epidemiological requirements for industrial entities to be met at design, construction and operational stages, and for other economic activities. Aims to protect the health of the population. It addresses the rights of citizens to live in a safe environment and to receive full and free information on sanitary-epidemic conditions, the environment and public health.
	Law of the Azerbaijan Republic on Protection of Public Health No. 360-IQ.	Sets out the basic principles of public health protection and the health care system. The Law assigns liability for harmful impact on public health, stipulating that damage to health that results from a polluted environment shall be compensated by the entity or person that caused the damage.
	Law of the Azerbaijan Republic on Public Radiation Safety No. 423-IQ.	Includes requirements for ensuring radiation safety in industrial entities. The Law establishes the main principles of government policy on radiation safety, as well as environmental norms protecting the safety of employees and populations in areas potentially affected by the use of radioactive sources. The Law provides for compensation for damage to health, property and life due to accidents.
	Law of Azerbaijan on Technical Safety - 733-IQ	The current law sets legislative, economic and social basis of PDF (Potential Dangerous Facilities) exploitation.
Liability	Law of the Azerbaijan Republic on Mandatory Environmental Insurance.	Identifies requirements for the mandatory insurance of civil liability for damage caused to life, health, property and the environment resulting from accidental environmental pollution.
Permitting	A System of Standards for the Environment Protection and Improvement of Natural Resources Utilisation. Industrial Enterprise Ecological Certificate Fundamental Regulations, GOST 17.0.0.04-90.	The MENR issues ecological documents on the impact on the environment of potentially polluting enterprises. The documents include maximum allowable emissions, maximum allowable discharges, and an "ecological passport." The last item is specific to countries of the Former Soviet Union and contains a broad profile of an enterprise's environmental impacts, including resource consumption, waste management, recycling, and the effectiveness of pollution treatment. Enterprises develop the draft passport themselves and submit it to MENR for approval.
Cultural Heritage	Law on the Protection of Historical and Cultural Monuments.	Specifies the responsibilities of state and local authorities, and lays down principles for the use, study, conservation, restoration, reconstruction, renovation and safety of monuments. The Law declares that cultural objects with national status, historical and cultural monuments, cultural goods stored in state museums, archives, libraries, as well as the territories where they are situated, are not subject to privatisation. Requires archaeological studies prior to construction works in areas with archaeological significance.

2.6.1 National EIA Guidance

The mandatory EIA requirements within Azerbaijan are set out within the Law of Azerbaijan Republic on Environmental Impact Assessment (Ref.1). The purpose of this legislation is to give effect to Article 54.2 of the Law on the Protection of the Environment in Azerbaijan, establishing the legal, economic and organisation framework for assessment of impacts on natural environment and human health associated with economic activities proposed by public and private developers.

Under this law, an EIA must be undertaken with reference to the following key principles:

- Based on an analysis of environmental and socio-economic effects of the proposed activity;
- Ensuring accuracy, transparency and reliability of environmental information relevant to the proposed activity;
- Taking into account the requirement for preservation of ecological balance and biodiversity;
- Forecasting all possible environmental impacts and assessment of risk;
- Confirming compliance of the proposed activity with established permissible limits;
- Ensuring public disclosure, consultation and consideration of public representatives in addition to participation of government and municipal bodies, physical and legal entities and non-governmental organisations; and
- Ensuring state control and public transparency of EIA.

The process to be followed to undertake an EIA is provided in Article 4 of the EIA legislation, including the roles and responsibilities of the Developer and Competent Authorities; which includes the MENR. A summary of the EIA process, including the mandatory requirements are provided in Table 2.4 below.

Table 2-4: Summary of the EIA Process in Azerbaijan and Mandatory Requirements

Scoping and Requirement for EIA	
Activities Subject to EIA	The categories of economic developments that are subject to mandatory EIA are set out within an Appendix to the Law. These include hydrocarbon exploration, development and extraction.
Scoping	The Developer is required to carry out the EIA of the proposed activity following a preliminary consultation with the Competent Authority (MENR). The preliminary consultation is required to define the content, scope and methodology of the assessment, and to ensure completeness and accuracy of the relevant documentation used in the EIA.
EIA Report	
General	The EIA Report shall be prepared during the project development stage and submitted to the Competent Authority to undertake a review of the EIA Report in accordance with the AR Law on Environmental Protection. It shall be written in an understandable style and shall include a description of baseline conditions, potential environmental and public health impacts, mitigation measures and recommendations aimed at minimisation of the negative impacts and shall include introduction and conclusion sections.
Project Description	A full description of the proposed development, its purpose, phases, types of its environmental impacts and methodology used for assessing environmental risks shall be provided.
Project Alternatives	An overview of at least two options alternative to the proposal (including zero option), as well as environmental justification for the option of applying the best available technology shall be provided.
Legislative Requirements	A summary of the legal framework and references of statutory and normative documentation used in the EIA shall be included.
Environmental and Socio-economic Description	Baseline environmental and socio-economic conditions and sensitivity of the areas affected by the proposed development should be described.

Impact Assessment and Mitigation	All impacts (direct and indirect, onsite and offsite, acute and chronic, one-off and cumulative, emergency and non-routine, transient and irreversible) should be identified and evaluated according to its significance and severity and mitigation measures provided to avoid, reduce, or compensate for these impacts.
Transboundary and Accidental Impacts	Where transboundary impacts are identified, these should be assessed as per the procedure and terms established by the Competent Authority (Cabinet of Ministers). Prediction of impacts associated with emergency events should be included within the EIA Report.
Environmental Management and Monitoring	An overview of the environmental management system to be adopted for the project through all project phases including relevant management and monitoring plans should be included.
Residual Impacts	A summary of the residual impacts and the prediction of their significance should be included.
EIA Disclosure	
Public Participation	The law requires that the public affected by the planned activities are informed during the EIA process. The Developer is expected to involve the affected public in discussions on the proposal.
State Ecological Examination	The review of the EIA Report in accordance with the Law on Environmental Protection will be undertaken by the MENR (over a statutory 3-month period), who will prepare an expert opinion. This will be published and made available to the relevant local executive authority where the development is located.

The approval of an EIA by the MENR establishes the compliance framework, including the environmental and social standards that an organisation should adhere to. The law requires that the EIA to be conducted by at least three Environmental Impact Assessors. These will be persons who are appropriately qualified, certified by the MENR and listed within a register. At the time of writing the procedures for certification and registration have yet to be established.

The Handbook for the Environmental Impact Assessment Process in Azerbaijan published in 1996, is aligned to the Law of Azerbaijan Republic on Environmental Impact Assessment and provides additional guidance on the EIA process and ongoing management and monitoring.

2.7 Regional Processes

2.7.1 European Union

EU relations with Azerbaijan are governed primarily by the EU-Azerbaijan Partnership and Cooperation Agreement (PCA) and the European Neighbourhood Policy (ENP).

The PCA entered into force in 1999. Under Article 43:

"*The Republic of Azerbaijan should endeavour to ensure that its legislation will be gradually made compatible with that of the Community*".

As part of the PCA an EU assessment of Azerbaijan's environmental legislation against EU Directives identified a number of recommendations for the approximation of national legislation with EU Directives (Ref.5). Based on this, a draft national programme was developed that emphasises a flexible approach to amending national legislation to take account of institutional capacity and cost (Ref.6) Following the enlargement of the European Union, the EU launched the ENP and Azerbaijan became part of this policy in 2004. The current National Indicative Programme for implementing the ENP (Ref.7) includes a commitment to support legislative reform in the environmental sector, including:

- Approximation of Azerbaijan's environmental legislation and standards with the EU's;
- Strengthening management capacity through integrated environmental authorisation;
- Improved procedures and structures for environmental impact assessment; and
- Development of sectoral environmental plans (waste and water management, air pollution, etc.).

2.7.2 Environment for Europe

Environment for Europe (Ref.8) is a partnership of member states, including Azerbaijan, and other organisations within the UNECE region. Under the auspices of the Environment for Europe a series of ministerial conferences on the environment have been held that have resulted in the establishment of the UNECE conventions described in Section 2.5.

2.8 International Petroleum Industry Standards and Practices

SWAP Exploration Drilling Project activities are required to comply with national legislation where it is no more stringent than "*the Environmental Standards set out in Part II of Appendix 9*" (SWAP PSA, Art. 26.4). The Oil Industry International Exploration and Production Forum (E&P Forum), the International Association of Geophysical Contractors (IAGC), the International Association of Drilling Contractors (IADC) and other international petroleum industry standards are specifically mentioned in the PSA.

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention) is of relevance to SWAP Exploration Drilling Project offshore activities and in particular to the regulation of chemicals.

2.9 References

Ref. No.	Title
1	Law ID 1175-VQ "Ətraf mühitə təsirin qiymətləndirilməsi haqqında", dated 13/07/2018, available at http://www.e-qanun.az/framework/39511
2	United Nations 2004, Environmental Performance Reviews Series No. 19 – Azerbaijan;,
3	Currie & Brown, 2008, Integrated Solid Waste Management System for the Absheron Peninsula Project
4	Popov 2005, Azerbaijan Urban Environmental Profile (an ADB Publication).
5	Mammadov, A. & Apruzzi, F. (2004) Support for the Implementation of the Partnership Cooperation Agreement between EU-Azerbaijan. Scoreboard Report on Environment and Utilisation of Natural Resources. Report prepared for TACIS.
6	SOFRECO (undated) Support for the Implementation of the PCA between EU-Azerbaijan, Draft Programme of legal Approximation.
7	European Commission, 2007. European Neighbourhood and Partnership Instrument, Azerbaijan National Indicative Programme (NIP).
8	United Nations Economic Commission for Europe UNECE (2008) Environment for Europe. Available at: http://www.unece.org/env/efe/welcome.html Accessed February 2018.

3 Impact Assessment Methodology

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3.1 Introduction

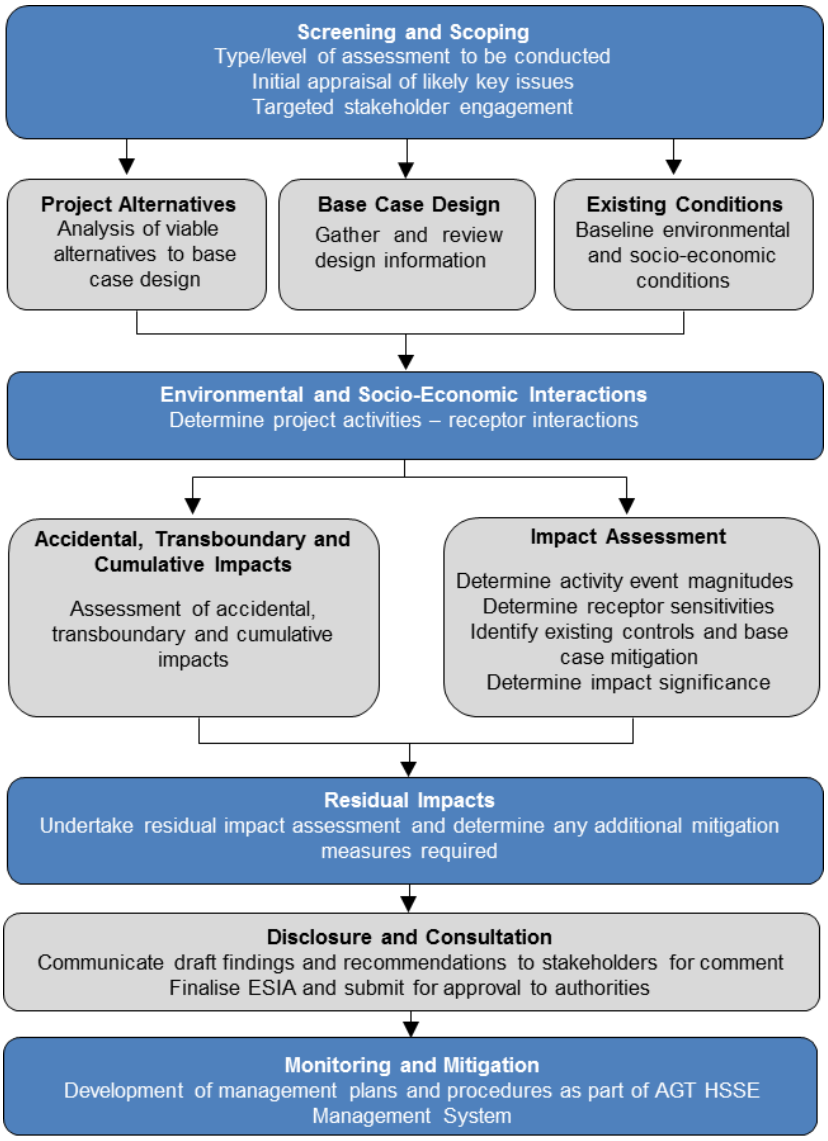
This Chapter presents a description of the Environmental and Socio-Economic Impact Assessment (ESIA) process adopted for the Project and the methodology used to assess impact significance.

3.2 ESIA Process

The ESIA process constitutes a systematic approach to the evaluation of a project and its associated activities throughout the project lifecycle. The process (refer to Figure 3.1) includes:

- Screening and Scoping;
- Project Alternatives and Base Case Design;
- Existing Environmental and Socio-Economic Conditions;
- Impact Assessment;
- Residual Impact Identification;
- Disclosure and Stakeholder Consultation; and
- Monitoring and Mitigation.

Figure 3.1: The ESIA Process



3.2.1 Screening and Scoping

Screening is the first step in the assessment process. It confirms the need (or otherwise) for an ESIA by appraising the type of project and its associated activities throughout the project lifecycle in the context of its biophysical, socio-economic, policy and regulatory environments.

The ESIA developed for the SWAP Exploration Drilling Project takes into consideration of the proposed Project location, scope of the project and anticipated project activities as well as applicable national and international legislation and SWAP Production Sharing Agreement (PSA) as detailed in Chapter 2: Policy, Regulatory and Administrative Framework. This is consistent with the approach taken for exploration drilling projects completed in the Azeri Chirag Gunashli (ACG) and Shah Deniz (SD) Contract Areas.

The approach and the scope of the ESIA was agreed with the Ministry of Ecology and Natural Resources (MENR) at a scoping meeting held in January 2019. Key issues raised by the MENR, which have subsequently been addressed within the ESIA, include the requirement to:

- Include information regarding geotechnical and geohazard surveys in support of the well location selection;
- Consider the drilling programme schedule such as to avoid potential impacts to migrating Caspian seals and birds in the vicinity of the Project;
- Include information on the generated waste forecast including waste streams and likely volumes; and
- Consider the physical impact and disturbance to the seabed from the exploration drilling activities.

Scoping is a high level assessment of anticipated **interactions** between **project activities** and **environmental and socio-economic receptors**[9]. Its purpose is to focus the assessment on key issues and eliminate certain activities from the full impact assessment process based on their limited potential to result in discernible impacts. To arrive at a conclusion to 'scope out' an activity/event, a mixture of expert scientific judgement based on prior experience of similar activities and events and, in some instances, scoping level quantification/numerical analysis (e.g. emission and discharge modelling) is used.

The SWAP Exploration Drilling Project Scoping process has included:

- The review of available environmental and socio-economic data and reports relevant to the area potentially affected by the SWAP Exploration Drilling Project activities;
- Primary and secondary environmental and social baseline data collected during the SWAP Exploration Drilling Project ESIA process; and
- Liaison with the SWAP Exploration Drilling Project Team to gather data and to formulate an understanding of project activities.

Based on the findings of the review and data gathering, the SWAP Exploration Drilling Project ESIA Team identified potential project related environmental and socio-economic impacts based on likely interactions between the proposed Project activities and environmental/socio-economic receptors. In addition, the Team identified gaps where the extent, depth and/or quality of available environmental, socio-economic and/or technical data at the scoping stage was insufficient for the SWAP Exploration Drilling Project ESIA process.

[9] For the purpose of this assessment, a receptor is considered a component of the existing biophysical and social environment (i.e. air, water, land, sediments, habitats, commercial fishing, etc.) that is affected by or interacts with the project activities.

3.2.2 Impact Significance Assessment

An **impact**, as defined by the international standard ISO14001:2015 is:

"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects".

Where an **environmental aspect** is defined as:

"Element of an organisation's activities or products or services that can interact with the environment".

An impact is defined where an interaction occurs between a project activity and an environmental receptor. The ESIA process ranks impacts according to their **significance** determined by considering project activity **event magnitude** and **receptor sensitivity**. Determining event magnitude requires the identification and quantification (as far as practical) of the sources of potential environmental and socio-economic effects from routine and non-routine project activities. Determining receptor sensitivity requires an understanding of the biophysical and human environment.

The approach to evaluating the significance of potential environmental and socio-economic impacts is set out in the sections below. Impacts can be positive or negative depending on whether they result in a beneficial or adverse change when compared to baseline conditions.

The sections below set out the methodology for both environmental and socio-economic impact assessment.

3.2.3 Environmental Impacts

3.2.3.1 Method for Determining Event Magnitude

Event magnitude is determined based on the following parameters, which are equally weighted and are each assigned a rating of 1, 2, or 3:

- **Extent / Scale**: Events range from those where the effect extends across an area:

  1 – Near to the source (e.g. in the range tens to hundreds of metres); to

  2 – At intermediate distance from the source (e.g. in the range hundreds to thousands of metres); to

  3 – At far distance from the source (e.g. in the range thousands of metres and above).

- **Frequency**: Events range from those occurring:

  1 – Once or twice; to

  2 - Repeatedly but intermittently (e.g. 10 to 20 times); to

  3 – Frequently and persistently (e.g. more than 20 times).

- **Duration**: Events range from those where effects occur over:

  1 – Instantaneous/short term (e.g. hours to days); to

  2 - Medium term (e.g. between a week and 3 months); to

  3 - Long term (e.g. more than 3 months to permanent).

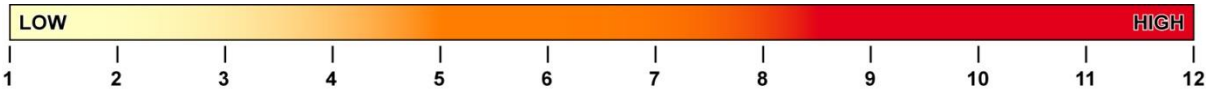
- **Intensity**: Concentration[10] of an emission or discharge with respect to standards of acceptability that include applicable legislation and international guidance, its toxicity or potential for bioaccumulation, and its likely persistence in the environment. Degree/permanence of disturbance or physical impact. Ranges from:

  1 - A low intensity event; to

  2 - A moderate intensity event; to

  3 - A high intensity event.

Overall, event magnitude is scored from low (1) to high (12) by adding the individual parameter scores:



Resulting individual ratings are summed to give the overall event magnitude ranking. Table 3.1 presents the score ranges for magnitude rankings of Low, Medium and High.

Table 3-1: Event Magnitude Rankings

Event Magnitude	Score (Summed Parameter Rankings)
Low	4
Medium	5-8
High	9-12

3.2.3.2 Method for Determining Receptor Sensitivity

Receptor sensitivity considers the type of receptor (namely, biological/ecological, human and physical receptor/feature); and is determined based on the following parameters, which are equally weighted and are each assigned a rating of 1, 2, or 3:

- Biological/Ecological Receptors:

  Presence ranges from:

  3 – Internationally threatened species[11]/protected area within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and during routine or reliably predictable peak presence; to

  2 - Internationally threatened species[4]/protected area within the area impacted by the project activities outside of period of high sensitivity or during routine or reliably predictable peak presence.

  Internationally near threatened species[12] within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and/or during routine or reliably predictable peak presence.

[10] In the case of underwater sound this parameter relates to peak sound pressure level or sound energy level depending on the criteria selected.
[11] IUCN Red List Classification of Critically Endangered, Endangered or Vulnerable
[12] IUCN Red List Classification of Near Threatened

Nationally protected species and/or species which are of importance to the local and regional ecosystem within the area impacted by the project activities.

1 - Presence of species which is none of the above.

Resilience (to the identified stressor) ranges from:

3 - Species which has little or no capacity to absorb or adapt to change (i.e. little or no capacity to move away from or adapt to the project impact), leading to potential for substantial change of character and/or loss of ecological functionality or population effects.

2 - Species and/or population which has moderate capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact), leading to potential temporary but sustainable effect which does not substantially alter character or result in significant loss of ecological functionality.

1 - Species and/or population has high capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact), and is potentially unaffected or marginally affected.

- Human Receptors:

Presence ranges from:

3 - People being permanently present (e.g. residential property) within the area impacted by Project activities; to

2 - People being present some of the time (e.g. commercial property); to

1 - People being uncommon in the geographical area of anticipated impact.

Resilience (to the identified stressor) ranges from:

3 - Most vulnerable groups (i.e. ambient conditions such as air quality are at or above adopted standards); to

2 - People being vulnerable to change or disturbance (i.e. ambient conditions such as air quality are below adopted standards); to

1 - People being least vulnerable to change or disturbance (i.e. ambient conditions such as air quality are well below applicable legislation and international guidance).

Overall, receptor sensitivity is then scored on a scale from low (1) to high (6) by adding the individual parameter scores:

Table 3.2 presents the score ranges for sensitivity rankings of Low, Medium and High.

Table 3-2: Receptor Sensitivity Rankings

Receptor Sensitivity	Score (Summed Parameter Rankings)
Low	2
Medium	3-4
High	5-6

3.2.4 Socio- Economic Impacts

The socio-economic impact assessment methodology uses a semi-qualitative assessment approach to describe and evaluate potential impacts based on the event magnitude and receptor sensitivity rankings set out in Tables 3.3 and 3.4 respectively.

Indirect socio-economic impacts (i.e. induced effects) are assessed using a similar approach.

Table 3-3: Event Magnitude Rankings

Magnitude	Criteria
Low	Changes in social, economic or cultural dynamics with slight and temporary effect on any given sector performance and/ or population wellbeing. These impacts are unlikely to result in concerns being raised by governmental bodies or stakeholders.
Medium	Changes in social, economic or cultural dynamics with moderate and noticeable adverse effect on any given sector performance and/or population wellbeing. Such impact may result in concerns being raised by governmental bodies or stakeholders.
High	Changes in social, economic or cultural dynamics with major adverse effect on any given sector performance and/or population wellbeing. Such impacts may result in immediate intervention by governmental bodies and stakeholders.

Table 3-4: Receptor Sensitivity Ranking

Sensitivity	Criteria
Low	Receptor sensitivity is considered low when there is a moderate to high capacity and means to adapt to a given change and maintain / improve quality of life.
Medium	Receptor sensitivity is considered medium when there is limited capacity and means to adapt to a given change and maintain / improve quality of life.
High	Receptor sensitivity is considered high in the case of vulnerable receptors, who have little capacity and means to adapt to a given change and maintain / improve quality of life

3.2.5 Environmental and Socio-Economic Impact Significance

For both environmental and socio-economic impacts, impact significance, as a function of event magnitude and receptor sensitivity, is ranked as **Negligible**, **Minor**, **Moderate** or **Major** as presented in Table 3.5.

Table 3-5: Impact Significance

		Receptor Sensitivity		
		Low	Medium	High
Event Magnitude	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Any impact classified as **Major** is considered to be significant and, where the impact is **negative**, requires additional mitigation. Impacts of **Negligible**, **Minor** or **Moderate** significance are considered as being mitigated as far as practicable and necessary, and therefore, do not require further mitigation.

3.3 Transboundary and Cumulative Impacts and Accidental Events

In addition to assessing impacts associated with the routine SWAP Exploration Drilling Project activities the following will also be assessed:

- **Impacts from Accidental Events:** Impacts that arise as a result of a technical failure, human error or as a result of natural phenomena such as a seismic event;
- **Transboundary Impacts:** Defined as impacts that occur outside the jurisdictional borders of a project's host country; and
- **Cumulative Impacts:** While an impact may be relatively small when considering the project or activity on its own, it may be magnified in combination with impacts from other projects and activities; these combined effects are known as 'cumulative' impacts.

Cumulative impacts may arise from the following:

- Interactions between separate project-related residual impacts; and
- Interactions between project-related residual impacts in combination with impacts from other projects and their associated activities within the same area of influence.

These can be either additive or synergistic effects, which result in a larger (in terms of extent or duration) or different (dependent on impact interaction) impacts when compared to project-related residual impacts alone.

The steps taken to undertake the cumulative impact assessment presented in Chapter 7 comprise the following:

1. Identify other known projects and activities within the vicinity of the SWAP Exploration Drilling Project where there is potential for cumulative impacts;
2. Define the spatial (i.e. impacts are so close in space that their effects overlap) and temporal (i.e. impacts are so close in time that the effect of one is not dissipated before the next one occurs) scope of the assessment;
3. Assess potential cumulative impacts to the environmental and socio-economic receptors potentially affected by the SWAP Exploration Drilling Project and the cumulative projects identified; and
4. Where required, define measures to avoid, reduce, or mitigate any potentially significant cumulative impacts to the extent possible.

Where there is potential for impact interaction, and the Project is sufficiently defined and sufficient data is available, a quantitative assessment will be undertaken. Where insufficient data is available, a qualitative assessment is presented (refer to Chapter 7).

3.4 Mitigation and Monitoring

The iterative and integrated nature of the ESIA and project planning processes means that the majority of proposed mitigation measures and strategies have been incorporated into the project and integrated into the Base Case design of the proposed exploration programme**.** These measures / strategies have included mitigation measures and ongoing commitments as previously adopted by other BP projects (including other exploration projects) in the Azerbaijan, Georgia and Turkey (AGT) Region.

The ESIA Report will be submitted for review and comment to the MENR who will have an opportunity to make comments on the findings, including suggestions for additional mitigation measures to those already committed to in this ESIA associated with the NKX01 exploration drilling activities. If deemed appropriate, such mitigation measures will be added to the proposed exploration programme design and/or management programme.

3.5 ESIA Disclosure and Finalisation

The Draft Final ESIA Report will be disclosed in compliance with Azerbaijani law enabling project stakeholders to review and comment on identified impacts and the assessment of those impacts,

ensuring that appropriate weighting has been given to local priorities and concerns where appropriate. Stakeholders and communities will have the opportunity to assess whether proposed impact mitigation and management strategies adequately achieve these objectives; respond to local needs; are culturally appropriate and technically viable.

Feedback received during this disclosure phase will inform the development of the Final ESIA Report, which will then be submitted for final approval. In the event that no comments are received the disclosed ESIA Report will be considered the final version.

4 Project Description

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4.1 Introduction

This Chapter of the Environmental and Socio-Economic Impact Assessment (ESIA) describes the activities associated with proposed exploration drilling, provides a summary of emissions and discharges expected to be generated by the Project activities, an overview of the alternative Project options assessed during the design phase of the project and the basis for the environmental and socio-economic impact assessment as presented in Chapter 6: Impact Assessment.

It is planned to drill a single exploration well located approximately 15km from the Azerbaijan mainland in a water depth of approximately 22m within the North East Prospective Area of the SWAP Contract Area, as shown in Figure 1.1, Chapter 1. The purpose of drilling the exploration well is to confirm the potential presence of hydrocarbon resources at the North East Prospective Area for future field development.

4.2 Options Assessed

A number of conceptual options were analysed for technical and commercial feasibility during the development stage of the Project. The following concepts were appraised for the Project exploration well drilling programme:

- **Steel Jacket** – the option of installing a permanent or semi-permanent drilling rig based on a steel jacket construction at the Project location was assessed by the Project Team. It was concluded that this was not a feasible option in particular if the NKX01 drilling shows further exploration, and potentially production, is not viable in this location. Decommissioning of a permanent or semi-permanent drilling rig would be a long and large scale process which would require the operation of a large number of vessels, producing significant volume of additional waste materials. The option is also not attractive given the volume of materials and associated impacts associated with constructing and installing the jacket.
- **Artificial Island** – the option of building an artificial island at the Project location upon which an onshore drilling rig would be positioned was assessed by the Project Team. This option was not considered feasible for several reasons. Firstly, due to the water depth (approximately 22 m), which would require the movement and positioning of a significant volume of material. Secondly, due to the water depths, a pyramid like structure would be required to be formed to achieve the necessary slope angles with the structure occupying a large footprint on the seabed. The island option would also require large volume of rock material and would create a permanent structure. This option was rejected.
- **Jack-up drilling rig** – the option of using a jack-up drilling rig at the Project location was assessed by the Project Team. The depth of the water is considered suitable and the use of a jack-up rig, a temporary structure with a small footprint on the seabed, would limit the impact to the environment particularly once the Project is complete and the jack up rig is de-mobilised.

The decision was taken by the Project Team to use a jack up rig for the Project.

4.3 Drilling Programme

As shown in Figure 4.1, drilling of the NKX01 exploration well, planned to commence in Q1 2021, is expected to be completed over a duration of approximately three months. An additional one month is scheduled for the drilling of an appraisal sidetrack well, which will be drilled if certain objectives are met following the successful completion of the drilling of the NKX01 well. The base case assumes that drilling activities will commence in January 2021 however, for contingency, should there be any delay for logistical or operational reasons, and based on prior experience and best estimates, a delay of up to 2 months may occur.

In the event that problems are encountered while drilling the surface hole the well may be re-drilled within 50m of the original seabed location.

Figure 4.1 NKX01 Exploration Well Drilling Schedule (Base Case)

Project Activity	2020	2021				
	Dec	Jan	Feb	Mar	Apr	May
Mobilisation of Jack Up Rig						
NKX-1 Drilling						
Drilling of sidetrack *optional*						

4.4 Jack-up Rig Activities

It is planned that the Project exploration well will be drilled using a jack-up rig. If required, an appraisal sidetrack will be drilled and tests completed to expand the reservoir information obtained from the primary wellbore.

There will be no well testing activities conducted at the well location. It is not anticipated the jack-up rig will require major modifications prior to start of the drilling activities.

4.5 Logistics and Material Supply

Preference will be given to source equipment and materials which meet the required Project specifications from Azerbaijan wherever possible. Where international procurement is required, materials and equipment will arrive by road, rail, sea and air using established transportation routes. The vessels used to support the drilling activities are expected to be provided from the existing fleet available in the Caspian Sea.

All supplies required during the drilling activities at the NKX01 location will be transported from the existing BP Supply Base with drilling fluids provided from the Advanced Fluids Facilities (AFF).

4.5.1 Jack-Up Rig Positioning

The jack-up rig be towed to the Project location using three tugboats. The hull of the rig is a triangular structure and each tugboat will be attached to one of the three corners of the hull to manoeuvre the rig into position. When the jack-up rig is in position, the legs will be lowered down with "spud cans"[13] contacting with the seafloor. Once the legs are firm and stabile on the seabed the jacking procedure will continue and the hull will be raised out of the water until the base is elevated approximately 20m above the sea surface.

The mobilisation, positioning and set up of the jack-up rig is expected to take up to four days and a further four days to demobilise the rig at the end of the drilling programme. A mandatory 500 m exclusion zone (for non-project related vessels) will be established around the rig while drilling is in progress.

4.5.2 Logistics and Utilities

In addition to the jack-up rig, vessels will be required throughout drilling programme to supply consumables such as drilling mud and fuel to the jack-up rig, ship solid and liquid waste to shore for treatment and disposal as well as carry out crew change operations. Table 4.1 provides an estimate of the number and function of the vessels that will support the drilling activities.

Estimated volumes of waste and greenhouse gas (GHG) and non GHG atmospheric emissions generated during the drilling programme are summarised within Section 4.10 below.

[13] Spud cans are the base cone of the jack-up platform leg and provide stability for the rig on the seabed.

Table 4-1: Jack-Up Rig and Support Vessels

Vessel/Rig/Helicopter	#	Duration/ Frequency of Use	Function	Maximum Persons on Board	Average Fuel Consumption (tonnes/day)
Jack-Up Rig	1	120 days	Drilling of NKX01 (90 days) and the appraisal sidetrack (30 days) (assuming this is completed)	120	16
Support during drilling (cargo vessels)	3	One vessel per day	• Supply drilling mud, diesel and other consumables to the drilling rig. • Ship solid and liquid wastes (including drill cuttings) to shore for treatment/disposal.	18 (vessel crew)	10 (per vessel)
Helicopter	1	3 trips per week	Personnel transfer	21	0.6 (per flight)
Tug Supply	3	4 days	Tow out and position the jack-up rig	18 (vessel crew)	25 (per vessel)
		4 days	Demobilise the jack-up rig		
Standby vessel	1	120 days	Standby vessel during the drilling programme	15 (vessel crew)	10 (per vessel)

Tables 4.2 and 4.3 summarises the key characteristics of the jack-up rig and support vessel utilities.

Table 4-2: Summary of the Jack-Up Rig Utilities

Utility/Support Activity	Description
Power Generation	• Main Power 5 x Caterpillar 3516C (3125 kVA each) • Emergency Power 1 x Caterpillar 3516 C (3125 kVA)
Black and Grey Water	• Grey water and treated black water will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. • Sewage sludge will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.
Galley Waste	• Galley waste will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.
Seawater / Cooling System	• Seawater will be used onboard the jack-up rig within the engine and compressor systems for cooling. • Three seawater lift pumps will be operated onboard of the jack-up rig to support rig's firefighting and water maker systems. • Cooling system will discharge seawater up to 180m^3/hr via a flexible hose approximately 5m below sea level.
Fresh Water	• Fresh water will be supplied from shore by supply vessels and stored onboard for use.
Drainage	• Rig floor runoff, including WBM spills, collected via rig floor drains will be recycled to mud system with no discharge of drill cuttings or drilling fluids. • Non oily drainage (deck drainage and wash water) may be discharged to sea as long as no visible sheen is observable. • In the event of a spill, main jack-up rig deck drainage will be diverted to hazardous drainage tank for spills including synthetic oil based mud (SOBM) / low toxicity material oil based mud (LTMOBM), oil/diesel/cement and oily water. Contents of hazardous waste tank will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. • Onboard the jack-up rig, waste oil collected from the drainage system and returned to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Table 4-3: Summary of Support Vessel Utilities

Utility/Support Activity	Description
Black and Grey Water	• Grey water will either be sent to the vessel sewage treatment plant with black water or discharged directly to sea without treatment as long as no floating matter or visible sheen is observed. • Under routine conditions black water will be treated within the sewage treatment system to: - MARPOL 73/78 Annex IV: Prevention of Pollution by Sewage from Ships standards. No chlorination of the effluent will be required under routine conditions, however when chlorine is used for disinfectant purposes, it is planned to maintain the concentration of residual chlorine in the effluent below 0.5mg/l and discharge to sea. In the event it is not practicable to achieve this concentration, the effluent will be contained and shipped to shore. • When vessels' sewage treatment system is not available black water will be shipped to shore managed in accordance with the existing BP AGT Region plans and procedures. Sewage sludge will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.
Galley Waste	Depending on the availability of the vessel system, galley food waste will either be: • Sent to vessel maceration units designed to treat food wastes to applicable MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships particle size standards prior to discharge[14]; or • Contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.
Fresh Water	• Fresh water will be supplied from shore by supply vessels and stored onboard for use.
Drainage	• Oily and non-oily drainage and wash water will be segregated. • Non oily drainage (deck drainage and wash water) may be discharged to sea as long as no visible sheen is observable. • Oily water will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Consumables such as drilling mud and diesel will be provided to the jack-up rig by vessels from the existing onshore facilities previously used during Azeri, Chirag and Gunashli (ACG) and Shah Deniz (SD) pre-drilling programmes and which also supply the operational ACG and SD platforms.

4.6 Drilling Operations and Discharges

Jack-up rig activities will include:

- Preparation of the drilling equipment;
- Installation of conductor;
- Drilling and installation of subsequent well sections and casing strings;
- Drilling of one appraisal sidetrack (if required); and
- Installing and cementing casings.

4.6.1 Well Design and Drilling Fluid Types

All well-bore sections will be drilled using drilling fluids/drilling muds, the primary role of which is to:

- Maintain down-hole pressure to prevent formation fluids entering the well-bore;
- Remove drill cuttings generated by the drill bit as it bores through the rock strata and transport these to the surface;
- Lubricate and provide cooling to the drill bit and the drill string; and
- Seal the wall of the well-bore in order to provide.

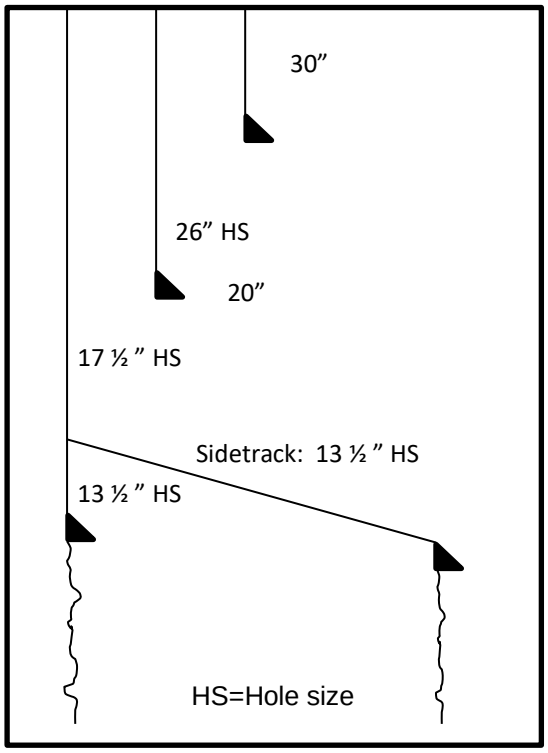
The proposed well design is presented in Table 4.4 and illustrated in Figure 4.2.

[14] Designed to produce a slurry of food particles and water that washes easily through the required 25 mm screen

Table 4-4: NKX01 Exploration Well Design

Hole Size (in)	Casing Size (in)	Section Length (MD) (m)	Drilling Mud System	Disposal Route of Drilling Muds/Cuttings
NKX01 Exploration Well				
30	30	100	WBM	Mud and cuttings will be returned to the jack-up rig, contained and shipped to shore for disposal.
26	20	650	SOBM/LTMOBM	
17 ½	$13^3/_8$	810		
13 ½	n/a	824		
NKX01 – Appraisal Sidetrack (if required)				
13½	n/a	861	SOBM/LTMOBM	Mud and cuttings will be returned to the jack-up rig, contained and shipped to shore for disposal.
Note: Within the final well design, the lowest 13 ½ " hole size may be replaced with a smaller 12 ¼ " hole size; the decision will be made following further engineering analysis and prior to drilling commencing.				

Figure 4.2 Generic Casing Design



4.6.2 Drilling String Lubrication

Prior to the start of any drilling activities, the jack-up rig crew will apply pipe dope to the internal surfaces of the drilling string joints to prevent thread damage. Pipe dope is lubricating grease which prevents the joints from becoming stuck together under high torque conditions. It is anticipated that heavy metal free dope will be used for this purpose. Drilling of the well sections will be carried out using closed loop system and therefore it is not anticipated that pipe dope will be discharged to sea during these activities.

4.6.3 Drilling Fluids and Cutting Generation

Drilling mud required for the Project will be routinely prepared on shore and supplied to the jack-up rig via hose connections from the supply vessels. Measures to avoid discharges to the marine environment during mud transfers include:

- Appropriate design of the mud pumping system and connections between the jack-up rig and supply vessels;
- Preventative maintenance of transfer equipment;
- Appropriate procedures will be used; and
- Conduct appropriate training/ awareness sessions for the relevant personnel, where required.

Mud will be transferred from the supply vessel to the jack-up rig as required by drilling operations i.e. per hole section. Properties of the mud used for each specific hole section will be different. Once the mud is used in the hole section it becomes part of a closed system being continually circulated from the surface to the bottom of the hole and back to surface until the hole section has been drilled to the target depth.

When drilling the larger hole sections, the cuttings returned to the rig with the mud will be removed from the drilling fluid by the solids control system on the jack-up rig. The recovered cuttings will be transferred from the solids control system to one of the four International Standards Organisation (ISO) tanks located onboard the rig. Once the ISO tank(s) are full, they will be transferred to a supply vessel positioned alongside the rig. Supply vessels will have large drill cuttings boxes (LDCBs) available onboard to store drill cuttings with approximate total capacity of 16 tonnes.

When drilling the smaller diameter and shorter hole sections, the solids control system will also be used to separate the returned mud and cuttings with the cuttings sent to one of four small drill cuttings boxes (SDCBs) located onboard the rig. When each SDCB is full, it will be moved to a supply vessel positioned alongside the rig and replaced by an empty SDCB onboard the rig.

Used and separated mud will be backloaded to a supply vessel via the rig's bulk mud system. Once mud has been transferred to the dedicated mud tanks onboard the supply vessel it will be transported to shore for disposal in accordance with existing BP AGT Region waste management plans and procedures.

4.6.3.1 Conductor Section

Installation of the 30" conductor will be carried out using a drive and drill system. This system comprise a mechanical device installed on the rig that provides downward hammer movements to drive the conductor pipe deep into the seabed. Hammer movements will be repeated until the conductor will not travel further into the seabed through hammering (i.e. driven to refusal). At this point, the depth of the hole will be increased by drilling from the rig prior to undertaking further driving of the conductor section by hammering until the conductor shoe has reached the planned depth.

WBM will be used during 30" conductor drive and drill operations; drill cuttings will be circulated back to the rig by a closed loop system. The mud and cuttings will be separated as described in Section 4.6.3 above, contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. Should a blockage of the drilling system occur during drive and drill operations, remaining cuttings and muds will be transferred to the cuttings bucket and no discharges to the marine environment are anticipated. Table 4.5 presents a summary of the total expected chemical composition of the conductor section drilling fluids to be used.

Table 4-5: Estimated Use of WBM Drilling Chemicals – 30" Conductor Section

Chemical	Trade Name	Function	Estimated Use (tonnes)[1]	Hazard Category[2]
Barite	Barite	Weighting Agent	70	E
Bentonite	Bentonite	Viscosifier	25	E
Soda Ash	Soda Ash	Alkalinity Control	1	E
Poly Anionic Cellulose	Polypac UL	Water soluble polymer designed to control fluid loss	2	E
Xanthan Gum	Duovis	Viscosfier	1	E
Nut Shells	Nut Plug	Loss Control Materials (LCM)/Pipe scouring	0.7	E
Magnesium oxide	Magnesium oxide	pH control	5	E

Notes:
1. Volumes will depend on the actual subsurface conditions encountered as such these volumes are best estimates based on previous experience.
2. Two methods of hazard assessment are used in accordance with internationally recognised practice - CHARM and Non CHARM. The CHARM Model is used to calculate the ratio of predicted exposure concentration against no effect concentration (PEC:NEC) and is expressed as a Hazard Quotient. Hazard Quotients are assigned to 1 of 6 categories and "GOLD" is the least hazardous category. Those chemicals that cannot be modelled by CHARM are assigned to a category (A to E) based on toxicity assessment, biodegradation and bioaccumulation potential. Category E is the least harmful category. Source: CEFAS, Offshore Chemical Notification Scheme - Ranked Lists of Notified Chemicals, Updated September 2018.

4.6.3.2 Lower Hole Sections

To improve well bore stability, ensure appropriate lubrication, optimise compatibility with deeper well formations and minimise the risk of stuck pipe, either a synthetic oil based mud (SOBM) or a low toxicity mineral oil based mud (LTMOBM) will be used for the 26", 17½" and 13½" hole sections. The density of the drilling mud system will be monitored and adjusted by the addition of chemicals according to the down-hole conditions. The density and chemical composition of the SOBM/LTMOBM will be dependent on the actual well conditions encountered during drilling operations.

Muds and cuttings from the lower hole sections will be returned to the jack-up rig, separated as described in Section 4.6.3 above, contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. Table 4.6 presents the expected composition of the lower hole section drilling chemicals and the estimated use for the NKX01 well.

Table 4-6: Estimated Use of SOBM/LTMOBM Drilling Chemicals - Lower Hole Sections

Chemical	Trade Name	Function	Estimated Use (tonnes)[1]	Hazard Category[2]
Barite	Barium sulphate ore	Weighting agent	700	E
Calcium Chloride	Calcium chloride	Borehole stabiliser	75	E
Ecotrol	Polymer	Fluid loss control and reduces the risk of drill string sticking	2.5	E
Lime	Calcium hydroxide	Alkalinity, calcium ion treatment	10	E
Suremul EH	Emulsifier	Emulsifier	35	C
Surewet	Surfactant	Wetting agent for drill solids and barite	6	D
Rheflat Plus	Alkenes/Fatty Acid	Rheology modifier	0.2	D
Rhethik	Oxybisethanol/ Diethylenetriamine	Viscosifier	4	*
Rhebuild	Propylene arbonate	Temporary viscosity agent	0.1	C
Escaid 110 base oil	Base Oil	Mineral Oil base fluid	600	D
Versatrol M	Gilsonite/Lignite	Fluid Loss Additive	18	D
VG Plus/VG Supreme	Organophyllic Clay	Viscosifier/ removal of cuttings	22	E
G-Seal Plus	Graphite	Lost circulation/ seepage control	16	E
Durcal-130	Calcium Carbonate	Lost circulation/ seepage control	16	E
Walnut	Nut Shells	Lost circulation/ seepage control	5	E
Safe-Carb	Calcium Carbonate	Lost circulation/ seepage control	20	E
Notes as per Table 4.5. * Not currently listed into UK Offshore Chemical Notification Scheme (OCNS) Ranked Lists of Notified				

4.6.4 Summary of Mud and Cuttings

Table 4.7 presents the estimated quantities of waste drilling fluids and cuttings for each well hole section (based on the experience of the project engineers and the diameter and length of each well section) and the planned disposal route.

Table 4-7: Estimated Well Cuttings and Mud Volumes Per Hole Section

Hole Size (Drill Bit Diameter)	Description	Estimated Quantity of Cuttings (tonnes)	Estimated Quantity of Waste Drilling Fluids (tonnes)[1]	Drilling Fluid/ Mud System	Cuttings and Mud Disposal
NKX01 Exploration Well					Muds and cuttings will be returned to the jack-up rig, contained and shipped to shore for disposal.
30"	30" conductor	300	50	WBM	
26"	20" casing	517	160	SOBM/LTMOBM	
17 ½"	13 3/8" casing	250	187		
13 ½"	-	198	346		
NKX01 Appraisal Sidetrack					
13 ½" on ST	n/a	206	360	SOBM/LTMOBM	
Notes: 1. The WBM chemical usage includes water. Currently WBM is not stored for reuse. Untreated WBM is not stable over extended periods without additions of viscosifier and biocide. 2. Note that estimates of WBM waste is not equivalent to the estimated volumes of chemical used as per Table 4.6. This is because allowance is made for mud volumes left behind in casings. 3. Estimated volume of SOBM/ LTMOBM shipped to shore is conservative as it excludes mud volumes left behind in the well following casing, attached to the cuttings shipped to shore and the SOBM/ LTMOBM returned to shore for reuse on subsequent wells. 4. 8½ in hole section will not be cased (the well is for data gathering purposes only), section length will be will be 300m					

4.6.5 Casing and Cementing

Once a well section has been drilled, a steel casing string will be installed and cemented into place. The casing provides structural strength for the well, protecting it from weak or unstable formations and is cemented into place by pumping cement slurry into the well bore.

The cement passes around the open lower end of the casing and into the annulus between the casings outer wall and the host rock formation. This is true for all casing strings except 30" conductor, which will be driven into the soil rather than being cemented. Any excess cement generated during the cementing activities will be circulated out from the well and returned to the jack-up rig and contained in the Drill Cutting Boxes (DCB) for transportation to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. At the end of cementing of each casing string excess cement will remain in the jack-up rig cement unit and will be mixed with seawater to wash it out. The cement unit will be surrounded with barriers so cement will be contained and transferred to the DCBs on-board the jack-up rig for transportation to shore. There will be no planned discharge to the marine environment associated with cement or cement unit wash out.

The volume of cement used to cement each casing is calculated prior to the start of the activity. Sufficient cement is used to ensure that the casing is cemented securely, and necessary formations are isolated. The estimated volumes of each cement chemical, and the associated hazard categories, are presented in Appendix 4C along with volumes associated with a potential cement system equipment commissioning mix trial and abandonment plugs as described in Section 4.10.

4.6.6 Drilling Hazards and Contingency Chemicals

A number of contingency chemicals will be retained for use in the event that hazards predominantly associated with downhole mud losses are encountered during drilling. Losses are the events of losing the fluid from the wellbore into the formation due to number of factors, such as lower than anticipated rock strength, faults, natural fractured zones, etc. To prevent this, Loss Control Materials (LCM) can be added to the mud system.

Table 4.8 lists the estimated chemicals intended to be stored on the jack-up rig and used in the event of contingencies when drilling with SOBM/LTMOBM. By definition, the use of contingency chemicals cannot be predicted with accuracy, however, their use will be minimised to the lowest practicable extent in accordance with operational needs. Along with SOBM/LTMOBM and cuttings, unused contingency chemicals remaining in the mud system will be returned to the jack-up rig and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. There will be no planned discharges of contingency chemicals to the marine environment.

Table 4-8: Estimated Usage of Drilling Contingency Chemicals

Chemical	Function	Estimated use (tonnes)[1]	Hazard Category[2]
G-Seal	Stress cage application	13	E
Durcal 130	Stress cage application	13	E
Safecarb	Stress cage application	14	E
Safecarb	Stress cage application	14	E
Starcarb	Calcium carbonate – LCM	2	E
NutSHELL	LCM /Cement scouring pill	2	E
M-I-X II	LCM FIBER	4	E
Notes as per Table 4.5			

4.7 Well Displacement

Displacement of the well will be achieved by circulating a number of fluid slugs or "pills". The function of the displacement pills (lighter synthetic mud sweeps) is to displace any drilling fluids. Table 4.9 details the chemicals and fluids planned to be stored on the rig and used for well displacement.

Table 4-9: Estimated Well Displacement Chemicals

Chemical/Fluid	Function	Estimated Use (tonnes)[1]	Hazard Category[2]
Brine	Weighted circulation fluid	12.5	N/A
SAFE-VIS LE (@7ppb)	Viscosifier	0.2	E
Deepcelan	Surfactant	0.9	GOLD
Transition Pill			
Brine	Weighted circulation fluid	35	N/A
Drill water	Circulation fluid	6	N/A
SAFE-VIS LE (@7ppb)	Viscosifier	0.8	E
FLOVIS PLUS	Viscosifier	0.1	GOLD
Wash Pill			
Brine	Weighted circulation fluid	22	N/A
Deepclean	Detergent	4	D
Tail Spacer			
Brine	Weighted circulation fluid	7	N/A
Drill water	Circulation fluid	4	N/A
FLOVIS PLUS	Viscosifier	0.05	GOLD
Notes as per Table 4.5			

It is planned that displacement chemicals will be circulated back to the jack-up rig with the drilling fluids and will be reused/recycled. It is not planned to discharge displacement chemicals or fluids to the marine environment under routine conditions. Solids collected within the jack-up rig separator during well displacement will be collected and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

4.8 Blow Out Preventer (BOP)

A Surface Blow Out Preventer (BOP), known as a Dry BOP, will be located on the jack-up rig and will be installed on the well after the 20" casing has been cemented into place to control well pressure. The BOP control system will use hydraulic fluids in a closed loop system to actuate the BOP valves. There will be no planned discharges to the marine environment from the operation of the BOP valves.

4.9 Well Logging

A number of well logging activities will be undertaken during the drilling of the exploration well, including:

- Mud logging;
- Monitoring of well bore parameters;
- Wireline logging to obtain information on the physical properties of the formations, pressures and fluids by means of sensors deployed on logging tools;
- Logging while drilling (LWD) to obtain information on the physical properties of the rock formations and fluids by means of sensor gauges on specially adapted drill collars; and
- VSP (Vertical Seismic Profile) logging for correlation with surface seismic data. VSP measurements will be done using geophones inside the wellbore and a source (air gun) at the surface near the well.

With regard to VSP, two activities are planned:

- Shallow section VSP to be undertaken during the casing of the 20” hole section. This will allow real-time updates to inform the geological projection; and
- Conventional VSP to be undertaken following the completion of all drilling activities to provide seismic well data for potential future field development.

Based on the base case schedule it is planned that shallow VSP will be performed between January and February 2021. Conventional VSP will be undertaken only in the event the well Is successful and would be undertaken towards the end of the drilling schedule.

For both VSP events, it is anticipated that the VSP will comprise one source with four guns (likely to be 2,000 psi pressure airguns) with a total cluster volume of up to 500 cubic inches and zero to peak amplitude of 1.01 MPa. The sources will be hung over the side of the jack-up rig and suspended from

one of the cranes in a single position at approximately 5m below the surface of the water. The airguns will be fired simultaneously. The total duration of the VSP survey is anticipated to last up to a maximum of 16 hours, however data acquisition is likely to be over a period of 6–8 hours. As soon as the VSP survey is complete the sound source will cease operating. The existing control measures incorporated into the Project design to be implemented prior to and during VSP activities assuming both the base case project schedule and assuming a potential delay of up to 2 months are provided within Chapter 6 Section 6.4.1.

4.10 Well Abandonment

Following drilling, casing, cementing and displacement activities, the well will be permanently abandoned with cement plugs. The wellhead and casing strings above the seabed will be retrieved in accordance with BP policies. Cement plugs will be positioned on top of a mechanical plug which will effectively act as a foundation for the cement. In the absence of a mechanical plug the cement plug will be mechanically load tested. The cement plugs will be pressure tested to verify pressure integrity.

During permanent abandonment activity, the cement unit will be contained with barriers and all excess cement generated during well abandonment activities will be contained and transferred to the DCBs on-board the jack-up rig for transportation to shore as waste. There will be no planned discharges to the marine environment associated with the well abandonment activities.

4.11 Emissions, Discharges and Waste Summary

4.11.1 Summary of Emissions to Atmosphere

Table 4.10 summarises the GHG (i.e. CO_2 and CH_4) and non GHG emissions associated with the Project.

Table 4-10: Estimated GHG and Non GHG Emissions Associated with Drilling Activities

Tonnes	Total Emissions Estimates for Rig Transfer and Drilling Activities
CO_2 (k tonnes)	24
CO (tonnes)	74
NO_x (tonnes)	433
SO_2 (tonnes)	0.7
CH_4 (tonnes)	2
NMVOC (tonnes)	17
GHG (k tonnes)	24

Basis of Estimate:

1. Total duration of the NKX01 well drilling programme expected to be 4 months (3 months for NKX01 well drilling and 1 month for appraisal sidetrack drilling);
2. Rig, vessel and helicopter anticipated use and fuel consumption assumed as per Table 4.1
3. Emissions factors for rig engines from E&P Forum - Report No. 2.59/197. CO2 - 3.2; CO - 0.0157; NOx; 0.0594; CH4 – 0.000018; VOC – 0.002;
4. Emissions factors for vessels and helicopters from EEMS Atmospheric Emission Calculations Issue 1.8 UKOOA 2004:
   Vessels: CO2 - 3.2; CO - 0.008; NOx; 0.059; CH4 – 0.00027; VOC – 0.0024;
   Helicopters: CO2 - 3.2; CO - 0.0052; NOx; 0.0125; CH4 – 0.000087; VOC – 0.0008;
5. Sulphur Dioxide Emission Factor = 2 x weight fraction of sulphur in diesel (0.05wt%)
6. GHG = CO_2 + 25 * CH_4

4.11.2 Summary of Discharges to Sea

Discharges to the marine environment will be limited to discharges from the support vessel utilities as described within Table 4.3 and non oily drainage (deck drainage and wash water) and cooling water from the drilling rig as described within Table 4.2.

There will be no planned discharges to sea of drilling muds and cuttings, chemicals (including pipe dope) or cement during drilling of the Project exploration well.

4.11.3 Summary of Hazardous and Non-Hazardous Waste

The estimated quantities of non-hazardous and hazardous waste expected to be generated during the NKX01 exploration well drilling programme are provided in Table 4.11.

Waste quantities have been estimated based on operational data from the drilling of the wells within the SD Contract Area using the Istiglal MODU and the estimated duration of the NKX01 drilling programme.

All waste generated during the drilling activities will be shipped to shore and managed in accordance with the existing BP AGT Region Waste Management Procedures.

The planned destination of each key waste stream is also provided within Table 4.11.

Table 4-11: Total Estimated Hazardous and Non Hazardous Waste Associated With the NKX01 Exploration Well Drilling Programme

Classification	Physical Form	Key Waste Stream	Estimated Volume (tonnes)	Destination
Non-hazardous	Solid Waste	Metals – scrap	34	Non-hazardous landfill dedicated for BP operations – current facility has been designed and constructed to EU standards.
		Paper and cardboard	<1	
		Wood	23	
		Cement	105	
		Domestic/office wastes	47	
	Total Non-hazardous Waste		**209**	
Hazardous	Solid Waste	Batteries - dry cell	<1	Treatment/disposal by State licensed and BP approved contractor or storage pending availability of appropriate contractor
		Batteries - wet cell	<1	
		Clinical waste	<1	
		Oily rags	7	
		Container – plastic	<1	
		Filter bodies	<1	
		Toner or printer cartridges	<1	
		Container – metal	12	
		Lamps/tubes – mercury vapour	<1	
		Explosives	<1	
	Liquid Wastes	Sewage – untreated	3	Treatment/disposal by State licensed and BP approved contractor or storage pending availability of appropriate contractor.
		Well suspension fluids	4	
		Drilling muds SOBM/LTMOBM	1289	
		Drilling cuttings SOBM/LTMOBM		
		Paints and coatings	<1	
		Water – oily	419	
		Solvents, degreasers and thinners	1	
		Oils - lubricating oil	31	
		Bentonite	24	
		Drilling muds WBM – contaminated	2310	
		Drilling cuttings WBM – contaminated		
		Laboratory chemicals and testing reagents	3	
		Drilling chemicals	79	
	Total Hazardous Waste		**4184**	

4.12 Management of Change Process

During the detailed planning and execution stages of the Project programme, there may be a need to change a design element or a process. A formal process will be implemented to manage and track any such changes, and to:

- Assess their potential consequences with respect to environmental and social impact; and
- In cases where a new or significantly increased impact is anticipated, to inform and consult with the MENR to ensure that any essential changes are implemented with the minimum practicable impact.

Changes which do not significantly alter existing interactions or impacts, or which give rise to no interactions or impacts, will be summarised and periodically notified to the MENR, but will not be considered to require additional approval. This category will include items such as minor modification of chemical and drilling fluid systems, where the modification involves substitution of a chemical with equal or less environmental impact than the original.

If internal review and assessment indicates that a new or significantly increased impact associated with a planned activity may occur, the following process will be applied:

- Categorization of the impact using ESIA methodology;
- Assessment of the practicable mitigation measures;
- Selection and incorporation of mitigation measures; and
- Re-assessment of the impact with mitigation measures in place.

In practical terms, the changes that will require prior engagement and approval by the MENR are those that:

- Result in a discharge to the Caspian that is not described in the Project ESIA;
- Increase the quantity discharged as detailed in the Project ESIA by more than 20%[15,16;] or
- Result in the discharge of a chemical not referenced in the ESIA and not currently approved by the MENR for use in the same application by existing BP AGT Region operations.

Once the changes (and any appropriate mitigation) have been assessed as described above, a technical note will be submitted to the MENR describing the proposal and reporting the results of the revised impact evaluation. Where appropriate, this may include the results of environmental testing and modelling (e.g. chemical toxicity testing and dispersion modelling). Following submission of the technical note, the Project team will engage in meetings and communication with the MENR in order to secure formal approval. Once approved, each item will be added to a register of change. The register will include all changes, including those non-significant changes notified in periodic summaries, and will note any specific commitments or regulatory requirements associated with those changes.

15 For the discharges detailed in the ESIA, an increase of 20% in volume would result in a 3-4% increase in the linear dimension of the mixing zone. For instance, a mixing plume 100m by 20m by 20m would increase by less than 2m in each dimension. Taking into account the actual size of the predicted mixing zones, this magnitude of increase is considered to make no material difference to the physical extent of the impacts. In practical terms, this would apply to increases of more than 20% (the value was selected to be conservative).
16 Unless increase is deemed to have no material effect on the associated impact(s).

5 Environmental and Socio-Economic Description

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5.1 Introduction

This Chapter describes the environmental and socio-economic baseline conditions relevant to the Shallow Water Absheron Peninsula (SWAP) Exploration Drilling Project.. The purpose of this Chapter is to provide sufficient information to allow the potential impacts related to drilling of the proposed NKX01 exploration well, to be assessed in accordance with the assessment methodology as set out in Chapter 3 of this Environmental and Socio-economic Impact Assessment (ESIA).

This Chapter provides relevant information on the following relating to environmental baseline conditions:

- Physical setting including a summary of seismicity, geology, meteorology and climatic conditions relevant to Caspian region as a whole (i.e. the entire geographic area in which the Caspian Sea is located) and to the SWAP Prospective Areas focused on the Project location and its immediate vicinity;
- Marine environment including an overview of bathymetry and oceanography within the area where the Central and Southern Basins of the Caspian Sea meet, the Prospective Area where the NKX01 exploration well will be located and a summary of the seabed and water column physical, chemical and biological/ecological conditions in this location, including areas known to be of importance for fish and seals (including haul out sites) during sensitive periods (i.e. during migration, spawning and feeding); and
- Coastal setting and environment, specifically protected and coastal areas known to be of importance for birds along and in the vicinity of the Azerbaijani Absheron region coastline.

With regard to socio-economic baseline conditions, information is provided relating to:

- An overview of Azerbaijan national and regional socio-economic context, including demographics;
- A summary of small-scale coastal fishing, offshore commercial fishing, tourism and recreational activities currently undertaken within Azerbaijani nearshore waters and specifically within the vicinity of the Project location;
- A description of regional and international shipping routes located within the vicinity of the Project location, associated port infrastructure and the known location of subsea obstructions; and
- Cultural heritage comprising a summary of the marine archaeological and cultural heritage sites known to be present in the waters around the Absheron Peninsula.

The geographic scope of the data presented is based on the data available for the Project location, with local, national and regional information provided, where relevant, to provide a basis for the assessment of impacts.

5.2 Data Sources

This Chapter has been prepared based on the following:

- Review of available BP and third party ESIAs completed for projects in the Absheron region and in the Azerbaijan sector of the Caspian Sea, specifically within or in close proximity to the Project location. Key documents include:
    - SWAP 3D Seismic Survey ESIA (2015) (Ref. 1). The ESIA was prepared to obtain permission to undertake a 3D seismic survey across and in the vicinity of the SWAP Contract Area (onshore and offshore). A number of specific surveys were undertaken to gather additional environmental data, including offshore shallow water environmental surveys, terrestrial ecology surveys, noise surveys and terrestrial cultural heritage surveys. A socio-economic study was also undertaken in November 2015 within the onshore areas of the 3D Seismic Survey Area. The survey included the identification of residential areas located within, or immediately adjacent to, the 3D Seismic Survey Area, the physical presence of coastal facilities where users of the sea access the water via ports and jetties,

coastal recreational facilities and fishing areas used for commercial and coastal fishing activities located adjacent to and within the 3D Seismic Survey Area;
  - 3D SWAP Seismic Survey Environmental Risk Assessment (ERA) (2016) (Ref. 2). This document was prepared for submission to the MENR to assess a number of changes made to the SWAP 3D Seismic Survey design including changes to the 3D Seismic Survey Area and the schedule; and
  - Azeri Chirag Guneshli (ACG) ESIAs and Environmental Technical Notes (ETNs) (Refs. 3,4,5,6,7,8 and 9) and Shah Deniz (SD) ESIAs (Refs. 10 and 11) prepared for the phased developments within the ACG and SD Contract Areas, including the associated subsea export pipelines to the onshore Sangachal Terminal.

- Primary data held by BP associated with the studies and surveys undertaken to support the BP ESIAs listed above and ongoing operational monitoring data collected as part of the Environmental Monitoring Programme (EMP).
- Primary seal observation data collected during the SWAP 3D Seismic Survey activities in 2016.
  - Primary data provided by SOCAR for seabed and water column biological monitoring surveys undertaken in 2014 for the Gurgan-Deniz offshore field (Ref. 12).
- Secondary data collected through consultation with local governmental and other organisations including:
  - The Ministry of Ecology and Natural Resources (MENR);
  - Caspian Shipping Company;
  - The Ministry of Culture (MoC);
  - Azerbaijan Fisheries Research Institute; and
  - The State Oil Company of Azerbaijan Republic (SOCAR).
- Secondary data and literature publicly available on the internet including reports published by Azerbaijan State Committee of Land and Mapping, United Nations Educational, Scientific and Cultural Organization (UNESCO), International Union for Conservation of Nature (IUCN); United Nations Environment Programme Global International Waters Assessment (UNEP / GIWA) and the World Bank.

A survey to collect water column and sediment sampling data for the Project location locality was undertaken in July 2018 in water depths ranging from approximately 20 to 25 metres (m). In total 6 water column and 38 sediment samples were taken, and physical, chemical and biological analysis was undertaken. A survey was also undertaken at the QBDX01 location (shown in Figure 1.1) approximately 10km to the south west of the Project location in water depths of approximately 3 to 6m.

5.3 Physical Setting

5.3.1 Geology

The Caspian Basin represents one of the largest continental lake systems in the world. The recent geological sequence is characterised by Fluvial Deltaic sandstones and Lacustrine shales. The Project location lies just to the north of the ridge between the South and Central Caspian Basins, in a relatively shallow gently sloping, but in a relatively flat shelf or plateau area.

The Caspian region is characterised by the tectonic collision within the Arabia-Eurasia zone which has produced a series of anticlinal (arch-like) upward thrusting folds and exhibits horizontal motion rates of several centimetres per year (Ref. 13). The Absheron Ridge, which separates the Southern and Central Caspian Basins (refer to Section 5.4.1 below), is considered to be the sea floor expression of the Absheron-Prebalkhan Uplift Zone (Ref. 4), which lies along and defines the northern margin of the South Caspian Basin.

Geological data obtained from surveys undertaken in 2002 (Refs. 6 and 7) indicate this area is likely to comprise the Pleistocene aged Absheron formations, underlain by the upper Pliocene aged Akchagyl Formation. Deposits from the Absheron and Akchagyl Formations primarily comprise grey to green claystones and marls interbedded with minor layers of siltstones and sandstones. Below these

formations are the Pliocene hydrocarbon-producing deposits of the Surakhany (anhydrites), Sabunchi, Balakhany and Pereriv formations.

The Pliocene geological sequence is characterised by the deposition of fluvial deltaic sandstones and lacustrine shales. Fluctuations in sea level (driven primarily by climate change) resulted in rapid large-scale avulsion of the Volga Delta and the deposition of laterally continuous lacustrine Shales and sands into a low gradient lacustrine basin. Approximately 8 kilometres (km) of sediment was deposited into the basin over six to ten million years during this period. Geophysical surveys completed in 2018 at the Project location identified the shallow geological layers in the area. These comprised a thin layer approximately 1m deep of very loose sand/very soft sandy clay underlaid by a layer of firm to hard sediments of clay/silt/sand up to 12m below the seabed followed by a layer interpreted as possible bedrock that comprises layers of clay/silt/sand.

5.3.2 Mud Volcanoes

Approximately half of the world's known mud volcanoes are found within the Southern Caspian basin (Ref. 14). Periodic fluid upwelling from deeper overpressured shales has led to the formation of numerous mud volcanoes and seepage features. This formation occurs through the rapid sedimentation of low permeability clay layers which leads to a thick blanket (>20km thick) of low density shale containing high excess pore-pressures. These overpressures in the sediments, combined with the vertical and lateral stresses induced by the regional compressive tectonics, are key traits which explain the upward migration of fluids in the near-seabed sediments which result in the numerous mud volcanoes at the seafloor.

Azerbaijani waters contain a number of hazardous active and inactive mud volcanos and fluid upwelling features which result in a number of seabed and sub-seabed features visible from geophysical and geotechnical data (Ref. 15).

It is estimated that there are more than 170 mud volcanoes located across the Caspian Sea, though it is understood that none are located within the vicinity of the Project location (Ref. 4). The indicative locations of known mud volcanoes at the time of writing are shown in Figure 5.1.

5.3.3 Seismicity

The main source of seismic activity within Azerbaijan results from the Caucasian segment of the Alpine-Himalayan (Mediterranean) folded belt, which was generated through the collision between the Eurasian and Afro-Arabian lithospheric plates, which continues to occur. The rate of northward motion of Arabia relative to Eurasia has remained more or less constant at about 2 centimetres per year (cm/year) since the collision began.

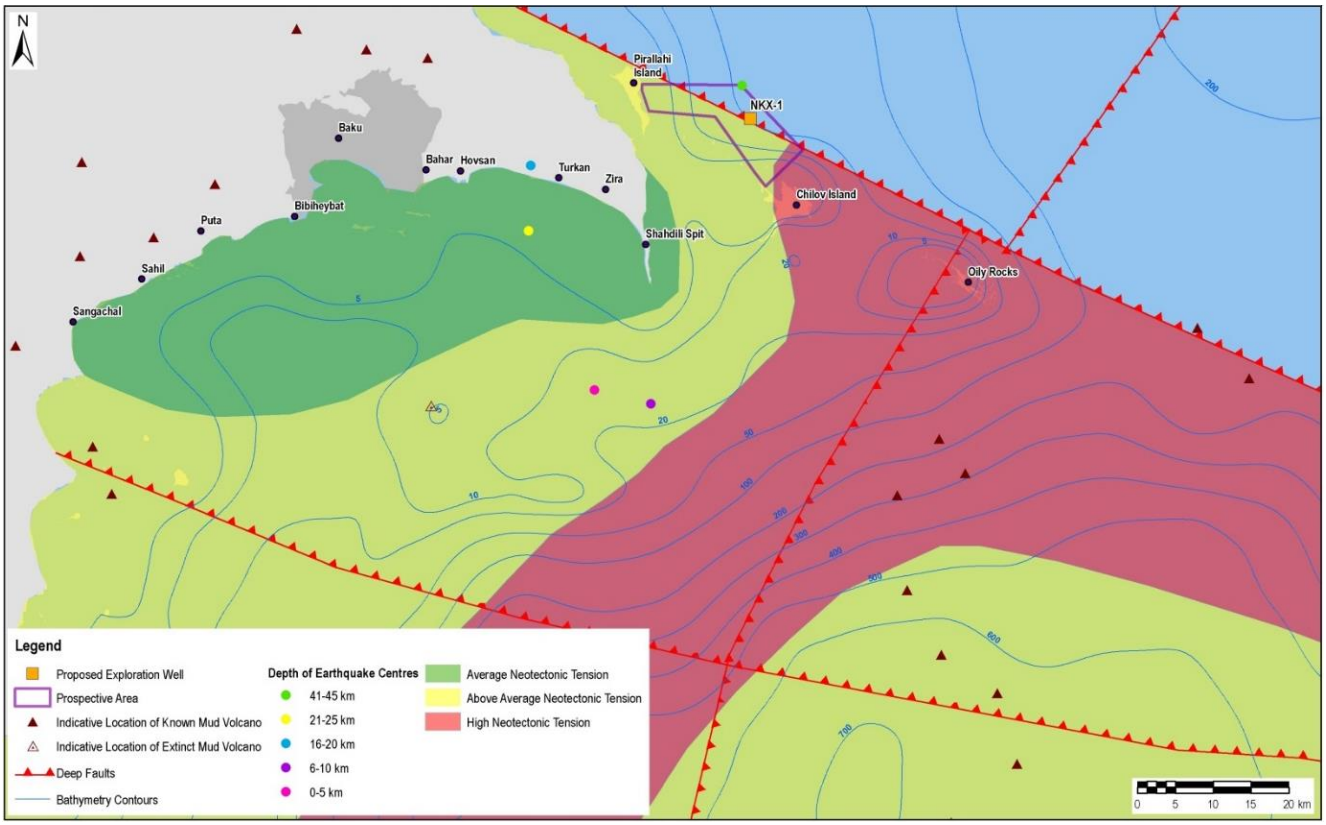
The Southern Caspian is defined by the Scythian microplate (regional tectonic block), as part of the Russian plate, the Turanian, Iranian and small Caucasian plates, as well as the South Caspian microplate. Current neotectonic (more recent) processes are leading to convergent movements of these plates. These convergent plate movements are generally associated with relatively high levels of seismic activity.

Seismic monitoring of the region has been ongoing since early 2000 using modern telemetric stations with satellite communication systems. A seismic assessment (Ref. 16) undertaken for the region in 1996 detected 565 earthquakes which occurred from 650 AD to 1996 and included a subset of nine significant (magnitude[17] 6-7.7) historic earthquakes since 1668. Since the 1996 study, there have been a further four earthquakes with magnitude greater than 5 within the Baku region, including a magnitude 6.8 event in 2000.

Figure 5.1 shows that the area where the NKX01 exploration well is located is adjacent to deep fault line and to an area subject to above average neotectonic tension. Figure 5.1 also shows the location and depth of recorded earthquakes within the Absheron region.

[17] The magnitude is a number that characterises the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph.

Figure 5.1: Seismic Characteristics and Locations of Mud Volcanoes and Earthquake Centres in the Vicinity of the Project (Refs. 17, 18 & 19)



5.3.4 Meteorology and Climate

Over the Caspian area, July to August average temperatures vary between 24 and 26°C, with a maximum of 44°C on the sun-baked eastern shore. Monthly average temperatures during winter range from −10°C in the north to 10°C in the south (Ref. 20). In the western part of the Southern Caspian where Azerbaijan is located, annual variations in the temperature regime are considerable, but in general air temperatures below freezing are uncommon. The climate along the coastline of the Absheron region is classified as being warm and semi-arid.

Extreme air temperatures offshore derived using a combined data set that comprises measurements taken from the platforms in the offshore ACG Contract Area over a total duration of approximately nine years provides estimates of extreme return period values for hundred year values of 40.8°C and -7.3°C for the maxima and minima, respectively. The average air temperatures above the Caspian Sea typically peak at 25.5°C during the summer and may drop to 0°C for some periods in the winter (Ref. 21).

Precipitation is highly variable throughout the Caspian region. Based on the rainfall data collected from the meteorological station at Baku, mean annual rainfall from 1992 to 2006 was 263mm. The maximum monthly rainfall from 2002 to 2006 was 184mm in December 2002. October to February were wet months receiving an average of 41 to 79mm rain/month, with drier months occurring from July to August receiving an average of 1 to 5mm rain/month (Ref. 11).

In regional terms, the wind conditions are influenced by the north-south orientation of the Caspian Sea as well as the physical and geographical conditions of the coastline. Based on data collected during 2007 at Baku Airport[18] the predominant wind direction in the vicinity of Baku is north, occurring approximately 15% of the year. North-north-westerly and north-north-easterly winds account for approximately 10-12% of other winds. Wind speeds typically range from 0.5m/s to 12m/s with

[18] The anemometer is located 10m above ground level.

approximately 30% of winds being greater than 8m/s (Ref. 11). Strong winds and storms can arise at any time of the year but are more frequent during the winter months with the largest number of days with storm winds of more than 15 m/s occurring around the Absheron Peninsula (Ref. 4).

Moisture saturated air converges in the south-west Caspian giving rise to foggy conditions during the winter months. Such conditions are expected to occur for around 10% of the year, mainly between October and May (Ref. 21).

5.3.5 Air Quality

At a national level, air quality varies across Azerbaijan with higher pollutant concentrations recorded in cities (such as Baku) due to increased industry and transport emissions than in rural areas. Monitoring of pollution of ambient air in Azerbaijan is undertaken by the Department of National Environmental Monitoring and reported on an annual basis since 2005 at 26 stations in cities across the country, including nine locations within Baku city (Ref. 22). Outside of Baku it is understood that air quality in coastal areas of the Absheron region is not routinely monitored except in the vicinity of the Sangachal Terminal located approximately 40 km south west of Baku.

From the survey data available, air quality along the coastline of the Absheron region is known to be variable. In the vicinity of Bibiheybat, concentrations of NO_2 recorded between 2005 and 2013 have varied between approximately 25µg/m^3 and 50µg/m^3 with a concentration of approximately 38g/m^3 recorded in 2013; significantly higher NO_2 concentrations (up to 120µg/m^3) have been recorded within Baku itself (Ref. 23). Annual monitoring at Sangachal Terminal in 2014 recorded an average concentration of 22 µg/m^3, which is considered to be representative of more rural locations such as those along the Absheron Peninsula. Air quality within the Absheron Peninsula is not expected to be affected by the poor air quality within the Baku area as the predominant wind direction is north and the rural coastal areas in this region are expected to have relatively good air quality.

Monitoring of dust and particulate levels around the Sangachal Terminal and within Baku indicate average particulate concentrations (as PM_{10}[19]) of 24.3 and 240µg/m^3 which is 6 times more than the annual average EU limit value of 40µg/m^3. Windblown dust is a known nuisance issue across the region and within Baku, and considered typical of such an environment.

5.3.6 Onshore Noise

The noise environment along the coastline of the Absheron Peninsula varies depending on the location and the presence of nearby noise sources such as roads, commercial facilities and communities in addition to natural sound from wind and waves. To support the SWAP 3D Seismic Survey ESIA, a noise survey was undertaken between the 11th and 14th November 2015 to identify the existing levels of ambient noise at a number of community receptors[20]. Survey locations were selected at locations considered to be representative of the typical noise environment for the land use type (i.e. urban, rural, coastal or commercial/industrial). The noise environment in coastal areas was dominated by wave noise, with the highest average noise levels (69 dB (L_{Aeq})) were recorded in coastal areas around Lokbatan, Bibiheybat and Pirallahi. No significant sources of commercial or industrial noise were noted at any location during the noise survey.

The closest noise monitoring locations to the Project location were situated either side of the bridge between Pirallahi Island and the Absheron Peninsula. Results from these survey locations ranged between 57dB and 65dB $L_{Aeq,5min}$ and results were dominated by noise from waves and wind.

[19] Atmospheric air containing dust having particulates with <10 um diameter aerodynamic size distribution.

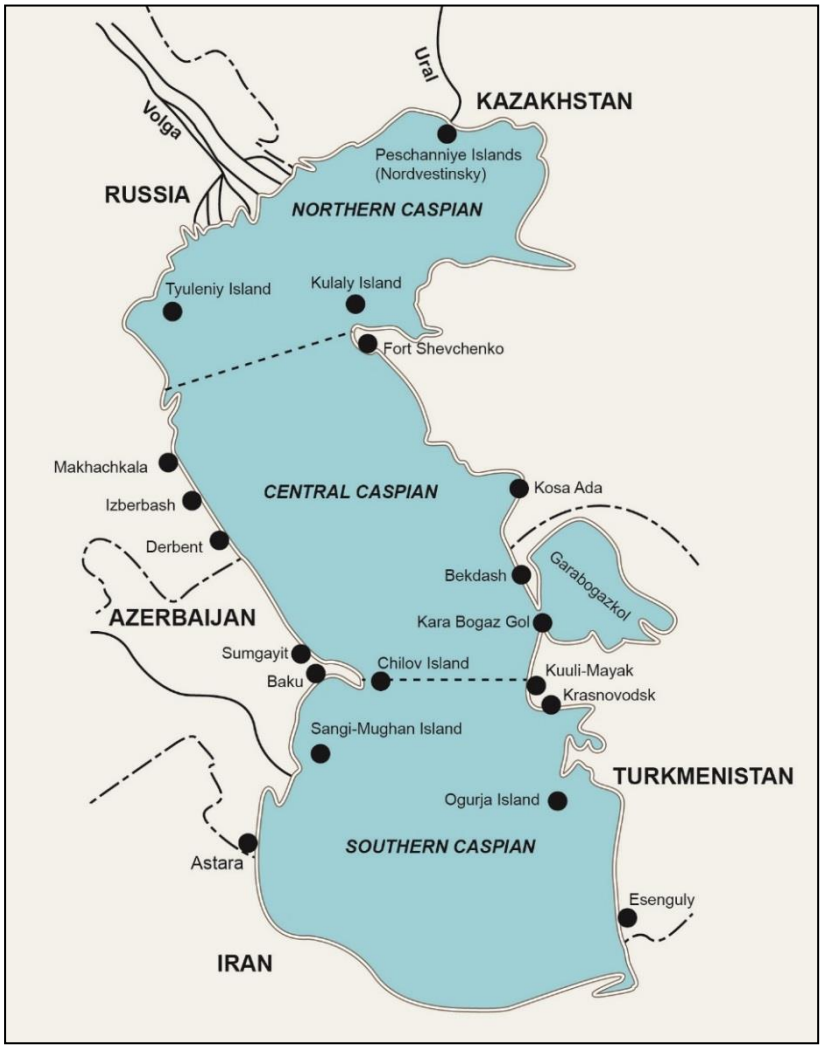
[20] Receptors where a low noise environment is desirable for the use and amenity of these receptors and which may be adversely affected by noise (such as residential dwellings, hospitals, schools, religious sites and community buildings).

5.4 Marine Environment

5.4.1 Bathymetry and Oceanography

The Caspian Sea is the largest landlocked water body on Earth with a surface area of approximately 371,000km^2. It is fed by numerous rivers; the largest of which is the Volga to the north. The Sea is made up of three basins: the Northern, Central and Southern Basins (Figure 5.2). The Northern Basin is the smallest (about 25% of the total surface area) but is very shallow. The Central and Southern Basins have similar surface areas, but the Southern Basin is deeper and contains almost twice the volume of water as the Central Basin. The deepest recorded depth is in the Southern Basin at just over 1,000m.

Figure 5.2: Location of the Northern, Central and Southern Basins of the Caspian Sea (Ref. 24)



The Absheron Ridge, which effectively separates the Central and Southern Basins, is a narrow section of relatively shallow water (between 50 to 300m deep) which extends from Absheron Peninsula to the Khazar Peninsula on the east coast of Turkmenistan. The NKX01 exploration well is planned to be situated just to the north of Chilov Island and north of the Absheron Ridge.

5.4.1.1 Sea Level

The Caspian Sea has experienced significant water level fluctuations over the past several hundred years, including changes of several metres within the past few decades. The Caspian Sea and is one of the few water bodies in the world where the water level is lower than the global mean sea level of the world's oceans. The variation in sea level is a result of changes in water inflow from rivers (mainly the

Volga which represents 70% of total inflow), precipitation, loss from evaporation and discharge to the Kara-Bogaz-Gol in Turkmenistan. A recent study (Ref. 25) found that water levels in the Caspian Sea increased by approximately 12.74 cm/year during the period 1979–1995 and dropped approximately 6.72 cm/year during the period 1996–2015. The study found that increased evaporation rates over the Caspian Sea have significantly contributed to the recent drop in sea level and predicts accumulating evaporation rates over the Caspian Sea for the foreseeable future will lead to further sea level decline. The current sea level of the Caspian Sea is approximately 28m below mean sea level.

5.4.1.2 Wave and Current Regime

The main distinguishing features of the Caspian Sea are its isolation from the world's oceans and its intracontinental location. The Caspian is non-tidal, with the currents primarily influenced by wind, bathymetry, water density and temperature variations leading to some isolation between the Northern, Central and Southern Caspian areas (Ref. 26). The resulting large scale circulation pattern consists of two anti-clockwise currents in the Northern and Central Caspian, and the western anticyclonic and the eastern cyclonic gyres in the Southern Caspian. According to Kosarev and Yablonskaya (Ref. 21), in-flowing rivers influence the current regime, creating a southwards flow down the west coast of the Central Caspian and a counter current up the east coast as well as small residual currents in the southwest of the Caspian Sea.

The predominant wave heights in the Caspian Sea are relatively low with a minor build-up of swells, given the sea's land-locked nature and absence of tides. The greatest wave development occurs from the western section of the Central Caspian basin down and across the central section of the Absheron Ridge. The strong north-western winds under the influence of costal and nearshore morphology of the Absheron Peninsula create waves directed to the east nearshore and to the northwest offshore. During normal conditions, waves in the Absheron region are generally less than 2m in height (Ref. 27).

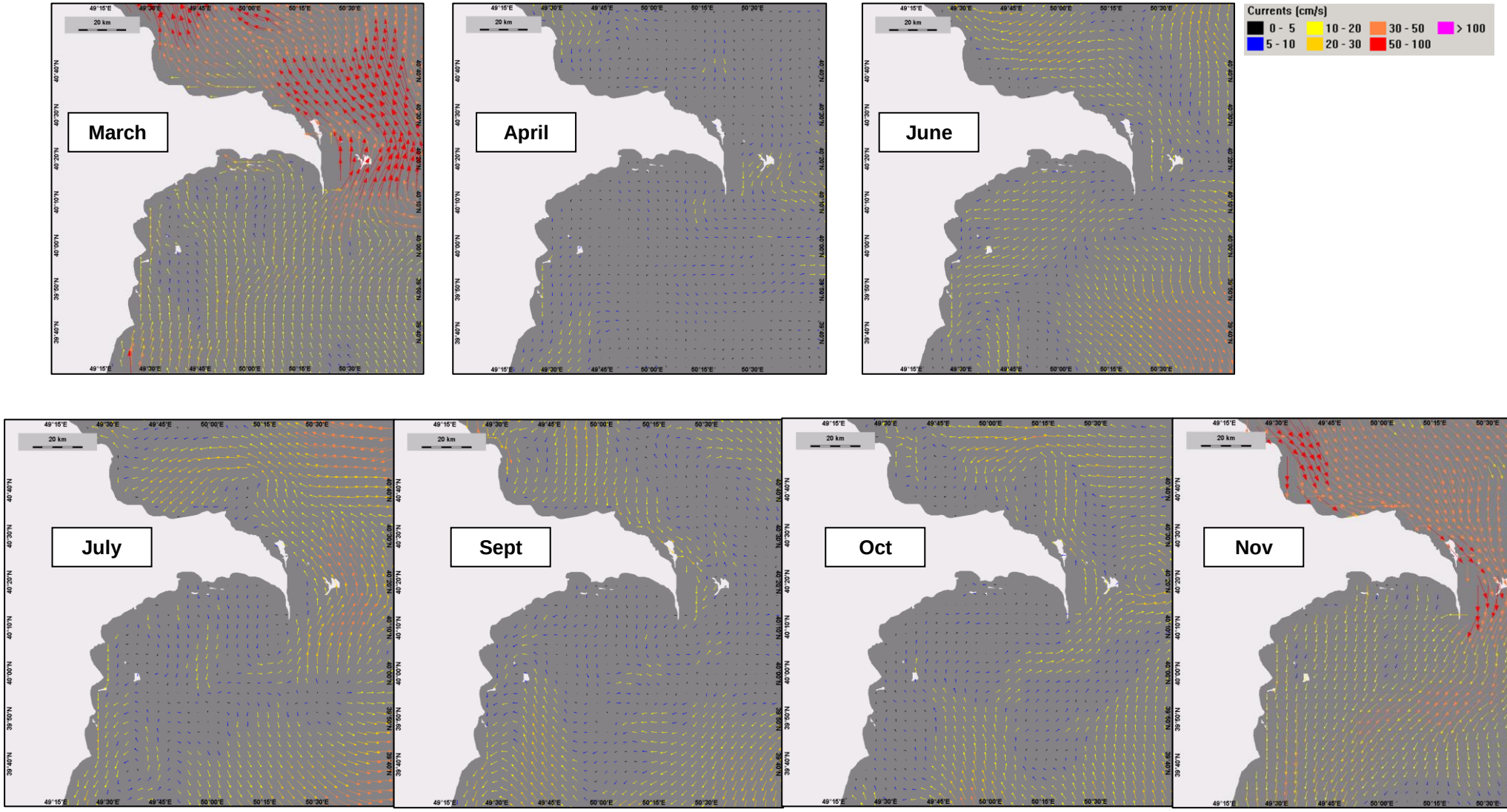
The mechanism that drives the currents can be traced back to the Northern Caspian Basin. Here, very cold winter air temperatures, shallow waters and large fluvial inputs from rivers, lead to rapid ice development and the formation of a reservoir of cold, dense water on the boundary with the Central Caspian Basin. The cold water is transported along the western Central Caspian Basin under the influence of cyclonic winds associated with the winter low pressure trough. A component sinks and flushes the bottom waters of the Central Caspian Basin, but in normal years a large volume finds its way over the western section of the Absheron sill and into the Southern Caspian Basin where it appears to mix and sink. A counter flow of relatively warm Southern Caspian Basin water along the eastern section of the Absheron sill balances the cold water inflow.

The irregular depth of the Absheron shelf complicates the winter seasonal flow further. The shelf is deeper on the western side (with a maximum depth of over 200m) than on the eastern side (where depths are usually less than 150m). Therefore, the cold water inflow penetrates beneath the level of the warm water outflow. This is thought to cause currents along the continental slope of the eastern shelf to flow towards the west. Currents in the region are complex and may be strong, especially during winter. The main component of strong currents is a winter wind driven circulation modulated, and sometimes reversed, by the action of passing storms. Tidal currents in the Caspian are negligible.

In the vicinity of the Project location, surface currents vary throughout the year in direction and speed. Figure 5.3 shows the expected circulation variation during March, April, June, July, September, October and November[21]. Strong northward currents can be observed at the beginning of March, later replaced in the summer by smaller anti-clockwise circulation areas near the shore. Stronger southwards currents resume in November at the beginning of winter.

[21] Data from the Imperial College London, ReEMS dataset from 2007.

Figure 5.3: Surface Currents Recorded Around Absheron Peninsula in March, April, June, July, September, October and November



5.4.1.3 Storm Surges and Waves

Storm surges occur in the Caspian Sea causing temporary rises or falls in sea level. Significant sea level changes occur in the Southern and Central Caspian Basin. These events are associated with persistent strong winds, particularly the strong prevailing regional winds that blow along the axis of the Caspian Sea, from north and north-west or from the south and south-east (Ref. 21). Strong winds from the north are more frequent and more severe than strong winds from the south. Waves in the Caspian Sea are wind driven and subsequently the windiest months also exhibit the greatest wave action (Ref. 28). The largest waves can be expected when the wind direction is northerly or southerly, as waves have longer time to build up at these wind directions.

Wave height data recorded offshore at Oil Rocks indicates that the months of July, August and September have the strongest winds and storms, with a greater frequency of wave heights in excess of 2m recorded. The period of October to February, however, shows the greatest number of wave heights between 1 and 2m, reflecting the steady occurrence of strong winds during this period (Ref. 11). South of the Absheron Peninsula, northerly winds create a fall in sea level while southerly winds result in a rise. In Baku Bay this change can be ±70-80cm. The typical time period for a storm surge is estimated to be 6-24 hours (Ref. 11).

Predicted metocean conditions were modelled using a variety of metocean data sources for the QBDX01 location as shown in Figure 5.4 below and the surrounding area including the Project location by the QBDX01 project team. The modelled metocean conditions suggest that extreme maximum wave heights would be in the range of 2 to 2.5m at the Project location with the highest wave heights associated with waves and wind from the north. This is consistent with the data recorded at Oil Rocks.

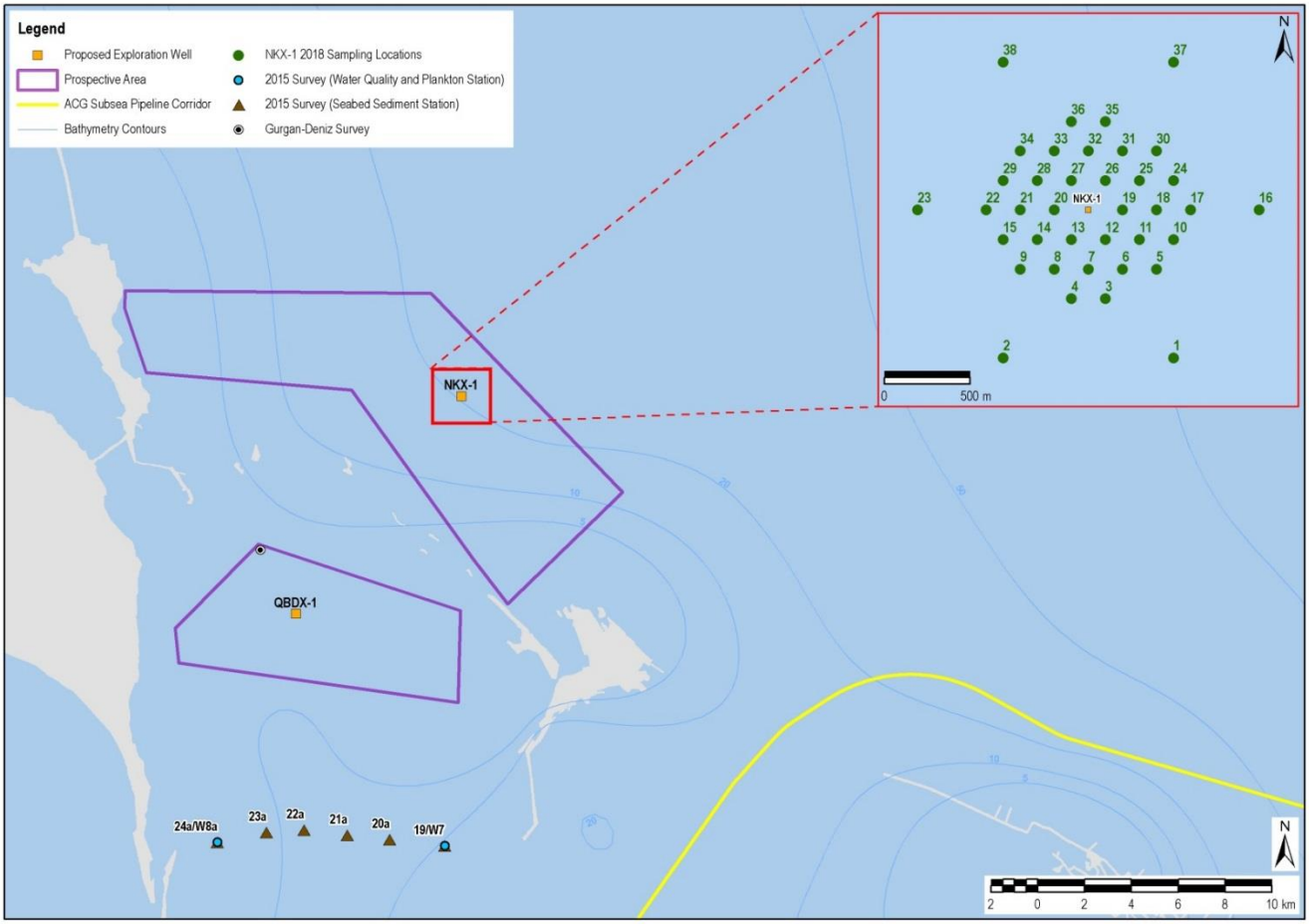
5.4.2 Marine Environment Survey Data

To establish the anticipated physical, chemical and biological characteristics of the seabed environment and the water column within the vicinity of the proposed Project location, the data sources as listed within Section 5.2 were reviewed. This included:

- 2014 survey data collected by SOCAR as part of the Gurgan-Deniz survey;
- 2015 Environmental Baseline Survey (EBS) for the earlier SWAP seismic survey; and
- 2018 EBS at the NKX01 location.

Figure 5.4 shows the locations of the EBS sampling stations relevant to the NKX01 location.

Figure 5.4: Location of 2015 SWAP EBS, Gurgan-Deniz 2014 and 2018 NKX01EBS Sampling Stations



5.4.3 Seabed Physical and Chemical Environment

5.4.3.1 Physical Properties of Sediment

Table 5.1 presents a summary of the physical properties of the sediments at and within the vicinity of the proposed NKX01 location.

Table 5-1: Physical Sediment Properties Recorded in Environmental Surveys in the Vicinity of the NKX01 Location

	2018 NKX01 EBS			2015 SWAP EBS (20-24)		
Parameter	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
Mean diameter (µm)	95	2482	1134	15	227	109
Sampling Station	07	22	-	22	24	-
Carbonate (% w/w)	36.9	96.3	83.7	32	65.2	47.1
Sampling Station	20	22	-	22	23	-
Organic(% w/w)	0.34	2.65	0.91	0.65	4.5	2.39
Sampling Station	22	07	-	24	20	-
Silt/Clay (% w/w)	1.2	49	11.6	5.1	78.1	43.3
Sampling Station	37	07	-	24	20	-
Silt (% w/w)	0.3	22.2	4.8	2.1	45.1	25.8
Sampling Station	23	07	-	24	22	-
Clay (% w/w)	1	27.2	6.8	3.01	34.5	17.5
Sampling Station	37	07	-	24	20	-

At the Project location the majority of stations (27 of 34) were classified as granule, very coarse sand or coarse sand, with mean particle diameters of 900-2482 µm. These stations were also characterised by high carbonate content, and low organics and silt-clay content. However, it should be noted that for 64 out of 98 sampling attempts across the 38 stations, sampling failed as stones and rocks prevented the grab sampler from closing properly. These results contrast to the results from the 2015 SWAP EBS locations which indicate less coarse sediment with coarser sediments observed closer to the coast.

The finest sediment recorded during the 2018 NKX01 EBS occurred mainly in two zones, one lying between stations 21 and 7, the other between stations 25 and 17. At these stations, silt-clay content was in the range of approximately 25-50%, indicating a physical structure capable of supporting organisms which live within the sediment (such as polychaetes, oligochaetes and amphipods). At station 20 there was an unusual combination of values for carbonate, organics and silt-clay; although sediment from this station was classified as medium sand, with comparatively low carbonate content, the organics and silt-clay content were also extremely low. Overall, it was found that the finer sediments are generally associated with higher organic and silt-clay content.

With regard to the larger rocks and stones within the area surveyed these were not quantified, however it can be concluded that they represent a qualitatively substantial substrate for those benthic organisms (such as barnacles and mussels) which require a solid surface for attachment.

5.4.3.2 Chemical Properties of Sediment

Hydrocarbon Concentrations

Table 5.2 summarises the sediment hydrocarbon concentrations recorded at the proposed NKX01 exploration well location.

Table 5-2: Minimum, Maximum and Mean Total Hydrocarbon Concentrations at the NKX01 Location

	THC (µg/g)	UCM (µg/g)	% UCM	Total 2-6 ring PAH (ng/g)	NPD (ng/g)	% NPD	Total EPA 16 (ng/g)
Min	2	1	64	34	23	38	6
Max	42	38	93	677	404	67	218
Median	11	10	87	109	70	63	27
Mean	14	12	86	190	113	62	49

The survey results indicate that total hydrocarbon concentrations (THC) were low across all the sample locations, ranging from 2µg/g to 42µg/g; the average and median values were 14 and 11µg/g respectively. The highest values for THC were found to occur at the stations with the smallest mean particle diameter and the highest silt-clay content.

Percent UCM values were high (in excess of 85%) at most stations, indicating that the hydrocarbons were heavily weathered. Lower values of %UCM were reported for stations 12, 13, 27 and 37, and were associated with very low THC concentrations. However, the methodology for deriving %UCM is not accurate at such low concentrations and therefore the low %UCM values may therefore reflect this methodological constraint rather than indicating the presence of fresh hydrocarbon material.

Concentrations of 2-6 ring PAHs ranged from 34 to 677 ng/g, with average and median values of 190 and 109 ng/g respectively. Concentrations of naphthalenes, phenanthrenes and dibenzothiophenes (NPD) ranged from 23 to 404 ng/g and represented (with the exception of station 10) between 55 and 67% of the total PAH.

Hydrocarbon concentrations recorded during the 2015 SWAP EBS at stations 20 to 24 ranged from 13 to 180 µg/g with a mean concentration of 77 µg/g. While slightly higher than those recorded in the 2018 NKX01 EBS, these are still considered to be low and do not indicate any significant contamination.

Heavy Metal Concentrations

Table 5.3 provides a statistical summary of the concentration of heavy metals recorded in the 2018 NKX01 EBS sediment samples and within the samples at stations 20 to 24 of the 2015 SWAP EBS.

Table 5-3: Minimum, Maximum and Mean Heavy Metal Concentrations Recorded in Environmental Surveys in the Vicinity of the Project Location

Parameter		2018 NKX01 EBS		2015 SWAP EBS (20-24)	
		Value	Station	Value	Station
Arsenic (µg/g)	Min	5.9	20	8.9	22
	Max	32.7	36	14.1	23
	Mean	14.8	-	10.3	-
Barium (µg/g)	Min	182	25	133	23
	Max	5033	19	308	22
	Mean	588	-	219	-
Cadmium (µg/g)	Min	0.054	20	0.122	22
	Max	0.219	24	0.183	23
	Mean	0.132	-	0.14	
Chromium (µg/g)	Min	13.5	20	11	24
	Max	56.3	07	42	20
	Mean	32.1	-	27.5	-
Copper (µg/g)	Min	3.0	20	3.9	24
	Max	26.4	07	22.1	20
	Mean	14.5	-	12.5	-
Iron (µg/g)	Min	7384	20	8415	24
	Max	33560	07	28066	20
	Mean	21941	-	18297	
Mercury (µg/g)	Min	0.029	20	0.05	22
	Max	0.155	10	0.265	24
	Mean	0.083	-	0.18	-
Lead (µg/g)	Min	3.8	20	6.87	24
	Max	19.6	17	16.3	20
	Mean	13.7	-	11.7	-
Zinc (µg/g)	Min	12.5	20	18.5	24
	Max	87.6	07	76.2	20
	Mean	50.0	-	46.2	-

In general, the results from the 2018 NKX01 EBS and 2015 SWAP EBS data showed that heavy metal concentrations in sediments vary little across the stations monitored with the exception of station 20 of the 2018 NKX01 EBS where higher concentrations were recorded. As was the case with sediment physical composition, station 20 of the 2018 NKX01 EBS was anomalous to the results for the other stations with respect to metal concentrations, with values for all metals which were considerably lower than at most other stations.

Whilst this might, to some extent, reflect the very low silt-clay content at this station, (2.87%), metal concentrations were higher at other stations (22, 23 and 37) with similarly low silt-clay content. Barium concentrations were variable, but not unusually so, with the exception of station 19. Ba (fusion) concentrations at this station were, at 6163µg/g, more than three times higher than the next highest concentration (1970µg/g at station 37). The reason for elevated concentrations reported are not known, however given the results of the surrounding sampling stations which are all significantly lower, the result could be anomalous and possibly due to sampling or analysis error. It may also be due to 3rd party activities at this location which involved discharge of drilling mud.

Concentrations of all metals in the 2018 NKX01 EBS are considerably lower than reported for the surveys undertaken along the ACG pipeline stations in shallower waters, reflecting the substantially lower silt-clay content at the majority of the NKX01 2018 EBS stations. This is particularly the case for mercury, where average NKX01 2018 EBS concentrations are approximately 25% of the average value for pipeline stations. The average and median mercury concentrations recorded in the 2018 NKX01 EBS were 0.083 and 0.076µg/g respectively; however, at 5 stations (7, 9, 17, 25 and 30) concentrations were in the range of 0.13-0.15 µg/g. Relatively high silt-clay concentrations were reported at these 5 stations. As Table 5.3 shows the concentrations of the metals recorded are however not significantly different to those that were recorded from the 2015 SWAP EBS for stations 20 to 24.

In general the results of the 2018 NKX01 EBS do not provide any broad indication of recent or current contamination; they most probably reflect the complex physical composition of the benthic environment at this location. The only potential indication of historical contamination might be the very high barium concentration at station 19, and the comparatively high mercury concentrations at 5 stations, which lie within the range of concentrations that have been recorded in shallow-water sediments between Baku Bay and Sangachal Bay (Ref. 1). It should be noted, however, that as a number of samples could not be collected due to rocks and stones preventing grab sampler closure, the sediment metal concentrations at the NKX01 location are indicative given the gaps in the data obtained.

5.4.4 Seabed Biological Environment

The biological benthic environment comprises marine flora (seagrass and algae) and benthic invertebrates as described below.

5.4.4.1 Marine Flora

Marine flora is a key component of the ecosystem, providing refuge for invertebrates and juvenile fish, stabilising sediments and reducing wave energy in shallow water environments and providing a food source for water and wading birds. Seagrass typically grows in shallow water where light can penetrate and is sensitive to changes in nutrient levels and turbidity, both of which can affect primary productivity for some species. While recent systematic data to confirm the presence and density of seagrass in the Project vicinity is not available, the drop down video survey undertaken as part of the QBDX01 monitoring survey undertaken in 2018 (water depth approximately 5m) showed significant areas of seagrass species, *Zostera noltii*[22]*.* The same species was also recorded in surveys in Sangachal Bay in 2002 and 2003 in water depths up to 10m (Ref. 1) and in subsequent surveys in Sangachal Bay in 2014 and 2016 in water depths up to 5m.

The species lists available from the 1960s and 1970s and the surveys undertaken in Sangachal Bay in 2002 and 2003 suggest a number of red and green marine algae species were known to be present along the Absheron coastline. However, the increase in discharges of wastewater to sea associated with increasing urbanisation of coastal areas, particularly in Baku, and the associated increases in nutrient levels and pollution, may have significantly affected the diversity, abundance, and distribution of floral species. The most recent survey video seabed survey undertaken in Sangachal Bay in 2016 around the area to be disturbed due to works associated with the SD2 project focused on characterising seabed habitats and substrates. The survey identified beds of *Zostera noltii,* including some densely vegetated areas, in water depths up to 5m. A layer of green algae was observed coating the seabed in a few locations. In general, the coverage and distribution of seagrass identified in 2016 survey was very similar to that found in 2014 survey carried out prior to the seabed disturbances caused by SD2 activities, but the quality of the seagrass was noted to have changed in the 2016 survey video footage, with the vast majority of seagrass being colonised by epiphytic growth and the video footage showing an increased presence of finer sediments within the seagrass.

Given the water depth at the NKX01 location is more than 20m it is considered unlikely that any significant marine flora would be present in this location.

5.4.4.2 Benthic Invertebrates

The abundance and species richness for each benthic taxonomic group recorded at each station associated with the 2018 NKX01 EBS, 2015 SWAP EBS (stations 20 to 24) and SOCAR Gurgan-Deniz EBS undertaken in 2014 are presented within Table 5.4.

[22] Zo*stera noltii* is the only species of seagrass present in the Caspian Sea (Ref. 67)

Table 5-4: Number of Invertebrate Species (S) and Percentage (%) of Total Abundance Recorded in Benthic Surveys Within and in the Vicinity of the NKX01Location

Taxon Group	2018 NKX01 EBS		Gurgan-Deniz EBS 2014		2015 SWAP EBS (20-24)	
	S	N (%)	S	N (%)	S	N (%)
Polychaete	3	17.6	5	44.4	4	36.2
Oligochaete	2	8.8	4	32.2	2	13.7
Cumacea	1	0.1	3	2.2	1	22
Cirripedia	1	57.9	1	9.4	1	0.1
Amphipoda	14	9.7	0	0.0	4	0.5
Decapod	1	0.0	1	2.6	1	0.1
Bivalve	3	5.3	4	9.1	3	27.4
Gastropoda	1	0.5	0	0.0	3	0.1
Insecta	1	0.1	0	0.0	0	0.0
Bryozoa	1	-	0	0.0	0	0.0
No. of species per sample	9-16		18-20		15-19	
No. of stations	38		6		5	
Total species per survey	28		21		24	
Average abundance/m^2		3104		3495		5524
Notes: S = number of species observed; N (%) = percentage abundance.						

The number of invertebrate species recorded within each survey ranged between 21 and 28. At the Project location the taxa recorded comprised 14 amphipoda (all native), 3 polychaete (two invasive and one native), 3 bivalve (invasive) and 2 oligochaete (both native). One species of cumacean, cirripede (barnacle), decapod (crab), insect, gastropod (snail) and bryozoan taxon was also recorded. All were native species except for the decapod. The variety of species recorded was greatest at the NKX01 location as compared to 2015 SWAP EBS (stations 20 to 24) and SOCAR Gurgan-Deniz survey however the lowest abundance was recorded at the Project location. Tables 5.5 and 5.6 present the species recorded per survey and the species per taxa and abundance per 2018 NKX01 EBS station respectively.

Table 5-5: Benthic Species Presence in Surveys Conducted within and in the Vicinity of the NKX01 Location

Species	2018 NKX01 EBS	2015 SWAP EBS (20-24)	Gurgan-Deniz EBS 2014
Oligochaetes			
Isohaetides michaelseni			✓
Psammoryctides deserticola	✓	✓	✓
Stylodrilus cernosvitovi			✓
Stylodrilus parvus	✓	✓	
Polychaetes			
Ampharetidae spp.			
Nereis diversicolor	✓	✓	✓
Nereis succinea	✓	✓	
Fabricia sabella		✓	✓
Hypaniola kowalewskii			✓
Manayunkia caspica	✓	✓	✓
Sabellidae spp.			
Crustaceans - Cumaceans			
Pterocuma pectinata		✓	✓
Stenocuma gracilis			✓
Stenocuma graciloides	✓		✓
Crustaceans - Cirripedia			
Balanus improvisus	✓	✓	✓
Crustaceans - Amphipoda			
Corophium chelicorne	✓		

Species	2018 NKX01 EBS	2015 SWAP EBS (20-24)	Gurgan-Deniz EBS 2014
Corophium curvispinum	✓		
Corophium monodon	✓		
Corophium mucronatum	✓		
Corophium nobile	✓		
Corophium robustum	✓		
Corophium spinulosum	✓		
Corophium volutator	✓		
Dikerogammarus haemobaphes	✓		
Gammaridae spp.		✓	
Gammarus ischnus	✓		
Gammarus pauxillus	✓		
Gmelina brachyura		✓	
Iphigenella acanthopoda		✓	
Iphigenella andrussovi	✓		
Niphargoides carausui	✓	✓	
Niphargoides obesus	✓		
Crustaceans - Decapoda			
Rhithropanopeus harrisii	✓	✓	✓
Mollusca - Gastropoda			
Caspia gmelini		✓	
Caspiohydrobia curta		✓	
Caspiohydrobia gemmata	✓	✓	
Mollusca - Bivalva			
Abra ovata	✓	✓	✓
Cerastoderma lamarcki	✓	✓	✓
Dreissena rostriformus distincta			✓
Mytilaster lineatus	✓	✓	✓
Bryozoa			
Conopeum seurati	✓		
Insecta			
Chironomus albidus	✓		

Table 5-6: Number of Benthic Taxa and Abundance (number per square metre (n/m²)) of Main Taxonomic Groups – 2018 NKX01 EBS

Station	Polychaete		Oligochaete		Cirripede		Cumacea		Amphipod		Decapoda		Insect		Bivalve		Gastropod		Bryozoan	
	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²	Taxa	n/m²
1	3	950	2	230	1	960	0	0	2	60	0	0	0	0	3	80	0	0	1	-
4	3	540	2	140	1	920	1	20	1	20	0	0	0	0	2	60	1	10	1	-
5	3	440	2	140	1	750	0	0	2	240	1	10	1	10	2	90	0	0	1	-
6	3	380	1	100	1	3050	0	0	3	270	0	0	0	0	3	190	0	0	1	-
7	3	740	2	160	1	4020	1	10	5	110	0	0	0	0	2	150	1	30	1	-
8	3	1560	2	200	1	140	0	0	5	110	0	0	0	0	1	10	0	0	1	-
9	3	830	2	650	1	2350	0	0	1	10	0	0	0	0	3	180	1	10	1	-
10	3	830	1	460	1	5320	0	0	1	10	1	10	0	0	2	840	0	0	1	-
11	3	290	2	100	1	1600	0	0	2	130	0	0	0	0	2	130	1	10	1	-
12	3	760	2	420	1	2150	0	0	4	80	0	0	0	0	3	270	1	10	1	-
13	3	680	2	210	1	300	1	30	5	250	0	0	0	0	3	120	0	0	1	-
14	3	670	2	120	1	420	0	0	4	330	0	0	0	0	1	20	0	0	1	-
15	3	570	2	450	1	540	1	20	0	0	0	0	0	0	1	10	1	10	1	-
16	3	880	2	330	1	1950	1	30	1	150	1	10	0	0	2	190	0	0	1	-
17	3	360	1	150	1	550	0	0	4	160	0	0	0	0	2	140	0	0	1	-
18	3	200	1	120	1	2920	0	0	3	310	0	0	0	0	2	90	0	0	1	-
19	3	350	2	660	1	1580	0	0	4	250	0	0	0	0	3	170	1	10	1	-
20	3	340	2	130	1	2310	0	0	2	20	0	0	0	0	3	340	0	0	1	-
21	3	200	2	570	1	560	1	10	3	920	0	0	0	0	3	150	0	0	1	-
22	3	1270	2	720	1	2500	1	10	1	10	0	0	0	0	3	60	1	10	1	-
23	3	550	2	450	1	500	0	0	6	910	0	0	0	0	1	40	1	10	1	-
24	3	510	2	280	1	200	0	0	7	580	0	0	1	10	2	120	0	0	0	-
25	3	340	2	110	1	4300	0	0	6	590	0	0	0	0	3	150	1	110	1	-
26	3	190	2	190	1	2850	0	0	4	200	0	0	0	0	3	130	1	10	1	-
27	3	510	2	300	1	1880	0	0	4	300	0	0	0	0	2	80	1	60	1	-
28	3	330	2	280	1	320	0	0	3	90	0	0	0	0	1	10	0	0	1	-
29	3	440	2	220	1	2420	0	0	3	100	0	0	1	30	2	80	0	0	1	-
30	3	720	2	560	1	1200	0	0	5	390	0	0	0	0	3	310	1	30	1	-
33	3	290	2	160	1	680	0	0	5	130	0	0	0	0	1	20	1	20	1	-
34	3	1660	2	440	1	340	0	0	1	10	1	10	1	10	2	40	0	0	1	-
35	3	750	1	470	1	11400	0	0	0	0	1	10	0	0	2	1550	1	40	1	-
36	3	220	2	70	1	1250	0	0	3	160	0	0	0	0	2	40	0	0	1	-
37	3	310	2	410	1	780	0	0	6	4310	0	0	0	0	2	110	1	30	1	-
38	3	640	2	180	1	3900	0	0	1	10	0	0	0	0	3	160	1	140	1	-

Within the 2018 NKX01 EBS, total abundance ranged from 1030 to 7470 individuals per m^2, with average and median values of 3104 and 3075 per m^2 respectively. The number of taxa present ranged from 9 to 16 per m^2, with average and median values of 12.

A large proportion of the total number of polychaete at each 2018 NKX01 EBS station consisted of juveniles of the two invasive *Nereis* species. *Nereis* is a burrowing omnivorous worm, and its abundance indicates that at least part of the benthic habitat was suitable for burrowing. The third polychaete species, *Manayunkia*, is native to the Caspian, and is a tube-building filter-feeder. The barnacle (cirripede) *Balanus* was present and very abundant at all stations; as with *Nereis*, large numbers of juveniles were present. These are likely to have recently settled and their presence indicates favourable conditions in terms of both physical habitat and food availability *Balanus* is a filter-feeder and requires a solid substrate on the sediment surface on which to settle. Maximum *Balanus* abundance was recorded at 2018 NKX01 EBS station 35. Cumacea, decapods and insects were only intermittently present, and in low abundance. Gastropods were present at 17 stations, in low to moderate abundance. Amphipods, the most diverse taxonomic group, were absent at only two stations (14 and 35) and were present in very low abundance at stations 3, 8, 9 19, 21, 34 and 38; abundance ranged from moderate to high at other stations. The highest amphipod abundance was recorded at station 37, attributable mainly to the species *Gammarus pauxillus*, which was the most consistently present and abundant amphipod over the whole 2018 NKX01 EBS.

The frequency of occurrence and relative abundance of both gastropods and amphipods is notable. These taxonomic groups are characteristic of offshore communities but are often absent in nearshore habitats where invasive species are present.

Bivalves were recorded at all 2018 NKX01 EBS stations, with between one and three species present. The burrowing filter-feeder *Cerastoderma* was the most consistently present and abundant. The epifaunal filter-feeder *Mytilaster* and the burrowing deposit-feeder *Abra* were less abundant and less consistently present than *Cerastoderma*. However, the highest single bivalve abundance record was for *Mytilaster* at station 35 (*Balanus* was also most abundant at this station). Juveniles of all three species were present.

The 2018 NKX01 EBS results show that a small number of taxa are numerically dominant throughout the survey area. *Balanus, Stylodrilus, Manayunkia, Gammarus, Psammoryctides* and *Nereis* were most abundant at the majority of stations. Of these taxa, only *Balanus* and *Nereis* are alien/invasive species. The barnacle *Balanus* was the most abundant organism at 26 of the 34 stations. The sabellid polychaete *Manayunkia* was most abundant at 5 stations (7, 12, 13, 23 and 34), the amphipod *Gammarus pauxillus* was most abundant at two stations (22 and 27) and the amphipod *Niphargoides carausui* was most abundant at station 20.

The habitat requirements of the species present vary considerably. Some, such as *Balanus* and *Mytilaster*, require a solid substrate, which at this location is provided by abundant stones and rocks. Others, such as amphipods, gastropods and the bivalve *Abra*, require a relatively muddy sediment on which to browse or into which to burrow. The mixture of species present at many stations suggests a mixture of habitat types on a very small scale, permitting species with different requirements to co-exist in close proximity to each other.

It is also notable that the species assemblage is characterised by abundant filter feeders – *Mytilaster, Balanus, Cerastoderma, Manayunkia*. For the first three of these, the abundance of juveniles suggests that feeding conditions (i.e., phytoplankton abundance) were good. The survey was undertaken in July, so primary production would be expected to be adequate, although perhaps less than would have been the case earlier in the year.

Bivalves, *Balanus* and polychaetes accounted for the bulk of biomass across the survey area. Bivalves and *Balanus* accounted on average for 83% of the biomass per station. Their combined contribution was less than 70% only at stations 7, 14, 23 and 34; overall biomass was low at these stations and was dominated by polychaetes. The dominance of *Balanus* and bivalves is in part attributable to their abundance, and in part attributable to the fact that these organisms have calcareous shells which contribute significantly to the weight of individuals. After *Balanus* and bivalves, polychaetes contributed most to biomass, with oligochaetes and amphipod biomass roughly 4 and 2% of polychaete biomass respectively.

5.4.5 Water Column Physical and Chemical Environment

5.4.5.1 Temperature and Salinity

Differential climatic conditions between the Caspian Basins cause large latitudinal variations in sea surface temperature. During the winter, the Northern Basin freezes while temperatures in the Central and Southern Basins remain well above freezing (10 to 11°C), although some ice may form during severe winters (Ref. 21).

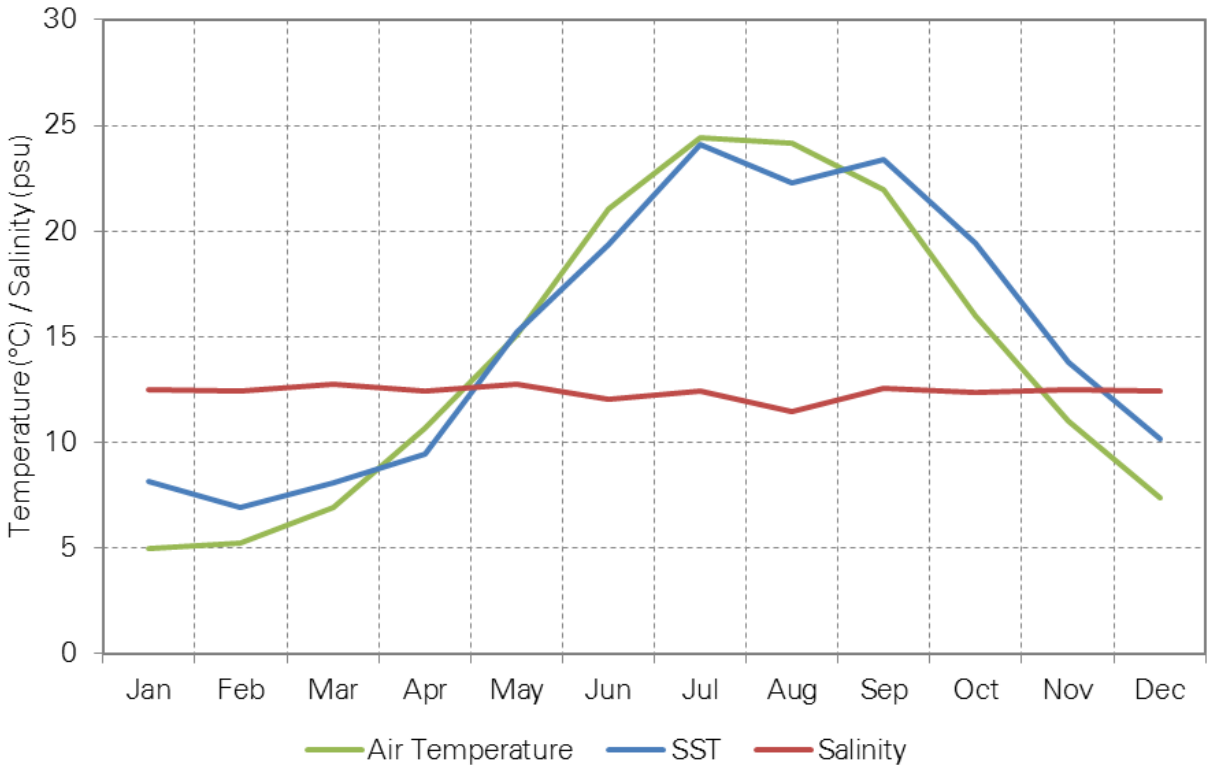
During summer, the waters in the Southern Basin become stratified and a strong thermocline develops that inhibits vertical mixing. Surface water temperatures can reach a maximum of approximately 28ºC in August (Ref. 29). Temperatures at depth remain approximately 6ºC all year round (Ref. 1).

During summer and autumn the thermocline moves deeper reflecting the increase in solar energy warming the surface water. As the thermocline deepens, the temperature stratification becomes less significant until the thermocline eventually breaks down during late autumn and winter months (Ref. 6). The sea surface temperatures recorded during the 2018 survey at the Project location in July 2018 varied between approximately 27 and 28.5ºC.

Surface salinity levels vary with water temperature (due to evaporation rates), distance to fresh water sources and the riverine input. Salinity in the Southern Basin increases from west to east due to the lack of freshwater inputs along the east Caspian coast. The salinity of near seabed and in the central water column is more stable in comparison with surface water salinity. The salinity of the surface water in the vicinity of the Project location is considered to be relatively constant all year round at approximately 11.5 Practical Salinity Units (PSU) based on the 2018 survey results.

Figure 5.5 shows the expected variation (Ref. 30) of air temperature, sea surface temperature (SST) and sea surface salinity (SSS) in the vicinity of the Project location.

Figure 5.5: Monthly Average Air Temperature, Sea Surface Temperature and Sea Surface Salinity in the Vicinity of the Project Location



5.4.5.2 Oxygen Regime

The deep water areas of the Southern Basin are characterised by lower dissolved oxygen levels compared to the Northern and Central Basins. This is caused among other factors, by poor penetration of sunlight and reduced photosynthesis activity, the deficiency of large river inflows and the stratification of the water column during the summer. Dissolved oxygen levels in the Basin decrease with depth and saturation can reach levels as low as 10% at 600m depth (Ref. 31).

Oxygen levels in the Southern Basin are also highly influenced by anthropogenic pressures and marine contamination. In the nearshore waters of Azerbaijan, the oxygen regime and concentration are understood to be greatly influenced by wastewater and sewage discharges. While oxygen levels across the Northern Basin are known to vary between 4.9 and 10.6 mg/l (Ref. 32), oxygen levels recorded in Project location during the 2018 EBS varied between 5.9-6.6 mg/l.

Throughout the year the surface waters of the Southern Basin are characterised by high oxygenation with high saturation levels occurring in the spring due to phytoplankton activity. During summer, the water column becomes stratified resulting in decreased oxygen levels below the thermocline (Ref. 33).

5.4.5.3 Water Quality

Water samples were collected at four of the 2018 NKX01 EBS monitoring stations (5, 9, 30 and 33) and at two of the 2015 SWAP EBS locations (W7 and W8a). Table 5.7 summarises the nutrient and organic and non-organic chemical levels recorded across the surveys while a summary of the minimum, maximum and average heavy metal concentrations is presented in Table 5.8.

Table 5-7: Chemical Analysis & Nutrient Levels Recorded in Water Column Surveys within and in Vicinity of the NKX01 Location

		2018 NKX01 EBS		2015 SWAP EBS (W7/W8a)	
Parameter		**Value**	**Station**	**Value**	**Station**
TSS (in mg/l)	Min	<2	30, 33	<2	W7 and W8a
	Mean	2.1	-	<2	
	Max	2.3	05	<2	
BOD-5 (mg/l)	Min	2	09	6.9	W8a
	Mean	3.2	-	7.2	-
	Max	4	05,33	7.5	W7
COD (mg/l)	Min	22	09	16.7	W8a
	Mean	23	-	17.5	-
	Max	24	05	18.2	W7
Nitrites NO_2–N (µg/l)	Min	<0.2	09, 30	<0.2	Both stations
	Mean	0.2		<0.2	
	Max	0.2	05,33	<0.2	
Nitrates NO_{2+3} –N (µg/l)	Min	<10	All Stations	<10	Both stations
	Mean	<10		<10	
	Max	<10		<10	
Ammonium NH_4-N (µg/l)	Min	<10	All Stations	<10	Both stations
	Mean	<10		<10	
	Max	<10		<10	
Total N (µg/l)	Min	509	30	382	W7
	Mean	570	-	458	-
	Max	629	05	535	W8a
Phosphates, PO_4 –P (µg/l)	Min	2.99	33	<1.6	Both stations
	Mean	6.1	-	<1.6	
	Max	7.75	09	<1.6	
Total P(µg/l)	Min	20	09	6.5	W8a
	Mean	20.6	-	9.3	-
	Max	21.6	05	12	W7
Silicates SiO_2-Si (µg/l)	Min	141	09	156	W7
	Mean	160	-	184	-
	Max	171	05	213	W8a

Table 5-8: Heavy Metal Concentrations Recorded in Water Column Surveys within and in Vicinity of the NKX01 Location

		NKX01 EBS 2018		SWAP EBS 2015 (W7/W8a)	
Parameter		Value	Station	Value	Station
Cadmium	Min	<0.1	All Stations	<0.01	W8a
	Mean	<0.1		0.019	-
	Max	<0.1		0.028	W7
Chromium	Min	0.04	09	0.49	W7
	Mean	0.047	-	0.5	-
	Max	0.057	05	0.51	W8a
Copper	Min	6.93	30	1.67	W8a
	Mean	7.02	-	2.13	
	Max	7.11	33	2.58	W7
Iron	Min	6.58	30	14.7	W7
	Mean	7.77	-	16.3	-
	Max	9.7	05	17.9	W8a
Lead	Min	0.34	05	0.19	W8a
	Mean	0.39	-	0.23	-
	Max	0.45	30	0.27	W7
Zinc	Min	5.64	30	2.7	W8a
	Mean	6.06	-	12.55	-
	Max	6.46	09	22.4	W7

Table 5.7 shows that the results from the 2018 NKX01 EBS indicated values for BOD, COD and total suspended solids that were low. Nitrite, nitrate and ammonium concentrations were close to, or below, the limits of detection. Total nitrogen and silicate concentrations were high; these values probably represent the cell contents of phytoplankton present in the samples. The results obtained were similar to those recorded during the 2015 SWAP EBS at locations W7 and W8a with the exception of phosphates and total phosphorus which were two to three times higher within the 2015 SWAP EBS samples. The reason for this is not known.

Concentrations of THC, PAH and phenols recorded within the samples from the 2018 NKX01 EBS were below the limit of detection in all samples (Table 5.8). Cadmium was also below the limit of detection. Concentrations of cobalt, copper, iron nickel, led and zinc were characteristic of Azerbaijan waters. When comparing to the results from the SWAP 2015 survey there was some variation in the concentrations recorded with concentrations of chromium ten times lower at the Project location, concentrations of copper, lead and zinc around two to three times higher and concentrations of iron around two times lower. In general, all heavy metals concentrations recorded were low and were well below the maximum allowable concentrations (MAC) for good fisheries water quality (Azerbaijan MAC Fisheries Waters). The survey results indicate that the water samples were chemically uncontaminated, and not subject to significant particulate loading.

It should be noted, however, that the surveys are generally conducted over short periods during a single season and therefore it cannot be inferred that contamination is low at all times of the year. Nevertheless, the results do indicate no evidence of persistent contamination.

5.4.6 Water Column Biological Environment

5.4.6.1 Plankton

Phytoplankton

The phytoplankton of the southern Caspian Sea is comprised of marine, euryhaline, and brackish water forms. The most numerous phytoplankton of the Southern Caspian, in terms of both numbers and taxa are diatoms, followed by dinoflagellates and cyanophytes (blue-green algae). Of the diatoms, the invasive species *Rhizosolenia calvaris* is often the most abundant and is now found to be generally

present throughout the year. This species has an exceptionally large cell size, and combined with its abundance, can be responsible for up to 90% of the total phytoplankton biomass (Ref. 4).

There are some broad spatial patterns in productivity evident in the Caspian Sea with higher levels of production (as measured by chlorophyll concentration) observed in some shallow water areas compared to open ocean, particularly where nutrient levels are high near urban coastal areas.

Table 5.9 presents a summary of phytoplankton community composition results recorded in the water column survey locations shown in Figure 5.4 with the species recorded presented in Table 5.10.

Table 5-9: Summary of Phytoplankton Community Composition in the Vicinity of the NKX01 Location

Taxon Group	2018 NKX01 EBS		2015 SWAP EBS (west)	
	S	N (%)	S	N (%)
Diatoms	20	43.3	31	1.8
Dinoflagellates	11	53.7	4	15.5
Green algae	4	2.9	7	0.1
Blue-green algae	1	0.1	7	82.6
Total species observed	36		49	
Notes: S = number of species observed; N (%) = percentage abundance.				

Table 5-10: Species of Phytoplankton Observed Within and in the Vicinity of the NKX01 Location

Species	2018 NKX01 EBS	2015 SWAP EBS (west)
Diatoms		
Actinocyclus ehrenbergii	✓	✓
Amphora ovalis		✓
Chaetoceros rigidus	✓	
Chaetoceros pendulus	✓	✓
Chaetoceros peruvianus		✓
Coscinodiscus gigas	✓	
Coscinodiscus granii	✓	✓
Coscinodiscus jonesianus	✓	
Coscinodiscus perforatus	✓	✓
Coscinodiscus radiatus	✓	✓
Cyclotella meneghiniana	✓	✓
Diploneis smithii	✓	
Ditylum brightwellii	✓	
Navicula cryptocephala v. veneta		✓
Navicula hungarica		✓
Navicula radiosa		✓
Nitzschia acicularis	✓	✓
Nitzschia reversa	✓	✓
Nitzschia tenuirostris	✓	
Pleurosigma elongata	✓	✓
Pleurosigma salinarum		✓
Psevdosolenia calcar-avis	✓	✓
Synedra ulna		✓
Thalassionema nitzschioides	✓	
Thallasionema nitzschioides		✓
Thallassiosira caspica	✓	
Dinoflagellates		
Glenodinium behningii	✓	
Goniaulax polyedra	✓	
Goniaulax polyedra		✓

Species	2018 NKX01 EBS	2015 SWAP EBS (west)
Peridinium conicum	✓	✓
Peridinium trochoideum	✓	
Prorocentrum cordatum	✓	
Prorocentrum micans	✓	
Prorocentrum proximum	✓	
Cholorophytes		
Ankistrodesmus acicularis		✓
Ankistrodesmus longissimus var acicularis	✓	
Ankistrodesmus pseudomirabilis v. spiralis		✓
Binuclearia lauterbornii	✓	✓
Binuclearia var. crassa	✓	✓
Chlamydomonas sp.	✓	✓
Pediastrum Boryanum v longicorrne		✓
Cyanophytes		
Anabaenopsis cunningtonii		✓
Merismopedia pynktata		✓
Oscillatoria chalybea		✓
Oscillatoria geminata	✓	

The results show the phytoplankton community is typically composed of diatoms, dinoflagellates, chlorophyta (green algae) and cyanophyta (blue-green algae). For the 2018 NKX01 EBS numerically, the phytoplankton community was found to be dominated by the diatoms *Thalassionema, Actinocyclus, Nitzchia* and *Chaetoceros*, and the diatoms *Prorocentrum micans* and *Prorocentrum cordatum. Pseudosolenia* accounted for between 5 and 45% of total biomass, and *Prorocentrum micans* accounted for between 33 and 78% of total biomass; together, they accounted for 78-82% of the biomass in each of the four samples.

In the 2015 SWAP EBS, the phytoplankton community was found to be dominated by high numbers of blue-green algae and very few diatoms were present although the number of diatom species is high.

Phytoplankton growth and composition follows a seasonal cycle with two ‘blooms’ of peak biomass in the Caspian Sea - a large bloom in the autumn and a smaller bloom in the spring. The seasonal cycle of production reflects seasonal changes in sunlight and water temperature and the availability of nutrients. During the winter phytoplankton production is low due to low water temperatures, low light levels and a mixed water column. Changes in light and temperature in the spring, and the resulting stratification of the water column trapping nutrients in the upper layers, results in a dramatic increase in growth, particularly by diatoms.

Growth remains high during the summer but there may be a successional shift from diatoms to dinoflagellates, typical of phytoplankton cycles in marine systems. Through the autumn the warm waters continue to be productive, often with a second higher peak in production levels, before phytoplankton biomass decreases again in winter (Ref. 66).

Zooplankton

The southern region of the Southern Basin has been reported to support around 180 species of zooplankton comprising protists, rotifers, copepods, cladocera and pelagic crustaceans such as mysids and the larvae of a range of invertebrate organisms (Ref. 1). The three main types of zooplankton found in the Caspian Sea are:

- **Copepods** - small, shrimp-like animals often no more than 1mm long, some native to the Caspian Sea and some introduced from other areas Copepods are generally the numerically dominant component of the zooplankton;
- **Cladocerans** - 'water fleas', often larger than copepods (1 - 5mm long), predominantly native to the Caspian; and
- **Ctenophore** – the 'comb jelly' *Mnemiopsis leidyi* is not native and was first recorded in the Caspian Sea in 1999. This species may have been transported into the Caspian Sea from the Black Sea.

Prior to 2000, the zooplankton present was largely dominated by naturalised and endemic species of copepods and cladocerans. Since 2003 however, native and endemic taxa have been rare or absent in BP-sponsored surveys, whilst the invasive copepod *Acartia* and the invasive ctenophore (comb jellyfish) *Mnemiopsis.* The latter is an effective predator on both zooplankton and on fish larvae and has had a marked effect on secondary productivity in the mid- and south Caspian. The persistence of *Acartia* might, in part, be due to its reproductive behaviour; whilst most native copepods and Cladocera keep their embryos in egg sacs or brood pouches until the nauplii hatch, *Acartia* releases its eggs directly into the water column. Since embryos spend less time associated with females, they are less likely to be consumed when females are predated by *Memiopsis.*

The zooplankton species recorded during the 2015 SWAP EBS (western locations) and the 2018 NKX01 EBS water column surveys are summarised within Table 5.11.

Table 5-11: Species of Zooplankton Observed within and in the Vicinity of the NKX01 Location

Species	2018 NKX01EBS	2015 SWAP EBS (west)
Cladocera		
Pleopis polyphemoides	✓	✓
Copepoda		
Acartia tonsa	✓	✓
Ctenophora		
Mnemiopsis leidyi	✓	✓
Larvae		
Larvae Balanus	✓	✓
Larvae Copepoda	✓	✓
Larvae Polychaete	✓	
Rotatoria		
Synchaeta Stylata	✓	

The survey confirmed rotifer *Synchaeta* and the cladoceran *Pleopis* were present in low numbers across the 2018 NKX01 EBS stations, as were barnacle and polychaete larvae. The invasive ctenophore *Mnemiopsis* was also present in low numbers in both surveys. The 2018 NKX01 EBS and 2015 SWAP EBS samples were both dominated by the invasive copepod *Acartia tonsa,* although at a maximum density of about 5 individuals per litre at the Project location including absolute abundance was low. Small numbers of copepod larvae were also present in the 2018 NKX01 EBS samples; although these were not identified to species, they would almost certainly be *Acartia* larvae. Although *Acartia* was numerically dominant in both surveys, absolute density was very low, with a maximum value equivalent to about 5 individuals per litre at the Project location. Barnacle, mussel and annelid larvae were present in the 2018 NKX01 EBS plankton samples.

Seasonal abundance of zooplankton is closely related to that of phytoplankton with peaks in abundance usually observed in the spring and autumn (approximately one month after the phytoplankton peak). Thus, there are large temporal changes in both the abundance and presence of zooplankton species. The surveys conducted are therefore indicative.

5.4.6.2 Fish

The Caspian Sea's unique geography, climate and hydrological characteristics create a range of different habitats that support a large diversity of fish species. The existence of shallow areas, deep depressions, and a wide range of salinities provide different environmental conditions and habitats favourable for species diversity. According to the latest literature, approximately 151 species and subspecies of fish can be found in the Caspian and associated river deltas (Ref. 34). Due to the Caspian Sea's isolation from other water bodies, the sea is characterised by the presence of many endemic species and the presence of 54 endemic fish species (Ref. 35).

Fish commonly found in the Central and Southern Caspian Sea can be categorised into the three following categories:

- **Migratory species**: this includes sturgeon and shad species whose key spawning grounds are the river Kura in the Southern Caspian and rivers Terek and Samar, which flow into the Central Caspian[23]. These species migrate in water depths of between 50 to 100m. Some species of sturgeon (i.e. Beluga) spend the spring and summer mostly in the Northern and Central Caspian and in autumn migrate southwards for wintering.
- **Other species (Semi- Migratory)**: this includes kilka (herring family), the most abundant fish in the Caspian. Kilka are widely distributed in the Caspian and are important prey for other species such as sturgeon, salmon and the Caspian seal. Mullet were introduced from the Black Sea in the 1930s and normally overwinter in the Southern Caspian and in spring migrate to feeding grounds in the Central and Northern Caspian.
- **Resident species**: several non-commercial species such as gobies are found in all regions of the Caspian Sea, predominantly in shallower areas (up to 30 to 70m in spring and summer, migrating to greater depths in winter). Gobies are second only to herring in the number of species in the Caspian Sea.

The most common species of fish in the Caspian Sea are kilka. However, in recent years the abundance and distribution of kilka has altered in response to a number of factors including overfishing and the presence of the invasive ctenophore (*Mnemiopsis leidyi*) which feeds on the zooplankton prey of many fish species. In addition, in April and May 2001, a mass mortality of 166,000 tonnes of kilka (mainly anchovy kilka) was recorded in the Central and Southern Caspian Sea. Earthquake data reveals that, in the first quarter of 2001, the local Absheron seismic plate was active, the water and gas systems in the soil were unstable suggesting a series of natural hydro-volcanic events occurred, resulting in the release of significant gas and poisonous substances into the water column. It is thought that this event was a significant contributor to the mass kill (Ref. 36).

Data from Department on Protection and Reproduction of Aquatic Bioresources (DPRAB) indicates that the total quantity of kilka (traditionally the most important species for the fishing industry) landed in the Azerbaijan Sector of the Caspian Sea has reduced by 99% from 1999 (271,000 tonnes) to 2016 (316 tonnes). The reduction in kilka species caught by the commercial fishing fleet over the past 10-15 years is generally attributed to the impact of the increased presence of *M. leidyi*, which is particularly evident since 2001. Recently there is evidence to suggest that kilka have started feeding on zooplankton *Acartia*. The prevalence of *Acartia* (*clause and tonsa*) within the structure of current zooplankton communities instead of *Eurythemora, Limnocalanus* and *Calanipeda*, is leading to a change in composition of the diet of the kilka (mainly the anchovy kilka).

As well as a reduction in catch size, the proportional share of species in catches has changed from being dominated by anchovy kilka (*Clupeonella engrauliformis*) to ordinary Caspian kilka (*Clupeonella cultriventris*). In addition, major aggregations of kilka have been observed in nearshore locations in less than 50m of water, such as at Oil Rocks rather than in deeper waters at the traditional fishing banks further offshore. The most common species of fish in the Caspian Sea after kilka is mullet.

Throughout their lifecycle, fish use spawning, feeding and wintering habitats. For fish species with limited migratory range these three habitats often coincide. Some fish species spend a certain amount of time at sea, but during the wintering and spawning seasons move to rivers. Some marine fish can undertake considerable migrations across the sea, while others inhabit relatively limited areas of the sea. The migration routes and spawning areas of the main fish species passing through the Southern Caspian are shown in Figures 5.6 and 5.7. Table 5.12 presents the fish species known to be present in the Southern Caspian including along the Absheron Ridge, their protection status, hearing sensitivity, the estimated water depth they are present per season and location where spawning takes place (Ref. 37).

In general, the main distribution of fish species in the Caspian Sea is within the shallow water shelf areas. Maximum concentrations of fish are typically found at depths of up to 75m for the majority of the year but it is common for Caspian fish species to migrate to warmer waters for overwintering and to migrate to nutrient rich shallow areas of the north or river deltas in the spring / summer for spawning

[23] Methods such as release of artificial sturgeon larvae and use of fish farms in an attempt to increase the sturgeon populations that have been affected by historic overfishing and reduced access to spawning grounds e.g. through damming, has been widespread through the Caspian since the 1950s onwards, in addition to more recent projects aimed at re-establishing access to native spawning grounds, where possible.

and feeding (Ref. 38). The coastal region is important for non-migratory species as it provides breeding and nursery habitat for a number of species during spring, summer and autumn.

Pelagic species such as kilka are typically present in the waters of the Southern Caspian year round, in greatest numbers during the main spawning and migration periods. Typically, they are present the shallowest water depths during this period, including the shallow waters surrounding the Absheron Peninsula with common kilka (*Clupeonella delicatula caspia*) present in water depths of 20-40m and moving to shallower waters (5-10m depth) to spawn. During autumn and winter, it is common for anchovy (*Clupeonella engrauliformis*) and big-eyed kilka (*Clupeonella grimmi*) to remain in the Southern Caspian in water depths from 60-100m in autumn, increasing to up to 450m in winter.

Goby species are very common and widespread in the Caspian Sea. Many goby species usually stay in shallow waters (up to 20 to 200m) and some migrate through and into deeper waters during autumn and into winter. There are occasions when they are found at greater depths (between 200-300m to 500m depths) but not typically. They are mainly distributed in the Central and Southern Caspian and avoid the coastal areas freshened by river flows.

Sturgeon species including critically endangered Beluga sturgeon (*Huso huso*) are generally found at water depths of between 50m and 100m. They generally spend spring and summer mostly in the northern and central parts of the Caspian Sea, spawning within riverine environments during spring before migrating southwards in autumn and remaining in the south during winter. They may pass through the waters surrounding the Absheron Peninsula during migration.

The seasonal distribution of most shad species and the water depths they are typically found at is similar to sturgeon species. The exception being big eyed shad (*Alosa brashnikovi autumnalis)* that are known to spawn in the shallowest waters along the coast of the Southern Caspian during spring before moving to greater depths during summer, autumn and winter.

Mullet spawn within the deep waters of the Central and Southern Caspian between the end of August to early September and migrate south in the autumn to dwell in the very south of the Caspian Sea in the winter, typically in deeper water depths, including waters ranging up to 600m. They would not be expected to be present in any numbers in the shallow waters surrounding the Absheron Peninsula.

The species most likely to be present within the shallow waters surrounding the Absheron Peninsula and specifically within the vicinity of the Project location are resident species including gobies in addition to species such as sandsmelt, Caspian pipefish and stickleback. While present in water depths of 20m or more year round, these species typically breed in waters of up to 10m deep, more commonly in shallow waters of up to 4m deep. In addition, common kilka (*Clupeonella delicatula caspia*) would be typically present in water depths of 20-40m during spring, summer and autumn with presence in the waters surrounding the Absheron Peninsula during spring migration in particular.

Figure 5.6: Kilka and Beluga Migration Routes

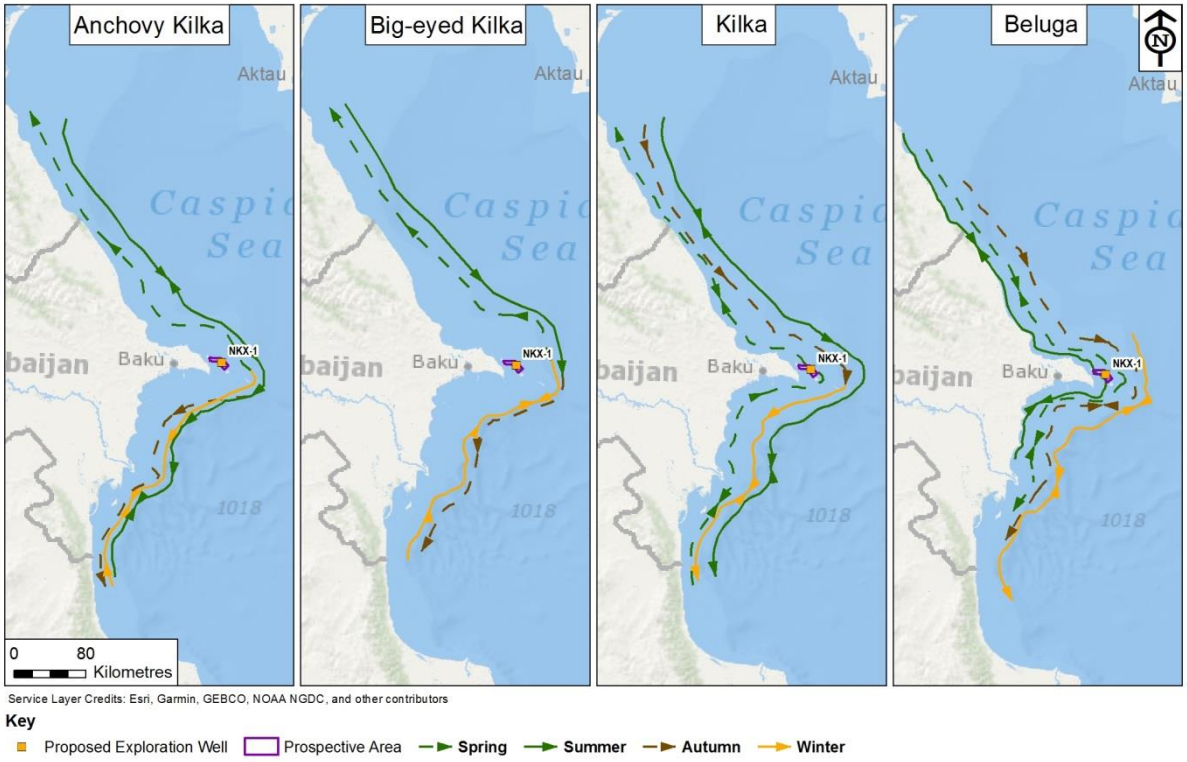


Figure 5.7: Shad, Sturgeon and Mullet Migration Routes

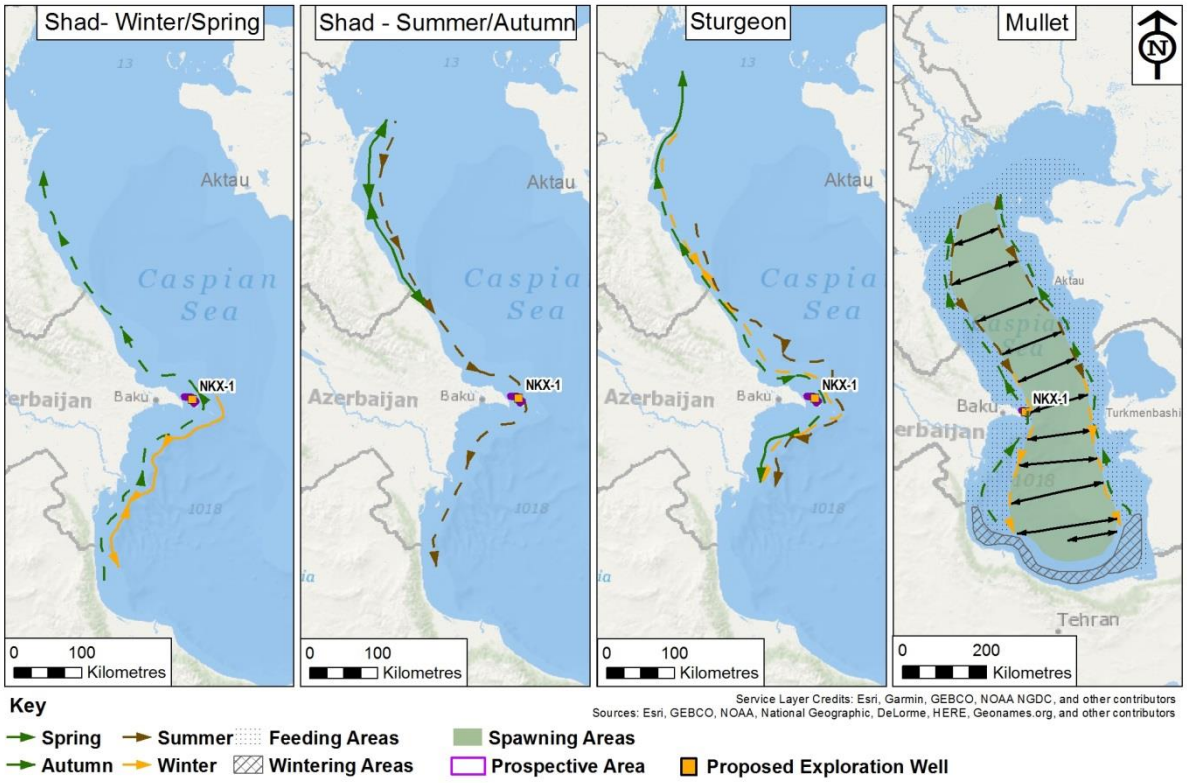


Table 5-12: Summary of Fish Species Expected to Present in the Southern Caspian Sea Including Along the Absheron Ridge

Name of Species	Common Name	Hearing Group	IUCN Red List Status	Spawning Location	Reason for Presence in Southern Caspian (Including Along Absheron Ridge)
STURGEON (Family Acipenseridae)					
Huso huso	Beluga	SB	CR[#]	River Volga, Ural, Kura, Sefīd-Rūd and sometimes Terek.	Spring migration to spawning areas located in Volga, Ural and Sefīd-Rūd Rivers. Typically found at water depths between 50-70m in spring/summer and 70-100m in autumn/winter. Feeding and breeding in sea feeding sites in spring/summer/ autumn months. Wintering areas in winter.
Acipenser güldenstädtii	Russian sturgeon	SB	EN[#]	River Volga, Ural, sometimes Terek and Kura.	
Acipenser güldenstädtii persicus natio cyrensis	Kura (Persian) sturgeon	SB	EN[#]	River Volga, Ural, Kura, Sefīd-Rūd and sometimes Terek.	
Acipenser nudiventris	Kura barbel sturgeon	SB	EN[#]		
Acipenser stellatus	Kura (South-Caspian) stellate sturgeon	SB	EN[#]		
KILKA (genus Clupeonella, family Clupeidae – herring)					
Clupeonella engrauliformis	Anchovy kilka	SB/HS	LV	The eastern part of the Central and South Caspian in the area of circular flows at depths of 50 to 200m in the upper layers of water not less than 15 to 20m from the surface.	Spring migration to spawning areas. Feeding and breeding in sea feeding sites in 50-130m depth in spring/summer/autumn months. Autumn migration to the wintering areas in the south. Wintering areas in winter.
Clupeonella grimmi	Big-eyed kilka	SB/HS	LV	The eastern part of the Central and South Caspian in the area of circular flows at depths of 350 to 450m in the upper layers of water not less than 15 to 20m from the surface.	Spring migration to spawning areas. Feeding and breeding in sea feeding sites in 80-450m depth in spring/summer/autumn months. Autumn migration to the wintering areas in the south. Wintering areas in winter.
Clupeonella delicatula caspia	Caspian common kilka	SB/HS	LV	North Caspian in 1-3 m depth, down part of deltas of Volga, on the opposite side of the mouth of the Ural River, Buzachi peninsula, up to 10m depth in shallow waters of the Middle and South Caspian.	Spring migration to spawning areas. Feeding and breeding in sea feeding sites in 20-40m depth in summer/autumn months. Wintering areas in winter.
SHAD (genus Alosa Cuvier, family Clupeidae – herring)					
Alosa caspia caspia	Caspian shad	SB/HS	LC	At a depth of 1 to 3m in Northern Caspian, opposite of Volga and Ural River mouth.	Spring migration to spawning areas. Feeding and breeding in sea feeding sites in 40-100m depth in summer/autumn months. Autumn migration to the wintering areas. Wintering areas in winter.
Alosa brashnikovi autumnalis	Big-eyed shad	SB/HS	LC	At a depth of 2-6m in western and eastern coastal area of the South Caspian.	
Alosa kessleri volgensis	Volga shad	SB/HS	LC	Volga River and in rare cases in Ural and Terek Rivers.	
Alosa kessleri kessleri	Black-backed shad	SB/HS	LC	Volga River and in rare cases in Ural river.	
Alosa braschnikowii braschnikowii	Dolgin shad	SB/HS	LC	At a depth of 1 to 4 m in the Northern Caspian, in the opposite side of Ural River mouth, Buzaji peninsula and around Saridash.	
Alosa saposchnikowii	Big-eyed shad	SB/HS	LC	At a depth of 1 to 6 m in the Northern Caspian, in the opposite side of Volga and Ural River mouth.	
CARP (family Cyprinidae)					
Rutilus frisii kutum	Kutum/Black Sea Roach	SB	LC	Kura and Terek Rivers, rivers of the western coast of the Southern Caspian, Small Gizilagaj Bay.	Spring migration to spawning areas. Spring/Autumn feeding route.

Name of Species	Common Name	Hearing Group	IUCN Red List Status	Spawning Location	Reason for Presence in Southern Caspian (Including Along Absheron Ridge)
					Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Rutilus rutilus caspicus	Roach	SB	LC	Small Gizilagaj Bay, Kura River, the rivers of the western coast of the Southern Caspian, extremely rarely in the Terek River.	Spring migration to spawning areas. Spring/Autumn feeding route. Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Aspius aspius taeniatus	Asp	SB	LC	Kura River, as well as in the rivers along the western shores of the South Caspian and Small Gizilagaj Bay, very rarely in Terek River.	Autumn/winter/spring migration to spawning areas. Migration for feeding during the whole year. Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Lusibarbus brachycephalus caspius	Caspian barbel	SB	LC	Kura River, as well as in the rivers along the western shores of the South Caspian and Small Gizilagaj Bay, very rarely in Terek River.	Spring/summer migration to spawning areas. Feeding and breeding in spring/summer/autumn months. Wintering areas in winter. Typically found at depths of up to 20-25m throughout the year.
Abramis sapa bergi	White-eye bream	SB	LC	Kura River, as well as in the rivers along the western shores of the South Caspian and Small Gizilagaj Bay, very rarely in Terek River.	Migration to spawning areas in winter and early spring. Southwest migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Pelecus cultratus	Sabrefish	SB	LC	Rivers Volga, Ural, Kura and Terek as well as in the rivers of the Lankaran coast.	Autumn/winter migration to spawning areas. North-south migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Abramis brama orientalis	East bream	SB	LC	Rivers Volga, Ural, Kura and Terek, rivers of the Lankaran coast.	Migration to spawning areas in winter and early spring. Southwest migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 10-25m throughout the year.
Chalcalburnus chalcoides	Danube bleak	SB	LC	Rivers Kura, Terek and other rivers of the western coast of the Central and Southern Caspian, extremely rarely in the Volga and Ural rivers.	Migration to spawning areas throughout the year and mainly end of autumn and winter months. Southwest migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 20-30m throughout the year.
Vimba vimba persa	Caspian bream	SB	LC	Kura and Terek Rivers, extremely rarely in the Volga River.	Spring migration to spawning areas. North-south migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 20-25m throughout the year.
Cyprinus carpio Linnaeus	Carp	SB	LC	Volga, Ural and Terek rivers as well as the Small Gizilagaj Bay, the Kura River and rivers of the southern coast.	Spring migration to spawning areas. North-south migration for feeding along the shore during the whole year. Wintering areas in winter. Typically found at depths of up to 8-20m throughout the year.
MULLET (family Mugilidae)					
Liza aurata	Golden mullet	SB	LC	Central Caspian (300 to 600m depth).	Spring/summer migration to the Central Caspian for feeding. Autumn/winter migration to wintering areas. Feeding and breeding in the sea feeding areas throughout the year. Typically found at depths of up to 400-500m throughout the year.

Name of Species	Common Name	Hearing Group	IUCN Red List Status	Spawning Location	Reason for Presence in Southern Caspian (Including Along Absheron Ridge)
Liza saliens	Leaping mullet	SB	LC	South and Central Caspian (5 to 700m depth).	Spring migration for feeding. Spring/summer migration to the spawning places located in deep-water areas of the sea. Autumn/winter migration to wintering areas. Feeding and breeding in the sea feeding areas throughout the year. Typically found at depths of up to 200-300m throughout the year.
GOBY (family Gobiidae)					
Neogobius bathybius	Deepwater goby	No SB	LC	Central and Southern Caspian, west coast, up to 10-20 m, sometimes up to 3-5 m.	Resident species dominate in shallow waters (30-200m in spring/ summer months), but can be also found in deeper areas of the sea in winter months (up to 300m).
Mesogobius nonultimus	Nonultimus goby	SB	LC		
Benthophilus grimmi	Grimms' pugolovka	No SB	LC		
Benthophilus ctenolepidus	Persian goby	No SB	LC		
Benthophilus svetovidovi	Pugolovka svetovidovi	No SB	LC		
Knipowitschia Iljini	Ilyin goby	SB	LC	Central and Southern Caspian, west coast, up to 70-80m, sometimes up to 40-50m.	Resident species dominate in shallow waters (100-300m in spring/ summer), but can be also found in deeper areas of the sea in winter months (300-500m).
Benthophilus leptocephalus	Slender-snouted pugolovka	No SB	LC		
Benthophilus leptorhynchus	Slender-snouted pugolovka	No SB	LC		
Anatrirostrum profundurum	Pugolovka-platypus	SB	LC		
Benthophilus stellatus leobergius Iljin	Caspian tadpole goby	No SB	LC	North, Central and Southern Caspian, west coast, up to 1-10m, included deltas of Volga, Kura, Terek, rivers.	Resident species dominate in shallow waters (1-10m), but can be also found in deeper areas of the sea in winter months (20-50m).
Neogobius fluviatilis	Monkey goby	No SB	LC		
Knipowitschia longicaudata	Knipovich long-tailed goby	SB	LC		
Neogobius kessleri gorlap	Caspian big-headed pugolovka	No SB	LC		
Neogobius ratan goebeli	Ratan Goby	No SB	LC		
Benthophilus macrocephalus Pallas	Big-headed pugolovka	No SB	LC		
Neogobius caspius	Caspian goby	No SB	LC	North, Central and Southern Caspian, west coast, up to 1-10m, included deltas of Volga, Kura, Terek, rivers.	Resident species dominate in shallow waters (1-10m), but can be found in deeper areas of the sea in winter months (60-150m).
Benthophilus granulosus	Granular pugolovka	No SB	LC		
Benthophilus Baeri	Baer pugolovka	No SB	LC		
Neogobius melanostomus affinis	Round goby	No SB	LC		
Neogobius syrman eurystomus	Caspian syrman goby	No SB	LC		
Others					
Salmo trutta caspius	Caspian brown trout	SB	EN[#]	Kura, Terek, Samur, Keyranchay rivers, small rivers of the western coast of the Central and South Caspian Sea, in rare occasions Volga and Ural rivers.	Autumn/winter migration to the spawning places. Feeding and breeding in the sea feeding areas throughout the year. Typically found at depths of up to 40-50m throughout the year.

Name of Species	Common Name	Hearing Group	IUCN Red List Status	Spawning Location	Reason for Presence in Southern Caspian (Including Along Absheron Ridge)
Atherina mochon pontica nation caspia*	Big-scale sandsmelt	SB	LC	In all areas of the sea, at the depth of 1.5-2.0m, mainly in the sandy seabed areas, mainly in the Gizilagaj Bay.	Present throughout the year for spawning, feeding and wintering in shallow coastal waters. Typically found at depths of up to 50m.
Gasterosteus aculeatus	Three-spined stickleback	SB	LC	Shallow parts of the rivers flowing into the Caspian Sea (estuaries) Volga, Ural, Kura, Terek rivers and others.	Present throughout the year for spawning, feeding and wintering in shallow coastal waters. Typically found at depths of up to 20m throughout the year.
Syngnathus nigrolineatus caspius	Caspian Pipefish	SB	LC	In all parts of the sea located close to the coast (depth of 1-4m), also in the areas where the Zostera plants grow such as the shallow parts of the rivers flowing into the Caspian.	Present throughout the year for spawning, feeding and wintering in shallow coastal waters. Typically found at depths of up to 10m.
Sander marinus	Sea pikeperch	SB/HS	EN#	Chilov and Pirallahi islands, Baku archipelago, Kurdashi aquatorium of the Central and Southern Caspian at a depth up to 10m in the coastal waters with rocky seabed.	Migration to spawning, feeding and wintering areas throughout the year. Typically found at depths of up to 50-100m.

Key:
Hearing group: SB – fish with swim bladder; V – sometimes does not have swim bladder depending on species; HS – hearing experts with wide hearing frequency rate.
IUCN Red List: CR: Critically Endangered; EN – Endangered; LV – Low Vulnerability; LC – Least Concern, # also included in CITES Appendix II.
*Also, known as Atherina boyeri caspia.

5.4.6.3 Fish Sensitivity

With respect to overall ecosystem health, heavy metals are recognised as being toxic to and accumulate in living organisms, and because of this, fish samples are often used worldwide to monitor the quality of ecosystems (Ref.69). Heavy metal concentrations within the Caspian Sea are thought to have accumulated mainly from the Volga River and known elevated concentrations of trace elements have been reported in coastal sediment samples (Ref.70). The most recent published study, however, found that concentrations of heavy metals (chromium, cadmium, cobalt and lead) in the three commercial species of kilka in the south Caspian Sea were lower than international standards (Ref.71).

North and south of the Absheron Peninsula are considered the most polluted areas along the Azerbaijan coast, mainly due to the majority of Azerbaijan's petrochemical industry is located on the Absheron Peninsula, and many of the physical facilities are still in use from the Soviet era. Sumgayit, to the north of the peninsula was the centre of this Soviet petrochemical industry and it also contained a number of chemical and manufacturing industries. The environmental strains from this legacy has remained and is playing a role in the environmental health of the Absheron region, including mercury-contaminated soils from the chlor-alkali plan, where an estimated 1566 tonnes of mercury had been spilled (Ref.72). During the period between 1995 to 2006, conditions within this coastal area and water basin were studied. Key findings from the studies carried out in the region found exposure of these sediments to Russian sturgeon found acute toxicity resulting from exposure was clearly established (Ref.73). To the south of Absheron, Baku bay sediments which contained PAHs, heavy metals and pesticides were studied to determine the effects of petrochemical industrial activities on the success sturgeon populations in the region. As the benthic environment accumulate most PAHs and heavy metals from the water column, bottom dwelling species such as sturgeon are most susceptible to effects. The study found a direct correlation between these contaminated sediments and acute toxicity of sturgeon (Ref.74). Environmental stressors such as these are thought to be contributing factors in the decline of sturgeon populations in the region.

The common threats to fish populations are over fishing, high levels of pollution (from both man-made and natural events) and habitat loss. Impacts relating to the oil industry are direct (e.g. accidental spills, noise) and indirect (e.g. fish consuming prey that ingested or had been affected by accidental spills). Fish species are vulnerable to oil and chemical spills, specifically during spawning, and are sensitive to increased turbidity and to underwater sound impacts, which may discourage them from approaching operational sites. Those species with swim bladders are most susceptible. Their response to underwater sound is determined by the duration, sound pressure level and frequency; and ranges from changes in behaviour, recoverable injury to, in extreme instances, mortal injury.

Hearing specialist fish, in particular kilka, are likely to be found in the vicinity of the Project location all year round although in smaller numbers in winter, which is outside the main spawning and migration periods.

5.4.6.4 Caspian Seals

The Caspian seal (*Phoca caspica*) is the only marine mammal present in the Caspian Sea. The species is endemic to the Caspian Sea and has been listed on the IUCN Red List of Threatened Species as Endangered since October 2008 and has been included in the AzRDB since 1993 (Ref. 39).

The population of Caspian seals has decreased by more than 90% since the start of the 20th century, considered to be due to a combination of commercial hunting, habitat degradation (through introduction of invasive species), disease, industrial development, pollution and fishing operations using nets (Ref. 40). The population of seals has been estimated using a number of different methods. A 2012 paper (Ref. 41), using an age-structured projection model and the annually recorded seal harvest, between 1867 and 2005 estimated the 2005 population to be 104,000. In comparison, data collected from aerial surveys in Kazakhstan and sea ice surveys resulted in estimates of between 100,000 and 170,000 (Ref. 42).

There have been a number of survey/research programmes undertaken to improve understanding of the distribution and population numbers of Caspian seals in the Caspian Sea. Data collection has included the following:

- **1980 – present**: Opportunistic monitoring of dead seals and confirmation of seal sightings by fishermen and helicopter pilots;
- **2005 - 2012**: Annual aerial surveys of the breeding population on the winter ice-field in the Northern Caspian from 18 to 27 February to estimate the overall breeding distribution; and
- **2009 - 2012**: Telemetry tagging survey, where 75 seals were tagged and their movements across the Caspian Sea tracked. Data collection included dive depths.

In addition, seal observations have been undertaken by BP during seismic or geotechnical surveys comprising:

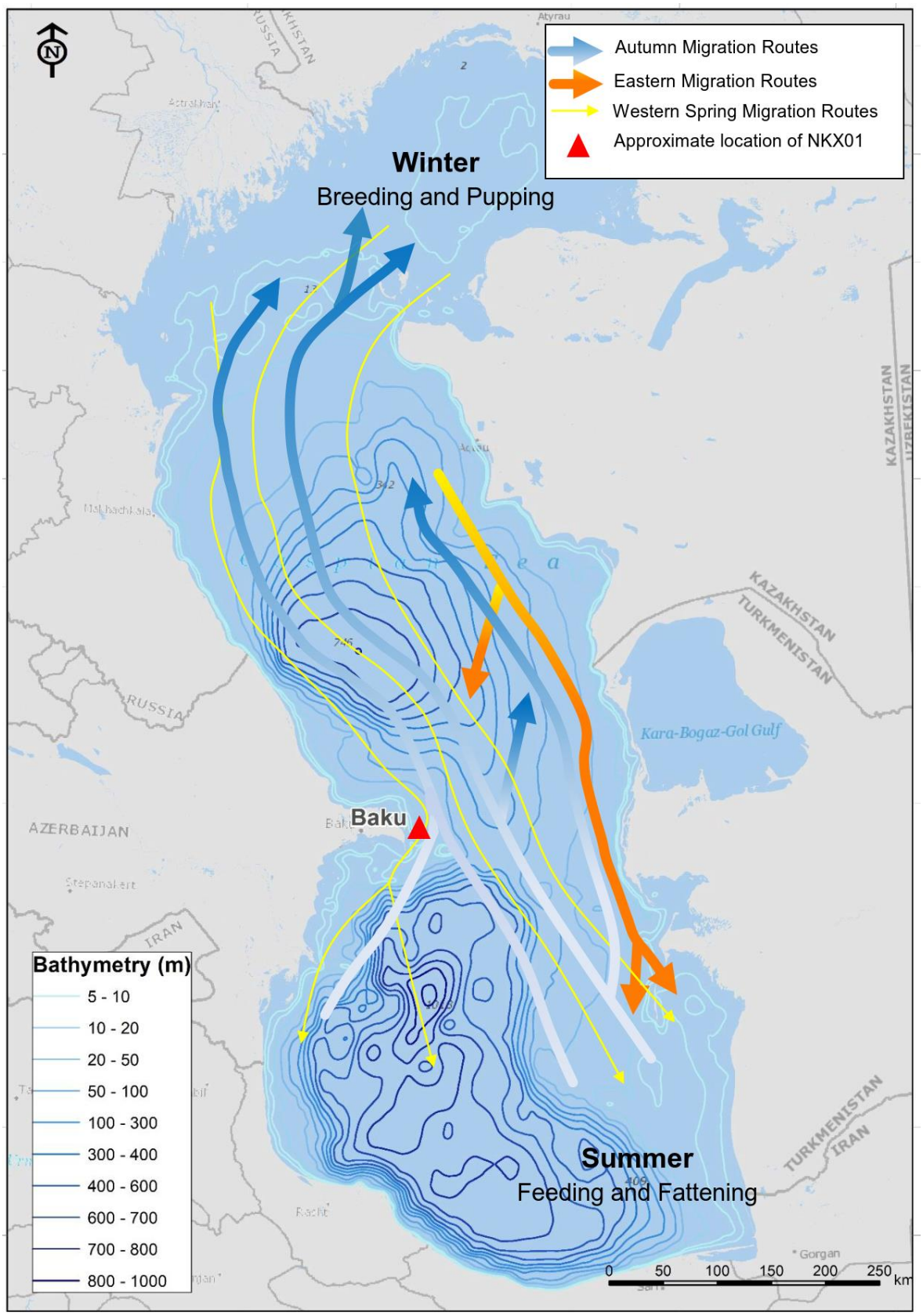
- 2016: October, November and December: observations from vessels during the SWAP 2D seismic survey
- 2018: Mid-March to late April seal observations made from the location of the proposed Azeri-Central-East (ACE) platform within the ACG Contract Area during geophysical investigation works.

Opportunistic sightings from fishermen and helicopter pilots continue to be recorded.

Caspian seals are observed in many regions of the Caspian Sea depending on the season. They were typically thought to undertake annual migrations between breeding locations in the Northern Caspian (where pupping and mating occurs on the ice) to feeding locations in the Central and Southern Caspian during the spring months, returning in the autumn (Ref. 43). Migration routes were thought to be largely restricted to narrow coastal routes where haul out sites are located, with most seals travelling south along eastern coastlines with a significant number also travelling along western coast and into Azerbaijani waters.

Recent satellite tagging research, conducted between 2009 and 2012 (Ref. 44) has shown that this pattern of migration is not as regular or direct as had been previously reported. Data obtained from 75 tagged adult seals, of both sexes, showed that whilst seals migrated to the ice field in the Northern Caspian during autumn-winter months for breeding (the timing depending on changeable metocean conditions), they did not all migrate south in the spring. For example, in 2011 40% of the tagged seals remained in the Northern Caspian and were considered to be ‘non-migratory’. The remaining 60% of the seals migrated to the Central and Southern Caspian in the spring for foraging and the migration routes taken were not restricted to proximity to haul-out sites as had been believed. A key finding of the study showed that over the summer, most seals spent an extended period (up to 6 months) at sea without hauling out. Indicative seal migration routes as suggested by previous research programmes, the satellite tagging study and also through direct observations (see below) are shown in Figure 5.8.

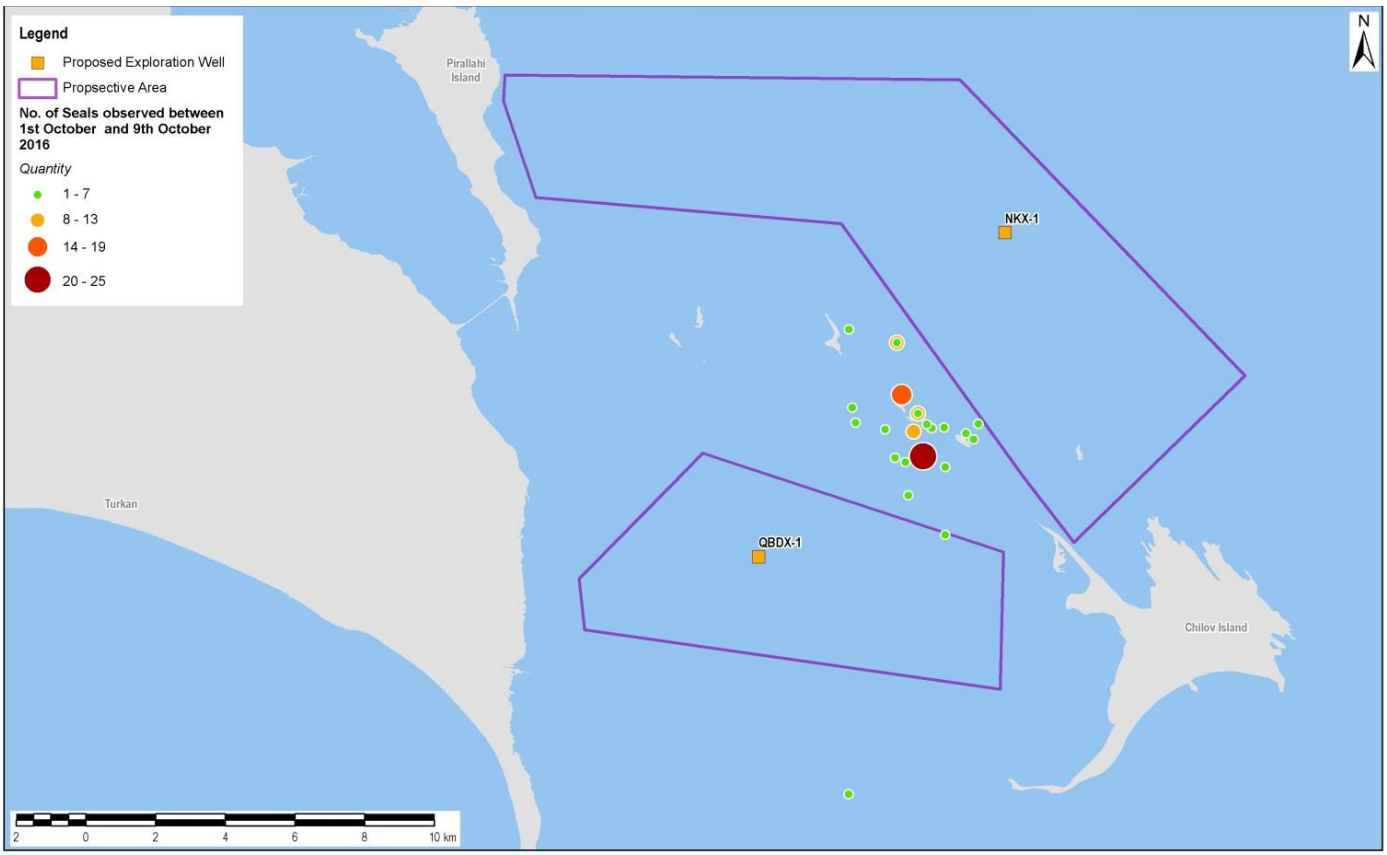
Figure 5.8: Spring and Autumn Migration of the Caspian Seal



The scientific opinion is that seals are showing signs of adaptation to anthropogenic disturbances (Ref. 45). It is understood that, following increased disturbances within the Dagestan coastal area of Russia (including reported mass poaching), seals tended to avoid coastal areas during the autumn and spring migrations and use routes located away from the coast. Thus, the latest research has shown it is not possible to assume the seals will always follow the previously defined migratory paths close to the east and west coastline. The observations made at the offshore ACE platform location during mid April 2018, where five seal sightings were recorded, provide some evidence support this.

However, there is still significant evidence to confirm that migrating seals continue to pass through the waters between Pirallahi Island, Chilov Island and Oil Rocks in large numbers (shown as a shaded area in Figure 5.8). The continued use of this route for migration is supported by observations made of seals in early October 2015 in this area during the execution of SWAP 3D Seismic Survey (refer to Figure 5.9). These observations confirmed seals both passing through the waters and using the islands in the vicinity for haul out.

Figure 5.9: Approximate Locations of Caspian Seal Observations in October 2016



The historical understanding of the migration and distribution of Caspian seals has been led by a research group, which included the late anthropologist D.V. Gadzhiyev and T.M. Eybatov. Data has been collected for over 35 years and, until 1997, was based on observations in Azerbaijan on the northern shores of Absheron Peninsula, on Shahdili Spit and Chilov Island and interviews with fishermen. Since 1997, this data has been supplemented with research studies, and observations from helicopter pilots and oil and gas offshore platform workers. A summary of the data relating to spring and winter for the years 2010-2019 is provided within Table 5.13. This confirms that the majority of seals recorded were located on the islands between, and including, Pirallahi Island, Chilov Island and Oil Rocks with the largest numbers observed during spring. It should be noted this data from aerial observations can only provide indicative information with regard to areas known to be used by seals as the observations are not systematic.

Table 5-13: Summary of Caspian Seal Sightings from Aerial Observations During Spring and Winter 2010-2019

Year	Spring	Winter
2010	Seals appeared in the Pirallahi island - Chilov island - Oil Rocks area at the end of April. In this year unusual (diffuse) spring migration was observed. Seals arrived as 3-5 individuals in a group and were distributed evenly in the sea around Oil Rocks. There were no seal accumulations at the island haul-out sites.	In January and February no seals were observed on the islands; in December seals were observed on the Shadili spit, Chilov island and Podplitochny (2-3 individuals at each site)
2011	The first large shoal of seals (200 – 400 individuals) was registered on 1 April in the area of Shahdili spit and islands between Pirallahi island and Chilov (Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella). The concentrations of seals were considered to be related to migration of herring (kilka), as according to fishermen, this coincided with mass migration of small kilka. At the end of April - beginning of May seals moved to the sea between Chilov island and Shahdili Spit, Seals were also observed at Oil Rocks. The first seals were recorded in Iranian waters at the beginning of June.	No recorded observations from fishermen or helicopter pilots during this period.
2012	Helicopter pilots reported that seals on the islands between Pirallahi and Chilov islands at the end of April which had moved on by the following week. Observations of occasional individual seals were reported. It was considered that the subsequent mass migration of seals was related to migration of kilka, but also migration of black sea roach (small kutum) and then gray mullet, which followed the kilka migration.	Observations were recorded of individual seals on the Urunos, Shahdili Spit and 2-3 individuals on Baklaniy island.
2013	Based on recorded observations migration was considered to have began in mid-April. Significant accumulations of seals were observed west from Chilov island. Large groups of seals were observed in the waters around Lebyazhi island, where seals have not usually been recorded as visiting.	Small groups of seals (2-5 individuals) were observed on Dardanella island, Malaya Plita and Podplitochny. One seal was observed on the Southern spit of Chilov island.
2014	Seals appeared in the Azerbaijan waters, in the area of Yalama coast (north of the Absheron Peninsula) at the end of March. Usually observations are reported in this area one week prior to appearance of the seals on the islands of Absheron archipelago. As in previous years the mass migration of seals was reported by fishermen to coincide with kilka migration, with seals reportedly eating fish from fishing nets.	Individual seals (1-2 individuals) were recorded on the Shahdili spit, 2-3 seals on Urunos. Groups of seals - 1-3 animals were recorded swimming between Chilov island and Oil Rocks.
2015	Mass spring migration in the area between Pirallahi and Chilov islands was observed commencing on 19-20 April. The largest number of seals was observed near Baklaniy and Urunos islands.	2-5 individuals on the Shahdili Spit and Urunos (Chilov island) were recorded. Small groups of 2-3 individuals were observed between Chilov and Oil Rocks.
2016	For the first time in many years there was no mass spring migration of seals. It was reported that small groups of seals started migration south in March following earlier ice melt in the North. The first seals were recorded by fishermen on the islands Dardanella, Koltush and Urunos on April 24. The number of seals reached 20-50 individuals. Most seals were found at Urunos. Small groups were also observed on Oil Rocks. Fishermen also noted that there was no mass spring kilka migrations in this area. Also, on the north coast of the Absheron Peninsula there were no seal corpses washed up onto the coast, commonly observed here each year. The small groups of seals present had disappeared in mid-May.	No seal observations were recorded.

Year	Spring	Winter
2017	Fishermen to the North of the Absheron Peninsula (Yalama and Mukhtadir) reported that seven seals were caught in nets in the first week of April. Like 2016, migration in 2017 was marked by no mass accumulations of seals on the islands of Absheron archipelago; small groups of seals usually appeared on individual islands during daytime and disappeared in the evening. The catch of kilka this year was reportedly low and only small groups of seals were observed. On April 17, seals were discovered between Pirallal and Chilov islands. They were moving in small groups of 7 to 16 individuals. In early May, the seals that were present disappeared from this location.	No seal observations were recorded in winter.
2018	Seals were observed in the northern Caspian on April 14 and around Oil Rocks in early May, moving in small groups. Helicopter pilots recorded a large group of seals on the Bolshaya and Malaya Plata islands on April 29. At the end of April fishermen discovered a large group of seals (up to a hundred individuals) between Yuzhnaya spit and Urunos island.	No data
2019	Fishermen from Yalama reported that they saw small groups of seals on March 16. The first seals were observed by helicopter pilots on the islands of Absheron archipelago on March 28, 2019 - 6 individuals - on the rocks of Bolshaya Plita and 2 individuals on Chilov island. No observations of large accumulations of seals were reported. In the area of small islands, small groups of seals (5-7 individuals) were recorded in the sea. Small groups were also seen on Oil Rocks. For the first time seals were reported hauled out on the northern coast of Azerbaijan in the areas of Yalamy, Nabran, Mukhtadyra and with numbers reported at sea at a distance of 300-500 m from the coast and in groups of 20-30 individuals.	No data

The data currently available, supplemented with local specialist knowledge, indicates that that the area to the south east and east of the Absheron Peninsula including Pirallahi and Chilov Islands and the other islands in this area is of high importance with regard to Caspian Seals, with seals known to be present in these locations, sometimes in large groups, from early-mid April to the end of May during the spring migration and also from October to mid-December for the autumn migration. The peak months with regard to sensitivity, are typically April, May and November with the spring months of higher sensitivity due to the vulnerability of the seals as their fat reserves are depleted after the months spent on sea-ice in the north during these months in particular.

In recent years it is understood that the northwards migration during autumn has been delayed and it may be that significant numbers of seals will be still present in Azerbaijani sector of Caspian Sea during the first half of December. In contrast to the spring migration, the autumn migration is generally not characterised by high speed movement of seals and therefore the islands of the Absheron archipelago are usually not typically crowded during the autumn migration months.

In addition to seal presence during migration periods, there is also the potential for seals that have not migrated to the southern Caspian to be present during from May to September for foraging with peak numbers coinciding with the peak kilka numbers in July. The smallest numbers of seals are expected be present between January and March when seals will be in the Northern Caspian pupping and mating, although this can vary by up to a month.

While this section presents an overview of expected seasonal distribution of the seals throughout the Caspian Sea, it does not represent a comprehensive understanding. There are a number of limitations in relation to the available data used to determine migration patterns:

- The tagging research programme was based on a 3 year period (2009 to 2012); there is no ongoing survey programme in place to monitor long-term trends of distribution across the Caspian Sea. Prior to 2009, historic distribution data had been based on live seals sightings provided by vessels and helicopter pilot observations (which continues), these opportunistic recordings however are not collected as part of an ongoing scientific programme; and
- The research programme tagged 75 seals. This is not considered to be a representative number to enable an accurate conclusion of the distribution of seals across the Caspian Sea (Ref. 45).

With regard to sensitivity, seals are directly and indirectly sensitive to pollution spills (such as oils or chemicals) and ongoing discharges which contribute to contamination over time. Seals are sensitive to underwater sound while diving or swimming so may be susceptible to high levels of underwater sound generated by vessel movements and construction activities, particularly impulsive sound e.g. associated impact piling. The reasons for the significant decline in the Caspian seal's population in the past century are complex but are thought to be associated with hunting, fishing activities, outbreaks of Canine Distemper Virus (CDV), invasive species and pollution (mainly organochlorides such as DDT).

5.5 Birds

The Caspian region has a high diversity of bird species, with a large number of endemic species present. Migrating and overwintering birds tend to move widely along the Caspian coast. Consequently, at a regional level, the coastal zone of the Caspian Sea has been identified as an area of ornithological importance as it supports both internationally and nationally significant numbers of migrating and overwintering birds. Given Azerbaijan's location within the bird migrating circuit of Europe, Asia and the Middle East a large number of bird species have been recorded, with onshore and offshore areas providing habitats for 347 avifauna species, including 31 species of seabirds (Ref. 47).

The Azerbaijan coastline of the Caspian Sea from the Absheron region moving south is an area of international and regional importance providing habitat for breeding, nesting, migratory and overwintering birds. An estimated 85 species of waterfowl and coastal birds have been recorded in this region over the past 17 years (Refs. 48, 49, 50 & 51). Many species of conservation importance, including globally threatened species, species included in Annex I of the EU Birds Directive (2009/147/EC) and birds listed in the Azerbaijan Red Data Book (AzRDB) can be found in this coastal area at some point. Fifteen of these species are included in the AzRDB and the IUCN Red List of Threatened Species.

The waters and coastline of the Absheron Region provide an abundant food source, including small fish (preyed on by grebes, herons, cormorants, gulls, terns and egrets), plants and invertebrates (fed on by grebes, swans, geese, ducks, coot and stints) and large fish and other birds (preyed on by harriers and white-tailed eagles). A total of around 130,000 waterfowl are found in the coastal waters of the Absheron to Gobustan region. The ornithological importance of this coastline is reflected in the designation of six Important Bird and Biodiversity Areas (IBAs) (Ref. 47) within the region, listed in Table 5.14 and shown in Figure 5.10. In a number of cases, some areas are designated as both protected areas and Sites of Ornithological Importance, although the area under each designation may slightly differ.

A literature review was undertaken in March 2018 to obtain the latest information on migratory, wintering and nesting bird species present along the Azerbaijan coastline of the Caspian Sea between Absheron and Neftchala (located within Shirvan National Park) (Ref. 9). The review was prepared using the latest available literature on bird data and the evaluation of coastal survey data from 2002-2017 in order to identify the likely species present, estimated number of birds, identify important and sensitive bird areas and confirm key bird migration routes and seasonal variations in their presence. A summary is provided in the sections below[24].

[24] Refer to Appendix 6A of the Azeri Central East Project ESIA (Ref. 9) for further details.

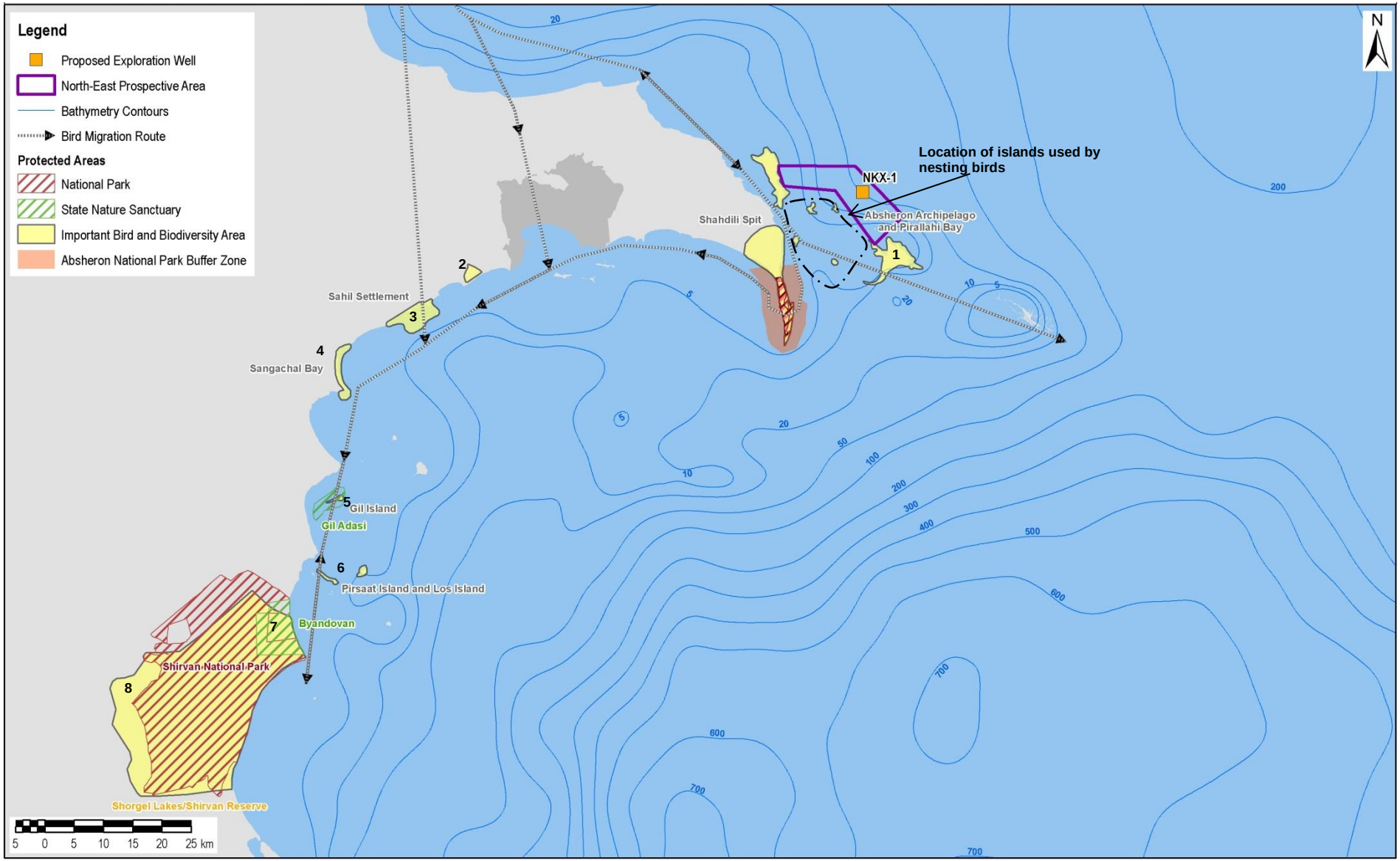
Table 5-14: Azerbaijani Sites of Ornithological Importance along the Absheron to Gobustan Coastline

Sites of Ornithological Importance		Designation	Reasons for Designation
1	Absheron National Park (including Shahdili spit and Pirallahi Island)[5]	KBA[1]/IBA[2] IUCNII[3]	KBA/IBA – The area is important for overwintering and migrating bird species. IUCN II - In 1969 the area was established as a Nature Reserve to protect, amongst others, the endangered Caspian seals and water birds of international importance. It was later designated as a National Park in 2005. Approximately 46 RDB species occur within and in the surroundings of the national park.
2	Red Lake	KBA/IBA	Significant populations of globally threatened bird species are known to occur here. The area is important for breeding bird species.
3	Sahil Settlement – 'Shelf Factory	KBA/IBA	Significant populations of globally threatened bird species are known to occur here. The area is important for overwintering and migrating bird species.
4	Sangachal Bay	KBA/IBA	The area is important for overwintering and migrating bird species.
5	Gil Island (or Glynanyi Island) State Nature Sanctuary	KBA/IBA IUCN IV[4]	KBA/IBA – The area is important for breeding bird species. IUCN IV –Designated in 1964 due to its importance for migratory and wintering waterfowl birds, seagull colonies and Caspian seals[25]. Two RDB species occur in the area.
6	Pirsagat Islands and Loc Island	KBA/IBA	Populations of globally threatened bird species are known to occur here. The area is important for breeding bird species.
7	Bandovan (or Byandovan) State Nature Sanctuary	IUCN IV	49 RDB species known to occur here.
8	Shirvan National Park	KBA/IBA IUCN II	KBA/IBA – Significant populations of globally threatened bird species are known to occur here. The area is important for overwintering and breeding bird species. IUCN II - In 1969 the area was established as Shirvan State Reserve, focused to protect one of the world's largest population of Persian gazelle (*Gazella subgutturosa*) and its rich water-wading ecosystem. The wetlands are considered as an important site for many valuable bird species, used for nesting, migration routes and wintering area. It was later designated as a National Park in 2003. Approximately 56 threatened species occur in this area.

Notes:
[1] Nationally identified sites of global significance that address biodiversity conservation at a local scale (individual protected areas, concessions and land management units). Key Biodiversity Areas (KBAs) comprise an 'umbrella' which includes globally important sites (e.g. Important Bird Areas (IBAs), Important Plant Areas (IPA), Important Sites for Freshwater Biodiversity, Ecologically & Biologically Significant Areas (EBSAs) in the High Seas, Alliance for Zero Extinction (AZE) sites).
[2] IBAs are key sites for the conservation of bird species, identified by BirdLife International. These sites are small enough to be conserved in their entirety and are different in character or habitat or ornithological importance from the surrounding area.
[3] The main objective of a national park (IUCN Category II) is to protect functioning ecosystems, rather than focussing on protecting a particular species or habitats through management of the reserves thus prioritising these species or habitats which would come under IUCN category IV
[4] Category IV refer to Habitat/Species Management Area. It aims protecting a particular species or habitats and its management prioritise these species or habitats.
[5] Comprises two adjacent IBAs: Shahdili Spit and Absheron archipelago (north) and Pirallahi Bay shown within Figure 5.10

[25] MENR, State Nature Sanctuaries. Available at http://www.eco.gov.az/en/b-yasaqliq.php

Figure 5.10: Protected Areas and Important Ornithological Sites Located on the Southwest Caspian Coast and Bird Migration Routes

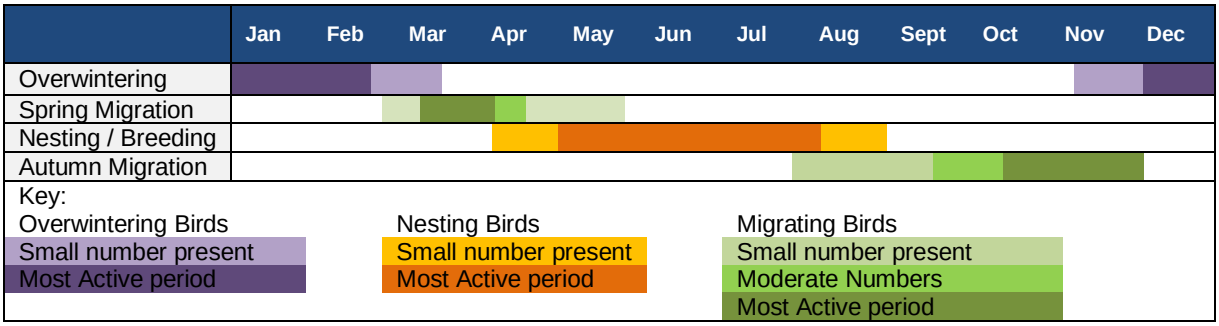


5.5.1 Migratory Birds

The distribution and abundance of birds in the coastal region is subject to significant seasonal changes particularly during the spring and autumn migration periods as birds move between feeding, breeding and overwintering grounds.

The coastlines of Azerbaijan are a major flyway for migrating waterfowl and coastal birds, who nest in the parts of Russia, western Siberia, and north-western Kazakstan and migrate to the southern coast of the Caspian Sea, the Kur-Araz lowland, Turkmenistan, southwest Asia and Africa for the winter. The autumn migration begins in the second half of August and continues until mid-December although this may extend into January during years of severe winter in Russia. The most active autumn migration period is November. The spring migration starts in the second half of February and ends in April, with the most active period during March. Table 5.15 below outlines the key migratory periods in the region and the migration routes are illustrated in Figure 5.10.

Table 5-15: Key Migration and Active Periods Along the Southwest Caspian Coastline (Absheron to Neftchala)



During the autumn migration, research has indicated that 51% of birds fly along the Caspian Sea coast to the south, 37% fly to the south west, while 12% of the birds fly from the Pirallahi-Shahdili coastline to the south east (Ref. 52). The migration routes broadly understood to be followed are illustrated in Figure 5.10.

84 species of waterfowl and coastal birds recorded along the Absheron-Neftchala coastline area between 2002 and 2017 are known to have migrant populations. The species composition changes sharply during migration periods, leading to the coastal area being highly sensitive during periods of overwintering and migration (although Shahdili Spit is considered to be sensitive all year around). Birds use these routes primarily for migrating to the southern coast of the Caspian Sea, the Kur-Araz lowland, Turkmenistan, south west Asia and Africa for the winter and then fly north along the same route during spring (see Figure 5.10).

5.5.2 Overwintering Birds

Approximately 36 species of waterfowl and 16 species of coastal migratory birds are reported to overwinter along the coastline from Absheron to the north to Neftchala to the south. The majority of birds to overwinter are ducks (of the genera *Anas, Netta* and *Aythya*) and coot (*Fulica atra*) but migrating herring, common, black-headed and great black-headed gulls (all of the genus *Larus*) also overwinter along the coastline. These particular species will dive in shallow waters to feed on small fish and benthic invertebrates on or near the seabed. Wading birds also feed in coastal waters but, with the exception of the beak, remain above the water during feeding. Table 5.15 above shows the key periods when overwintering birds are present and most active.

5.5.3 Nesting Birds

The breeding and nesting season along the Azerbaijan coastline begins at the end of April/beginning May and continues until mid-July. At the end of July and beginning of August, the birds leave their nesting places and disperse (refer to Figure 5.10). The coastline is host to a number of important nesting migratory seabirds, in particular the Mediterranean gull (*Larus melanocephalus*) (listed in the AzRDB) and the slender-billed gull (*Larus genei*), and a number of tern species (of the genera *Sterna*, *Chlidonius*

and *Hydroprogne*). A number of areas within the vicinity of the Project location of known importance for nesting birds include:

- **Pirallahi Island and other nearby islands (Tava, Koltis, Urinos, Yal and Garabatdag)** – These islands fall within the Absheron archipelago (north) and Pirallahi Bay IBA (refer to Figure 5.10) and comprise a mixture of habitats for nesting birds including areas of open dry land, wet sandy areas, shells heaped in piles and rocks and disused oil rigs. Key periods for all the areas/islands range from April to July. 0.1% (985 individuals) of the total number of birds nesting on the Caspian coastline nest on these islands. Other islands in this vicinity (including Chilov Island) are not important for nesting birds as suitable habitat is not present.
- **Shahdili Spit –** Shahdili Spit and the nearby small islands and platforms offshore support a large population of up to 3,700 recorded breeding pairs which represents 1.5% of the breeding bird population of the Caspian coast. Birds are split by habitat type but include over 1,000 pairs of Caspian gull and large numbers of common and sandwich tern. Also present are little grebe (inland), Eurasian coot, grey heron and little ringed plover. Shahdili Spit is a recognised IBA (Figure 5.10) and comprises a mixture of habitats for nesting birds including areas of open dry land, wet sandy areas, rocky areas, reeds and marshes. A wide variety of nesting species are known to use the area (primarily terns and gulls but also wading birds including plover and avocet, herons, grebes and coots). One nesting species of conservation importance, the Pied avocet, has been recorded in this area.

5.5.4 Diving Birds

Some species, particularly terns (genus *Sterna*), are specialist plunge divers, taking fast moving prey by diving into the water from height. Non-specialist feeders like the gulls may also dive to feed but do so with less skill and from lower height. Most gulls are more reliant on surface feeding, catching krill or small fish that have been concentrated by marine currents. Thus, there may be diving birds feeding in waters in the Absheron region during the nesting season.

5.5.5 Species of Conservation Importance

Table 5.16 lists the 15 species of bird of conservation importance (included on the IUCN Red List or listed in the AzRDB) known to be present along the Absheron to Neftchala coastline (predominantly migratory and overwintering birds).

Table 5-16: Bird Species of Conservation Concern Observed on the Southwest Caspian Coastline (Absheron to Neftchala)

Common Name	Scientific Name	Protection Status
Great white pelican	*Pelecanus onocrotalus*	AzRDB
Dalmatian pelican	*Pelecanus crispus*	AzRDB, IUCN Red List
Greater flamingo	*Phoenicopterus ruber*	AzRDB
Whooping swan	*Cygnus cygnus*	AzRDB
Tundra swan	*Cygnus columbianus*	AzRDB
Marbled duck	*Marmaronetta angustirostris*	AzRDB, IUCN Red List
White-eyed pochard	*Aythya nyroca*	AzRDB, IUCN Red List
Common pochard	*Aythya farina*	IUCN Red List
White-headed duck	*Oxyura leucocephala*	AzRDB, IUCN Red List
Western swamp-hen	*Porphyrio porphyrio*	AzRDB
Black-tailed godwit	*Limosa limosa*	IUCN Red List
Eurasian curlew	*Numenius arquata*	IUCN Red List
Curlew sandpiper	*Calidris ferruginea*	IUCN Red List
Northern lapwing	*Vanellus vanellus*	IUCN Red List
Mediterranean gull	*Larus melanocephalu*	AzRDB

With regard to sensitivity, the major flyway for migrating waterfowl and coastal birds, which is most active during March and November, passes along the Azerbaijani coastline. Birds are primarily migrating to the southern coast of the Caspian Sea, the Kur-Araz lowland, Turkmenistan, southwest Asia and Africa for the winter and then fly north along the same route during spring.

A number of overwintering species, particularly ducks, will dive in shallow waters to feed on small fish and benthic invertebrates on or near the seabed. Wading birds are common in shallow coastal waters.

Bird species at the key ornithological sites along the Azerbaijan coastline, particularly species that spend most of their time in the water (e.g. genera *Aythya, Anas, Cygnus, Bucephala, Mergus, Podiceps, Phalacrocorax, Pelecanus* and *Fulica atra*) will be most vulnerable to potential major spills. To date, no major spills have occurred due to activities associated with BP's operations.

5.6 Socio-Economic Environment

5.6.1 National Context

Azerbaijan comprises 77 administrative districts including 11 city districts and 10 economic regions. The majority of Azerbaijan's major settlements are in coastal locations, with 22% (Ref. 53) of the population resident in Baku.

Azerbaijan's economy is heavily dependent on its energy exports, with more than 90% of total exports accounted for by oil and gas products (Ref. 54). After oil and gas, the economy is dominated by the agricultural sector which, alongside fisheries and forestry, represented 5.27% of Azerbaijan's gross domestic product (GDP) in 2014. The majority of those engaged in agriculture are self-employed and live in rural areas. In 2011, agricultural lands comprised approximately 4.8 million hectares, including both pasturelands and sown areas, which equates to approximately 55% of the total area of Azerbaijan.

Other important economic sectors include manufacturing and services such as tourism, financial and telecommunications. The overall contribution of the fisheries industry to the Azerbaijani economy and to national food security and poverty reduction is low. However, there are local areas where fisheries are important for the rural economy and the livelihoods of coastal communities (Ref. 55).

In recent years, a significant reduction in poverty in Azerbaijan has been achieved (Ref. 56) and was accompanied by a rise of 91% in gross national income (GNI) per capita between 2001 and 2013 (Ref. 57). This rapid growth was due to the expansion of the oil and gas sector. However, in 2016 the Azerbaijani economy contracted by 3.8% driven by a fall of 5.4% in non-oil sector output. Oil GDP showed no growth in 2016 and oil export fell by 40% (Ref. 57).

Improvements in health and education have also been achieved across many parts of Azerbaijan. Basic infrastructure such as accessible roads and sanitation systems are typically lacking in some rural communities; and utility services such as electricity and water are not universally available when compared to the high level of development in the major cities.

Nationally, the level of inequality is high, particularly between rural and urban areas. Inequality is also high within urban areas with reported data showing significant disparities between the rich and the poor with regard to access to services (Refs. 58 & 59). As in other transition countries economic growth has not had a significant impact on employment. This is because the growth has not generated a comparatively significant number of jobs nationally, partly as it has not been based on a diversified economy.

5.6.2 Population, Demographic Structure and Ethnicity

At the beginning of 2017 the population of Azerbaijan was 9,706,600, with a gender distribution of 49.8% male and 50.2% female. The proportion of the population resident in urban areas has remained relatively constant at around 50% over the past 20 years. It is possible that the population of urban areas is under-recorded as many people who move to Baku for employment on a temporary or permanent basis may retain their formal registration in their place of origin.

Based on the 2009 census (the latest data that is available on the State Statistical Committee website (Ref. 60)), the majority of the national population (91.6%) was ethnically 'Azerbaijani', with the remaining 8% comprising a range of ethnic groups including Lezgis (2%), Armenians (1%), Russians (1%) and Talyshs (1%). The religious distribution in Azerbaijan is relatively homogenous, with the majority of the population defined as Muslim. Other religions include Orthodox Christianity, Judaism, Catholicism and Protestantism.

5.6.3 Commercial Fishing

5.6.3.1 Legislation Regulating Fishing Activity in the Republic Of Azerbaijan

Fishing activity is regulated through legislation, and respective rules and regulations. The legal basis for the organisation, management, development, usage and protection of fish resources in the Azerbaijan Republic is regulated by the Azerbaijan Republic Law "On Fishing" adopted in 1998 (No 457-IQ, 27.03.1998). In 2017, the "Regulations for fishing and hunting of other water bioresources" No 243, was adopted to outline the hunting means, including seasonal restrictions and equipment to be used in the Caspian Sea.

Coastal fishing is regulated by the "*Rules for state registration of small tonnage vessels, approved pursuant to Resolution 97 (dated 23 April 2008) of the Cabinet of Ministers of the Republic of Azerbaijan*". The *"Classification of small tonnage vessels sailing under the state flag of the Republic of Azerbaijan", Order 073 issued by the Ministry of Emergency Situations on 16 June 2007* and *Ministry of Justice Certificate 3350 on 26 June 2007* stipulate that the region in which small-tonnage vessels can fish is limited to 2-3 miles (5km) from the coastline.

A summary of the fishing regulatory authorities and their functions are provided in Table 5.17.

Table 5-17: Fishing Regulatory Authorities and Their Functions

Regulatory State Authority	Function
State Maritime Administration (SMA)	Issue documents identifying the vessel owner, crew members of the vessel and the country where the vessel is formally registered.
Ministry of Emergency Situations (MES)	Inspects the technical condition of the vessel and issues a certificate of seaworthiness. Technical certificates for large vessels are issued by the Baku representative office of the Russian Maritime Register of Shipping.
Department for the Increase and Protection of Aquatic Biological Resources (DPABR) –MENR	For vessels in possession of SMA and MES-issued relevant documents DPABR –MENR shall: • Issue formal permission to specific vessels and determine the catch quotas for biological marine products; and • Conduct inspections to approve that the volume and species of the biological marine products caught by the vessels are in accordance with license conditions.
Water Transport Police (WTP) at the Ministry of Internal Affairs (MIA)	For vessels holding respective documents issued by SMA, MES and DPRAB, WTP-MIA shall: • Inspect the vessel appropriate documents; • Confirm whether the vessel is designed for fishing or other purposes such as transporting dry cargo; and • Verify and confirm that the vessel is in possession of DPABR MENR-issued formal documentation and shall not allow the vessel to head for sea without the correct documents.
State Border Service (SBS)	For vessels holding the respective documents issued by SMA, MES and DPRAB-MENR, SBS shall: • Inspect to check the purpose of a vessel's journey out to sea; and • Not allow a vessel to head to the sea for catching fishery products within the economic zone on 10-nautical mile territory, unless it has the correct documentation.

5.6.3.2 Fishing Licensing

DPRAB-MENR is responsible for issuing fishing licences for both commercial and small scale coastal fishing. Coastal fishing areas for which licences have been granted are generally named after the adjacent coastal town or settlement, and it is understood that DPRAB-MENR authorises fishing activities within these coastal areas adjacent to these towns or settlements, extending up to 3 nautical miles from the shoreline.

Unlicensed fishing activity relates to both fish catch exceeding the quota and species authorised by the regulatory authorities, as well as fishing without any license, i.e. unlicensed vessels or unlicensed fishermen. There is evidence of violations of fishery protection legislation every year as well as instances of fishing gear and catch being confiscated. In 2017, there were 272 recorded cases of violations and 122 individuals subjected to administrative and criminal charges. The total amount of claims for damages caused to biological resources was 51,229 AZN (Ref. 61).

5.6.3.3 Commercial Fisheries

The latest review of fishing activity (completed in 2018 for ACE Project ESIA (Ref. 9)) indicated that commercial fishing is primarily undertaken in relatively shallow waters of the Caspian up to 50m depth where the largest concentrations of kilka (the primary catch) are found.

Heavy tonnage fishing vessels made of steel and approximately 30m length and 5m width are used to undertake offshore commercial fishing. Due to decline of the anchovy kilka population which used to be caught at 80-120m depth, fishing vessels have adjusted their methods to catch kilka at shallower depths.

Fishing methods and equipment typically used in offshore commercial fishing are described below:

- Underwater electric lighting method: electric lighting is the most common method used in the Caspian Sea to attract kilka, which are then caught using cone-shaped bag nets, centrifugal fish pumps, or air hoist (most common method for kilka fishing);
- Where fish are attracted using lighting and are then sucked in by pump, the method is implemented without fishermen's participation. This method is particularly efficient when the fish population concentration is high; and
- The use of cone-shaped fishing nets involves launching the nets from the boat and encircling the fish. The net is left under water for approximately 5-10 minutes before being lifted out the water. Cone-shaped nets are used at a maximum water depth of 20-90m.

Vessels used for offshore fishing are typically fishing trawlers and seine trawlers. Overall characteristics of these vessels are:

- Fishing trawlers are mainly designed for catching fish in the open sea using trawl nets. The use of a trawl net is not permitted to catch fishery-important kilka in the territorial waters of Azerbaijan; and
- Seine trawlers are designed for catching fish with bag nets (bottom net) and are the type of vessels used in Azerbaijan. Vessels are normally equipped with different gear including fish pumps, cone-shaped bag nets, and electric lighting. In Azerbaijan and for kilka fishing only, the use of cone-shaped fishing nets is permitted.
- Commercial fishing effort varies throughout the year due to fish presence and weather conditions. Low season is generally May to June when the kilka species migrate to the Northern and Central Caspian for spawning. High season is typically March to April with fishing also taking place in December to February and July to August although fishing effort is reduced during these months due to unfavourable winter (cold and windy) and summer (hot and clear skies) conditions. Favourable conditions are typically dull, cloudy weather conditions when electric lighting used to attract fish is particularly effective. While kilka is the most popular catch licenses also include quotas for other species such as shad, black sea roach, common carp, bream and grey mullet.

Currently the following legal entities carry out commercial fishing in the Southern Caspian:

- Closed joint-stock company (ZAP) "Khazarbalig" ("Khazarbalig" MMM); and
- Closed joint-stock company "Caspian Fish Co Azerbaijan".

In 2016 10 commercial fishing vessels belonging to these companies equipped with the gear necessary for fishing of valuable species were sailing under the Azerbaijan flag. All 9 vessels belonging to "Khazarbalig" CJSC are homeported in Lankaran city, while the 1 vessel belonging to "Caspian Fish Co Azerbaijan" CJSC, previously moored in Pirallahi island, was moved to the Bibiheybat port of Baku city. These vessels all use either fish pumps or cone shaped nets which can be used at depths of 50-120m and 25-80m from the sea surface respectively.

In 2009 25 out of the 44 fishing vessels that were registered had the appropriate permissions for fishing. It is understood that since 2009 most of these vessels have fallen into disrepair. Hence in 2016, only 10 fishing vessels are still operating and there are no moored vessels recorded without fishing passports.

Within the vicinity of the Project location, commercial fishing of common kilka has been undertaken in the past by one vessel to the south and southwest of Chilov Island towards the Makarov bank (in water

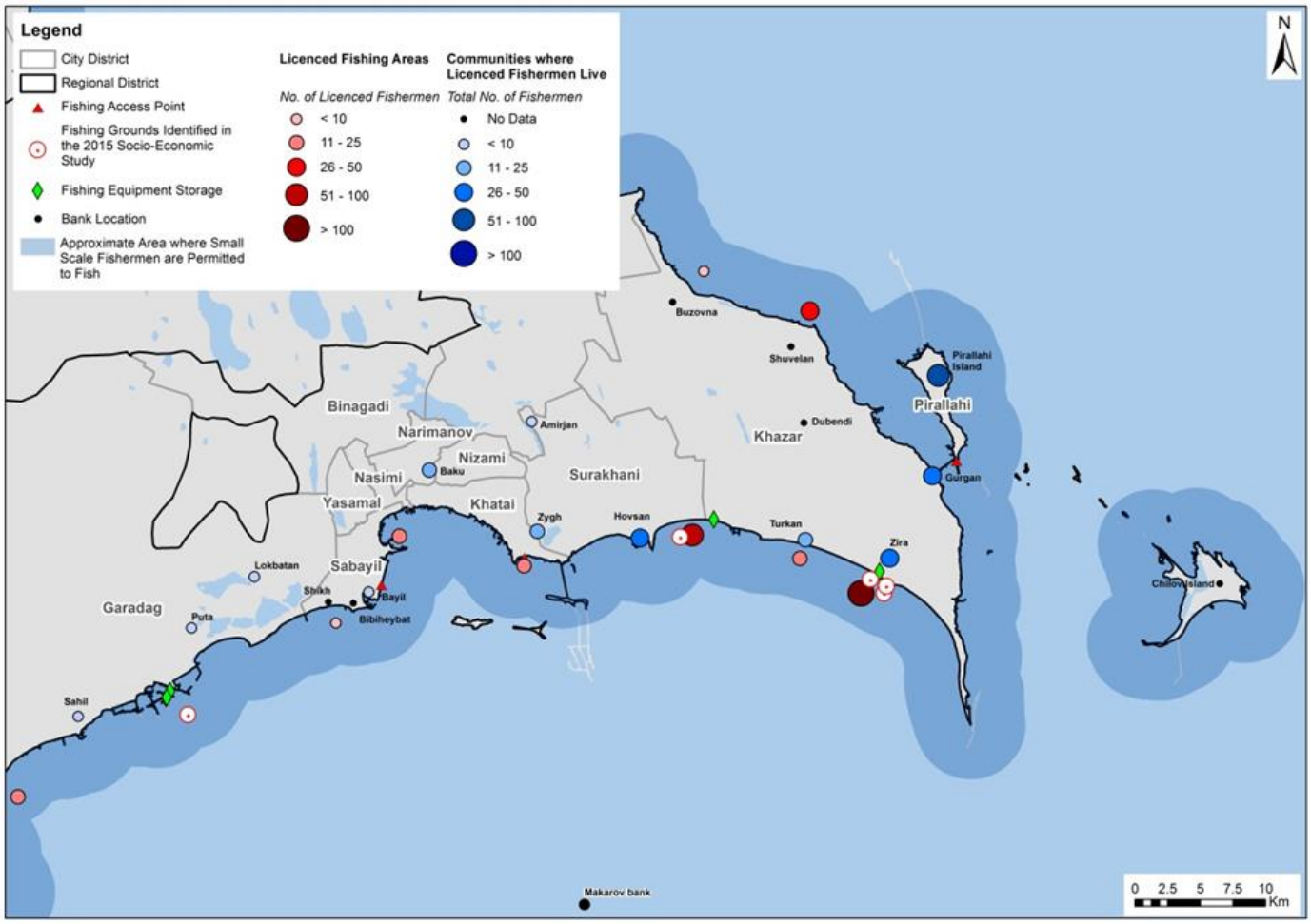
depths of 20-40 m depth) between October and March. The same vessel has also undertaken commercial fishing for anchovy kilka in the waters east and south of the Oil Rocks (in water depths of 40-80 m depth). However, in 2017-2018, the company operating this vessel did not request a license for fishing in these areas with the reason given that it was not economically viable due to low fish stocks in these areas. This is thought to be, at least in part, to the relatively high vessel traffic in this area with sea ferries, oil tankers, passenger ships and vessels serving the oil industry passing through routinely (Ref. 68).

5.6.3.4 Small Scale Coastal Fishing

Small scale coastal fishing is undertaken using medium sized small tonnage vessels made of Duraluminium or wood and of approximately 5m length and 2m width. The distance from the shore where small scale coastal fishing is normally undertaken is within 2-3 nautical miles from the coastline. The fishing areas where small scale fishermen are authorised to fish is specified in fishing licences issued by the MENR. Areas along the coastline between the Absheron Peninsula and Gobustan where the majority of licences have been issued for small-scale fishing include Zira, Hovsan, Shikh, Bayil, Zygh and Sangachal-Gobustan (Ref. 1).

The closest communities where licensed fishermen live to the Project location are the Pirallahi and Chilov towns, located in the distance of 14km and 12km respectively from the Project location. The location of the communities where licensed fishermen live along the coastline of the Absheron Region are shown in Figure 5.11.

Figure 5.11: Licenced Coastal Fishing Areas and Communities where Licensed Fishermen Live Along the Coastline of the Absheron Region (2015) (Ref. 1)



As part of the 2015 SWAP Survey, a field survey was undertaken within the MENR licenced fishing areas shown on Figure 5.11. 93 boats and 381 fishermen associated with these boats were identified as authorised to fish. Results from the survey indicated the following:

- Typical target species included: herring, kutum (roach), grey mullet, vobla (roach), kulma (white bream), and carp;
- High season is March to April and September to November with many fishermen stating that they fish either every day, or up to 3-4 days a week. High winds (about 14 m/s) restrict fishing activities;
- Of the fishermen interviewed, all reported fishing was for commercial purposes with catch sold to market; and
- In the communities of Yeni Turkan, Hovsan, Turkan (west of Baku Bay) and Zira (western shore of Absheron Peninsula), interviewed fishermen reported that fish caught are sold through the Caspian Fish Company.

5.6.3.5 Seasonality and Alternative Activities

The seasonal variation in offshore commercial fishing as well as small scale coastal activity within the Azerbaijan sector of the Caspian Sea is summarised below:

- ***December to February*** – mid to low season due to unfavourable winter weather conditions. Typically fishing undertaken by 50% of the commercial fishing fleet or less;
- ***March to April*** – high season with fishing particularly favourable during dull, cloudy weather conditions when electric lighting to attract fish is particularly effective;
- ***May to June*** – low season when kilka species are spawning and migrate to the Northern and Central Caspian Sea;
- ***July to August*** – mid - low season due to clear and cloudless weather; and
- ***September to November*** – high season with fishing particularly favourable during dull, cloudy weather conditions when electric lighting to attract fish is particularly effective.

Generally heavy tonnage fishing vessels, as well as smaller coastal fishing boats stay relatively idle during May-September, as well as during short-term demurrage (several days) in winter (December-March) due to varying weather conditions. Small scale fishermen interviewed during the 2015 SWAP field survey reported high and low seasons consistent with the above; however, they reported carrying out fishing activities all year round. It was reported that windy days would be the only days small scale fishermen would stop their activity.

During low season, alternative economic activities undertaken by fishermen to support their socio-economic status and household income include the following:

- Maintenance or overhaul of vessels;
- Repair or construction of fishing gear;
- Selling fishing gear;
- Finding temporary work as labourers in the construction sector; and
- Small scale private businesses selling foodstuff and agricultural products.

5.6.3.6 Unlicensed Fishing

Unlicensed fishing activity relates to both fish catch exceeding the quota and species authorised by regulatory authorities, as well as fishing without any license, i.e. unlicensed vessels or unlicensed fishermen.

Unauthorised equipment, boats, vessels or species is prohibited and is otherwise confiscated by the authorities. There is evidence of violations of fishery protection legislation every year as well as instances of fishing gear and catch being confiscated. In 2017 for example, there were 272 violations of fish protection legislation and 122 people were prosecuted. Confiscations included 57 fishing boats, illegal fishing equipment (5550 pieces) and various fish of different species. The sum of imposed fines for this period was 51229 AZN (Ref. 9).

5.6.3.7 Fishing Trends

Historically, kilka has been the main commercial species caught in Azerbaijan. Kilka was the single authorised commercial fishing species until 2012. Commercial catch of anchovy kilka has gradually decreased during the last 12-15 years due to the reduction of kilka reserves since 2001. Due to the reduced reserves of anchovy kilka, there has been a recent change (between 2012-2016) in the commercial fishing licences issued by the MENR where both the number of licences issued and the number of larger kilka fishing vessels has decreased. In parallel, the number of licences issued for other fish species and for small boats has increased.

Azerbaijan has also experienced a reduction in the number of recorded violations of fish protection legislation. The likely reason for this change is decreased activity of the DPRAB during the last 5-7 years in the prosecution of violations coupled with the reduction in natural reserves of sturgeon (including beluga, sturgeon, sturgeon stellate, ship sturgeon) and the corresponding reduction of illegal fishing of these prohibited species.

In recent years (2011-2016) the number of licences issued for fishing has increased compared to earlier years (2005-2010). This increase is associated with the additional number of licences issued for catching small fish (herring, roach, carp, small fry, bream, grey mullet, shemaya) and increased number of licences for small-capacity fleet (boats). The reduced weight of the landed commercial species of fish, which is a common trend for the entire Caspian Sea in recent years, is due to the reduced amount of kilka. The decreasing catch volume of kilka is becoming more significant, while the amount of small fish caught is increasing. Thus, as compared to 2005-2010, the trend in recent years (2011-2016) indicates a change in commercial fishing from targeting kilka to other small fish species. Due to the decreased amount of kilka landed, the number of fishing licences issued to large-capacity kilka vessels has reduced, while the number of licences issued for small fish harvesting and for small-capacity vessels (boats) has increased.

5.6.4 Tourism and Recreation

There are a number of locations along the coast of the Absheron region that are used for recreational activities water sports (including diving, sailing and kite surfing) and are available for beach users particularly in beach clubs and hotels. The majority of the beach locations used by the public for recreation are located along the northern and southern coastlines of the Absheron Peninsula with recreational beaches focused along the coastline adjacent to Hovsan and Turkan. The hotels located by the sea use the immediate beach and shoreline area for recreational activities, such as bathing. There is one known resort hotel located on Pirallahi island, approximately 15km from the Project location.

While diving for recreation is not known to be a popular recreational activity in the Azerbaijan sector of the Caspian Sea, three diving clubs are active in the Absheron region who undertake diving in locations illustrated within Figure 5.12.

Figure 5.12: Recreational Areas and Known Diving Sites Along the Absheron Peninsula Coastline

It is understood that there are currently no actively used tourist facilities located within close proximity to the Project location, however diving is undertaken in the western shore of the Absheron Peninsula and in the adjacent waters near Chilov Island and Kichik Tava Island. Diving is known to take place year round; although is less popular during winter months and not undertaken during windy or stormy weather. Diving is focused on the period between March and November, hence this is the most sensitive time for diving and recreational activities.

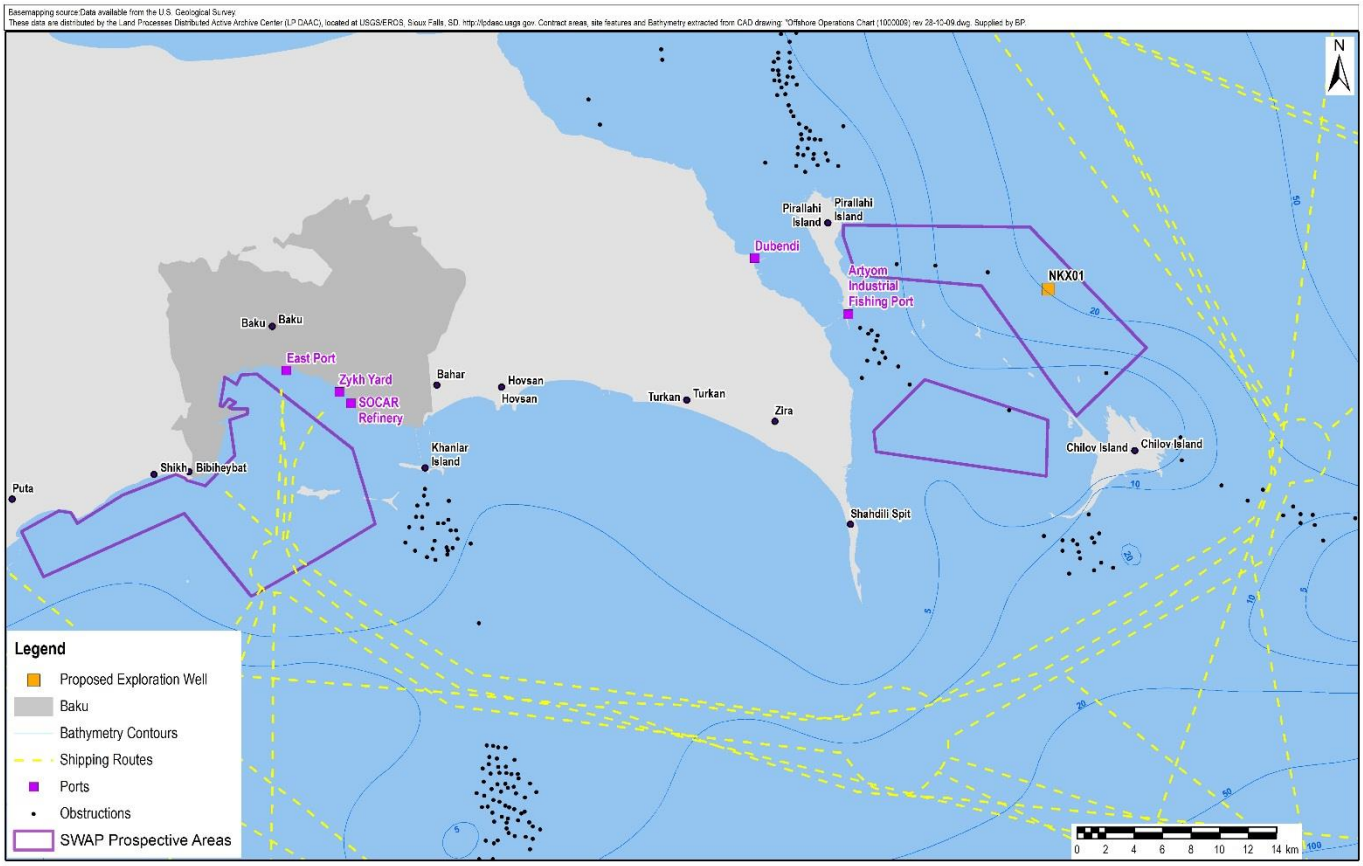
5.6.5 Shipping, Ports and Existing Offshore Infrastructure

The primary commercial ports of Azerbaijan are situated on the Absheron Peninsula and in the vicinity of Baku. These include the South Dock/ATA Yard, the East Port and the Zykh Yard. Further east Hovsan Port is a busy area primarily serving the fishing industry.

Shipping activities in the waters of the Central and Southern Caspian Sea include commercial trade, passenger, scientific and supply vessel operations to the offshore oil and gas industry. The main shipping routes, ports and obstructions (e.g. operational and abandoned oil and gas related structures) are illustrated in Figure 5.13.

It is understood that vessel movements between Pirallahi Island, Chilov Island and Oil Rocks occur approximately twice daily to transport local people, workers and supplies between these locations with boats used generally small i.e. approximately 2 m long and approximately 4-m wide. Small numbers of cargo ships and tankers have also been observed at Pirallahi Island coming from ports at Dubendi, Hovsan and Baku and from Oil Rocks. The types of vessels present in these locations are limited by water depth and available draft. To the west of Chilov island, shipping traffic is relatively busy with a number of the main shipping routes passing between Chilov island and Oil Rocks.

Figure 5.13: Shipping Routes, Ports and Obstructions in the Vicinity of the SWAP Prospective Areas



5.7 Marine Cultural Heritage

The ancient Paratethys Sea was a large shallow sea that stretched from the region north of the Alps in Europe to Central Asia. From the start of the Pliocene period (approximately five million years ago), the Paratethys Sea became progressively shallower; the Caspian Sea is a remnant of this. The Caspian has been subject to extensive fluctuation in sea levels, with recorded sequences of succession and regression (Ref. 62). As a result, a number of ancient settlements and fortifications have been claimed by rising sea levels, resulting in submerged archaeological landscapes.

Baku and the Absheron Peninsula have a rich cultural heritage dating back to the late Stone Age. The coastal plains were vulnerable to attack from the sea and consequently a number of fortifications were built along the coastline primarily during the 13th to 15th centuries. As the sea level of the Caspian Sea has fluctuated over time a number of the cultural heritage assets have been become inundated by the sea. There has been little marine archaeological research in Azerbaijan since the end of the Soviet era (Ref. 63). The only known marine archaeological site located to the north-east from Absheron Peninsular is Zira Fortress which is located on the east shore of the Shahdili Spit approximately 18km away from the Project location. The structure appears to have been significantly altered by the action of silt and/or sand drift. The site is not known to have been subject to archaeological investigation.

In addition, a number of medieval and early post-medieval shipwrecks in the vicinity of the Absheron Peninsula were investigated by the History Museum of Azerbaijan between the 1960s and 1980s (Ref. 64). It is understood the MENR have recently undertaken a study to identify and remove and/or salvage the shipwrecks of modern vessels around the Absheron Peninsula to clear navigational and environmental hazards (Ref. 65). In total it is understood that 99 modern shipwrecks were identified in areas just outside of Baku Bay, offshore of Sahil and Bibheybat. To date it is understood that 20 shipwrecks have been removed. Data identifying the locations of the modern wrecks is not currently available.

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6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management

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6.1 Introduction

The activities and events associated with the Project have been determined based on the activities described within Chapter 4: Project Description; and the potential for interactions with the environment identified.

In accordance with the impact assessment methodology (described in Chapter 3), ESIA Scoping has been undertaken to identify selected activities that may be "scoped out" from the full environmental impact assessment process if the event magnitude is identified to be very low and the receptor interaction predicted to be highly unlikely; supported with established controls and mitigations, that may include existing operational procedures and design measures etc.

Those activities that have not been scoped out have been assessed on the basis of event magnitude and receptor sensitivity, taking into account the existing controls and mitigation, and impact significance determined. Monitoring and reporting activities undertaken to confirm that these controls are implemented and effective, as well as additional mitigation and monitoring to further minimise impacts, where required, are provided. Assessments of cumulative and transboundary impacts and accidental (unplanned) events have also been undertaken and are provided in Chapter 7 of this ESIA.

6.2 Scoping

The Project activities and associated Events that have been scoped out due to their limited potential to result in discernible environmental impacts are presented in Table 6.1. The scoping process has used judgement based on prior experience of similar Activities and Events. In some instances, scoping level quantification/numerical analysis has been used to justify the decision. Reference is made to relevant quantification, analysis, survey and/or monitoring reports in these instances.

Table 6-1: Key "Scoped Out" Project Activities

ID	Activity/Event	Justification for "Scoping Out"
SW1	Disturbance from the generation of airborne noise from the jack-up rig	• Airborne noise levels generated by jack-up drilling rigs are typically in the region of 75 to 80 dB LAeq at a distance of 10m from the rig. • The nearest communities are Chilov town and Pirallahi town which are located at a distance of approximately 14km from the Project well location. • Using noise propagation calculations, airborne noise levels generated by the rig operation at the nearest towns are estimated to be 12 to 17 dB. This is well below the current baseline noise levels (which were dominated by wave and wind noise) recorded at the nearest location to the Project location (refer to Chapter 5 Section 5.3.6.). **Conclusion:** Due to the distance of the nearest communities located to the NKX01t well location it is not anticipated that airborne noise associated with the Project drilling activities will be discernible at the nearest community receptors (Chilov and Pirallahi towns).
SW2	Generation of waste[1]	• Waste generated during the NKX01 exploration drilling programme will be consistent with the type and quantity that has been routinely generated during previous drilling programmes conducted by BP in the Caspian Sea. • Waste onboard the jack-up rig and support/supply vessels will be segregated at source, stored and transported in fit for purpose containers. • State licensed and approved waste management facilities will be used for disposal of waste during the drilling programme. • Waste generated during the Project will be managed in accordance with the existing BP Azerbaijan Georgia Turkey (AGT) Region management plans and procedures. BP has gained significant operational experience in managing similar waste from over 15 years of drilling operations conducted in the region. • Waste management plans will be established for the jack-up rig and support/supply vessels (operated in accordance with the MARPOL 73/78 Annex IV: Prevention of Pollution requirements) in accordance with the existing BP AGT Region management plans and all waste transfers will be controlled and documented. **Conclusion:** Existing waste management handling and disposal sites have enough capacity to include waste generated during the drilling programme which will be managed in accordance with the existing BP AGT Region management plans and procedures and the waste management plans to be developed for the Project.

ID	Activity/Event	Justification for "Scoping Out"
SW3	Nuisance and disturbance to fishing and recreational activities	• No commercial fishing vessels are known to use the waters within 10km of the NKX01 well location. The nearest commercial fishing area is understood to be near the Oil Rocks and Makarov Bank located approximately 30km and 50km away, respectively. • As stated within Chapter 5 Section 5.6.3.4 coastal small-scale fishing is limited to 2-3 nautical miles (approximately 5km) from the coastline[26]. Taking into consideration the location of the Project (more than 10km from the closest coastline), no interaction between the Project activities and small-scale coastal fishing is anticipated. • The closest recreational resort (located on the north-east coast of Pirallahi Island) is approximately 14 km away from the Project exploration drilling location and therefore interaction is considered unlikely. • While diving is not known to be a popular recreational activity in the Azerbaijan sector of the Caspian Sea, three diving clubs are active in the region. The closest known dive site to the Project location is located approximately 10km to the south-west. Given the distance of the Project location from known dive sites, impacts are not anticipated. • Maritime businesses (including diving companies) will be consulted and informed of the Project activities and the planned schedule. **Conclusion:** Given the planned communication ahead of the drilling activities, the expected unlikely presence of recreational and commercial (small-scale fishing) sea users, the risk of interactions with commercial fishing and recreational maritime users is considered to be insignificant.
SW4	Nuisance and disturbance to birds	• The nearest Important Bird and Biodiversity Area (IBA) to the Project location is the Absheron National Park (including Shahdili spit and Pirallahi Island) which includes Chilov and Pirallahi islands and a number of smaller islands in between (refer to Chapter 5 Figure 5.10). • The Project location is approximately 3km away from the nearest island within the IBA. • At this distance it is considered unlikely that the noise and activity from the drilling would disturb the birds. Typically birds will not take flight until a disturbance is closer than 30-50m although they may be aware of disturbances at distances of 200-300m[27] • Jack-up rig and vessel personnel will be provided with environmental awareness training that includes measures designed to minimise sound and disturbance generated by offshore activities. **Conclusion:** Given that the Project location is located approximately 3km away from the closest island within the nearest IBA, the limited duration and scope of the drilling programme, it is not anticipated that project activities will cause any significant disturbance to birds.
SW5	Presence of jack-up rig and support vessels	• The North Khali Prospective Area is understood to be located outside of the main shipping routes with the closest shipping route passing approximately 8km to the east of the Project location. • Notifications regarding the drilling programme will be issued to the relevant maritime and port authorities, as well as directly communicated with sea users where necessary, in advance of the NKX01 exploration drilling programme. • All vessels will operate in compliance with national and international maritime regulations for avoiding collisions at sea, including the use of signals and lights. **Conclusion:** Given that the Project location is not located within the main shipping routes and communication lines with the relevant maritime and port authorities, as well as other sea users will be maintained by the project team prior to and during the drilling programme the risk of interactions with maritime users is considered to be insignificant.
SW6	Fugitive emissions from dry bulk transfer	• During the transfer dry bulk (primarily cement and barite) from the vessels to the rig some losses to the atmosphere of dry bulk may occur through vent lines (the vent lines must be open as part of operational requirements). • Fugitive emissions resulting from dry bulk transfer are expected to be minimal. **Conclusion:** No discernable impact to the marine environment is anticipated due to fugitive emissions resulting from dry bulk transfer.
Notes: 1. As described within Chapter 4 Section 4.6, it is planned that all muds and cuttings generated during the drilling activities along with cement returns and cement unit washout will be recovered, contained on-board the jack-up rig and shipped to shore for disposal according to existing BP AGT Region waste management plan and procedures. 2. As shown in Table 4.3 of Chapter 4, it is assumed all grey water, black water and galley waste generated onboard the jack-up rig will be contained and shipped to shore for disposal according to existing BP AGT Region waste management plan and procedures.		

[26] Order 073 issued by Ministry of Emergency Situations on 16 June 2007 & Ministry of Justice Certificate 3350 on 26 June 2007
[27] These limits are derived from BS5228:2009.(Ref. 18) and relate to noise associated with construction that has the potential to impact the local community. This guidance value differs from limit values associated with operational noise as construction noise is recognised as being temporary and has different characteristics to operational noise

Table 6.2 presents the Activities related to Project that have been assessed within this Chapter.

Table 6-2: "Assessed" Project Exploration Well Drilling Activities

ID	Activity	Event	Receptor
SW7	Jack-up rig power generation and support vessel engine emissions	Emissions to atmosphere (non GHG)	Atmosphere
SW8	Jack-up rig positioning	Underwater sound	Marine Environment
SW9	Drilling (excluding conductor driving)		
SW10	Use of Support Vessels		
SW11	Conductor driving		
SW12	VSP airgun operations		
SW13	Intake and discharge of cooling water	Water intake/entrainment	
SW14	Discharge of treated black and grey water from support vessels and other discharges (drainage water and galley waste)	Discharge to sea	
SW15	Jack-up rig positioning	Seabed disturbance	

6.3 Impacts to the Atmosphere

6.3.1 Mitigation

Existing controls associated with non greenhouse gas (GHG) emissions to atmosphere from jack-up rig power generation and support vessel operations include:

- Jack-up rig diesel generators and engines and support vessel engines will be maintained in accordance with written procedures based on the manufacturers' guidelines or applicable industry code or engineering standards to ensure efficient and reliable operation; and
- Good quality, low sulphur fuel will be used

6.3.2 Jack-up Rig Power Generation and Support Vessel Engine Emissions

Non GHG emissions to the atmosphere will arise from jack-up rig power generation and the use of support vessels. GHG emissions associated with the Project are discussed within Chapter 7 of this ESIA. This section focuses on the assessment of potential air quality impacts.

6.3.2.1 Event Magnitude

Description

As stated within Chapter 4: Section 4.4, it is anticipated that the NKX01 exploration well will be drilled using a jack-up rig. A drilling programme of approximately 3 months is anticipated. The duration of the drilling programme may potentially be extended by 1 month if sidetrack drilling is required (refer to Chapter 4 Section 4.3). Emissions will be generated through the use of the onboard jack-up rig engines and generators. In addition, as discussed in Chapter 4: Section 4.5.2, emissions will result from the operation of support vessels required throughout the drilling programme.

Assessment

Jack-up Rig Power Generation

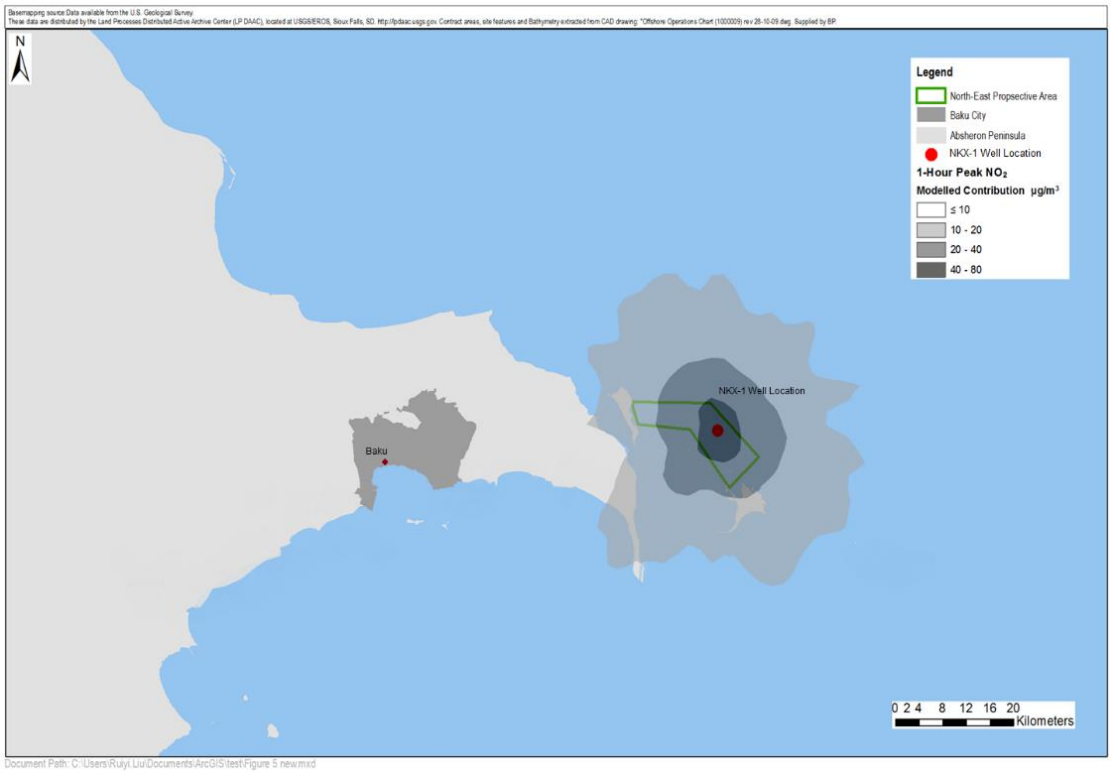
Air quality dispersion modelling undertaken for jack-up rig power generation is presented in Appendix 6A. The modelling focuses on NO_X (which comprises nitrogen oxide (NO) and nitrogen dioxide (NO_2)) as the main atmospheric pollutant of concern, based on the larger predicted emission volumes as compared to other pollutants (sulphur oxides (SO_X), carbon monoxide (CO) and non-methane hydrocarbons) and its potential to impact upon human health and the environment.

Due to the short duration of the drilling programme, short term (1 hour) NO_2 concentrations were modelled to assess the contribution of the emissions associated with the rig in the context of the short term European Union (EU) ambient air quality limit values for NO_2 of 200 micrograms per cubic metre (µg/m^3). This standard is relevant to locations where humans are normally resident (i.e. onshore settlements) and do not apply to commercial locations and workers, which are subject to standards under separate occupational health requirements.

As described in Chapter 4 Section 4.5.1, once the jack-up rig is positioned at the drilling location, the hull will be raised out of the water. Based on the specifications of jack-up rigs with similar power output operating in the Caspian Sea, it was assumed the height of the emission stack will be approximately 28m above the sea level (Ref. 17).

As shown in Figure 6.1, the modelling results demonstrated that, during routine drilling activities at the Project location, the maximum contribution of NO_2 for the short-term 1 hour period at nearest onshore receptors located along the coasts of the Pirallahi and Chilov islands as well as the coast of the Absheron Peninsula are predicted to be less than 20µg/m^3. The NO_2 background concentrations of Pirallahi and Chilov islands (closest receptors) are predicted to be approximately[28] 22µg/m^3; therefore concentrations are expected to be well below the short term limit value of 200µg/m^3.

Figure 6.1: Predicted Increase in Short Term (1 Hour) NO_2 Concentrations Due to Jack-up Rig Power Generation



No discernible change in pollutant concentrations or exceedances of the short term air quality standards relevant to human health are predicted at any distance from the jack-up rig due to the Project exploration well drilling activities[29]. Based on efficient operation, regular maintenance, planned use of good quality, low sulphur fuel and previous experience, routine operation of the jack-up rig engines and generators will not result in plumes of visible particulates from the generator exhausts.

[28] Based on 2014 Sangachal Terminal air quality survey in the absence of data and given the rural nature of the location the same concentrations are assumed for the Absheron Peninsula

[29] Historically in Azerbaijan ambient concentrations of NO_2, SO_2, CO and PM_{10} have also been assessed against specific 24 hour and 1 hour limit values. These limit values were not derived using the same health based criteria as the IFC, WHO and EU guideline values and the limit values derived are not widely recognised. However, Appendix 6A includes an assessment of expected air quality concentrations against these limit values for completeness. The modelling demonstrated that none of these limit values would be exceeded during NKX01 exploration drilling activities.

Support Vessel Engines

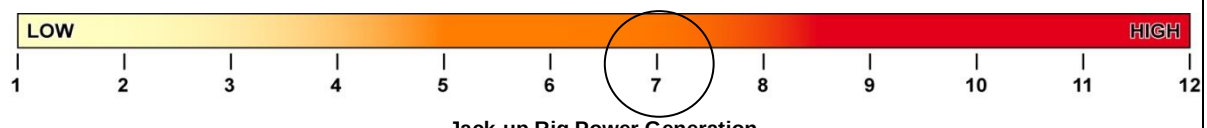
As stated within Chapter 4: Section 4.5.2, vessels will be required throughout the drilling programme to supply consumables (e.g. drilling mud, diesel, chemicals, etc.) and return solid and liquid waste to shore for treatment and disposal. The number and type of vessels anticipated to be used are presented in Chapter 4: Table 4.1.

The total volume of emissions of the key pollutant species relevant to human health, NO_2, for all sources over the entire drilling programme is presented in Chapter 4: Table 4.10. For the period of drilling activities, it is predicted that NO_2 emissions from support vessels will total approximately 294 tonnes. This is approximately 4 times more than the NO_2 emissions associated with jack-up rig power generation during exploration well drilling activities; however emissions from vessel movements will occur across a relatively large geographic area and over the entire drilling programme. They are therefore expected to disperse rapidly and are not expected to result in measurable increases in NO_2 concentrations at onshore locations.

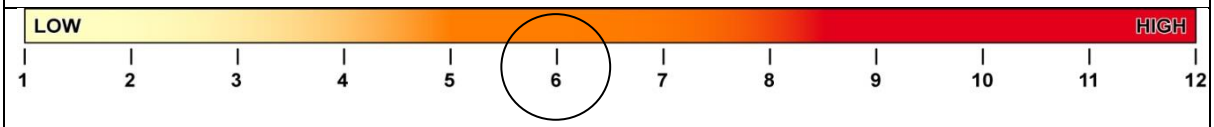
Based on efficient operation, regular maintenance, planned use of good quality, low sulphur fuel and previous experience, routine operation of the support vessels should not result in plumes of visible particulates from the vessel engine exhausts. Table 6.3 presents the justification for assigning a score of 7 for jack-up rig power generation and a score of 6 for support vessels emissions, which represents a Medium Event Magnitude.

Table 6-3: Event Magnitude

Event Parameter	Jack-up Rig Power Generation	Support Vessel Engines
Extent/Scale	1	1
Frequency	2	2
Duration	3	2
Intensity	1	1
Event Magnitude:	**7**	**6**



Jack-up Rig Power Generation



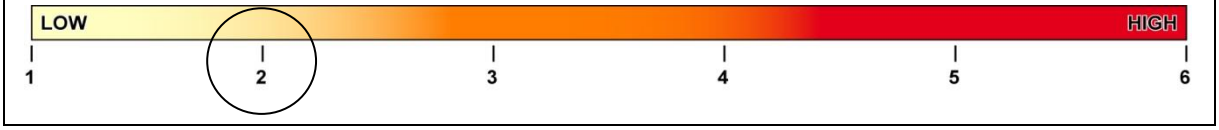
Support Vessel Engines

6.3.2.2 Receptor Sensitivity

Table 6.4 presents the justification for assigning a score of 2 to human receptors, which represents Low Receptor Sensitivity.

Table 6-4: Receptor Sensitivity

Parameter	Explanation	Rating
Presence	There are no permanently present (i.e. resident) human receptors within 14km of the NKX01 location.	1
Resilience	Changes in air quality onshore are expected to result in increases in short term concentrations which will be indiscernible at receptors. No exceedances of short term limits are anticipated.	1
Total		**2**



6.3.2.3 Impact Significance

Table 6.5 summarises impacts on air quality associated with the Project.

Table 6-5: Impact Significance

Event	Event Magnitude	Receptor Sensitivity	Impact Significance
Jack-up Power Generation	Medium	Low	**Minor Negative**
Support Vessel Engines	Medium	Low	**Minor Negative**

Monitoring and reporting requirements associated with emissions to the atmosphere during jack-up rig drilling activities include:

- Jack-up rig diesel usage will be recorded on a daily basis;
- Environmental management system inspections of drilling operations including jack-up rig drilling will be undertaken periodically; and
- The following will be provided to the MENR within the Environmental Report:
  - Volume of fuel used by the jack-up rig (recorded daily in tonnes and reported monthly); and
  - Estimated volumes of emissions generated as a result of fuel used (calculated using emission factors).

It is considered that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures and no additional mitigation is required.

6.4 Impacts to the Marine Environment

6.4.1 Mitigation

Existing control measures associated with underwater sound from vessels include:

- Vessels will not intentionally approach seals for the purposes of casual (recreational) marine mammal viewing which may result in disturbance; and
- Support vessels are subject to periodical performance review, which includes environmental performance. Corrective actions will be undertaken to address any performance gaps.

Existing control measures associated with underwater sound from conductor driving, and from shallow vertical seismic profiling (VSP) activities include:

- Plan to undertake conductor driving and VSP activities outside of the spring and autumn Caspian seal migration periods (April and May in Spring and October and November in Autumn).
- When undertaking conductor driving and VSP activities outside of the spring and autumn Caspian seal migration periods then:
  - Prior to and during VSP and conductor driving activities taking place:
    - Determine a Mitigation Buffer Zone of 500m around the Project drilling location for visual observations of seals.
    - Deploy a trained MMO or Caspian seal expert to the jack-up rig or a standby vessel in the immediate vicinity of Project location from where they can conduct visual observations within the Mitigation Buffer Zone.
    - Prior to activating to the VSP or conductor driving equipment using a soft-start (or ramp up) procedure[30], conduct marine mammal monitoring for 30 minutes to observe whether there are any seals within the Mitigation Buffer Zone If seals are sighted, the

[30] A risk mitigation measure employed by some users of underwater sound is a soft start or "ramp-up" procedure, whereby the source level is increased gradually before use at full power/. The expectation is that nearby seals respond by avoiding the sound source.

soft-start procedure should be delayed for at least 20 minutes to ensure no seals are within the Mitigation Buffer Zone.
- Implement soft-start (or ramp up) procedures for the VSP and conductor driving activities each time the air guns are activated or conductor driving equipment recommences after a period of inactivity (greater than 20 minutes).

Further Mitigation Measures

In the event a delay occurs in the drilling programme, causing the shallow VSP activity to be delayed to commencing no earlier than mid-March:

- Develop a Caspian Seal Observation Protocol in liaison with a local seal expert, which will include the following:
    - Monitor available information relating to timing of the ice melt in the Northern Caspian (typically during March) and compare to previous years (particularly 2011 and 2014).
    - Gather available seal observations from the Northern Caspian to give an indication of when seal migration is expected to commence in Azerbaijani waters
    - Gather available seal observations from the Northern Azerbaijani waters (e.g. from fishermen located in the vicinity of Yalama and Mukhtahir) (approximately 100km north of the well location) to determine when the seals migration has reached Azerbaijani waters and provide feedback to the rig operator on likely arrival of migrating seals in the NKX01 area.
    - Based on timing provided by the local seal expert using the information and observations collected, establish an observation point approximately 10km north of the well location and record seal observations such as to confirm the commencement of the spring migration at this location.
- Once spring migration has been confirmed at the observation point, the local seal expert will inform the jack-up rig operator to either immediately cease VSP activities in progress or prohibit commencing VSP activities.
- In the event VSP activities are not complete before the seal spring migration is complete, the local seal expert will continue to monitor the presence of the seals through the spring in the vicinity of the Absheron Peninsula. The VSP survey activities will be permitted to re-commence subject to existing controls once the seal expert has confirmed the spring migration has finished.

In the event the well is successful and the need for conventional VSP is identified further information will be provided to the MENR on the characteristics of the survey, timing, potential impacts and additional mitigation measures where required.

Should it become necessary to plan conductor driving activities to occur within the spring or autumn Caspian seal migration periods due to a delay in the drilling programme then:

- Prior to and during conductor driving activities taking place:
    - Determine a Mitigation Buffer Zone of 800m around the Project drilling location for visual observations of seals;
    - Deploy a trained MMO or Caspian seal expert to the jack-up rig or a standby vessel in the immediate vicinity of Project location from where they can conduct visual observations within the Mitigation Buffer Zone for up to two days prior to conductor driving activities taking place to record the presence of seals within the Mitigation Buffer Zone;
    - Prior to activating to the conductor driving equipment using a soft-start procedure conduct marine mammal monitoring for an 1 hour to observe whether there are any seals within the Mitigation Buffer Zone If seals are sighted, the soft-start procedure should be delayed for at least 20 minutes to ensure no seals are within the Mitigation Buffer Zone.
- If ramp up or soft start procedures are not considered feasible for conductor driving or VSP activities, an Acoustic Deterrent Device (ADD) (specifically set for the hearing range of pinniped seals) should be obtained and the following procedure implemented:
    - The trained Marine Mammal Observer (MMO) or Caspian seal expert deployed to the jack-up rig or a standby vessel should begin seal observations. The ADD should be activated,

and if possible, gradually increased to full intensity to allow any nearby seals to exit the Mitigation Buffer Zone:

- 30 minutes prior to the start of the conductor driving or VSP activities (when undertaken outside of the spring and autumn Caspian seal migration periods) or
- 1 hour prior to the start of the conductor driving activities (when undertaken within the spring and autumn Caspian seal migration periods).

- When VSP/driving starts the ADD should be turned off. The MMO should continue observations for the entire period to ensure accurate records are maintained;
- If VSP/driving activity stops for less than 30 minutes for any reason the ADD should be immediately activated. For planned pauses of greater than 30 minutes the device shall be switched on 30 minutes prior to re-commencement of the activity as outlined above to allow any nearby seals to exit the Mitigation Buffer Zone. The ADD is to be stopped once the activity re-commences.

Existing controls related to other discharges to sea from the jack-up rig include:

Rig Black and Grey Water:

- Grey and black water will be contained onboard the jack-up rig and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.
- Sewage sludge will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Rig Galley Waste:

- Galley waste will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Rig Deck Drainage:

- Non oily drainage (deck drainage and wash water) may be discharged to sea as long as no visible sheen is observable; and
- Rig floor runoff, including WBM spills, collected via rig floor drains will be recycled to the rig mud system with no planned discharge of drill cuttings or drilling fluids.

Existing controls related to support/supply vessels discharges include:

Vessel Black and Grey Water:

- Grey water will either be sent to the vessel sewage treatment plant with the black water or discharged directly to sea without treatment as long as no floating matter or visible sheen is observable.
- Under routine conditions black water will be treated within the vessel sewage treatment plant to MARPOL 73/78 Annex IV: Prevention of Pollution by Sewage from Ships standards. No chlorination of the effluent will be required under routine conditions, however when chlorine is used for disinfectant purposes, it is planned to maintain the concentration of residual chlorine in the effluent below 0.5mg/l and discharge to sea. In the event it is not practicable to achieve this concentration, the effluent will be contained and shipped to shore.
- When vessels' sewage treatment system is not available, black water will be contained and shipped to shore.
- Sewage sludge will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Vessel Galley Waste:

- Depending on the availability of the vessel system, galley food waste will either be:

- Sent to vessel maceration units designed to treat food wastes to applicable MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships particle size standards prior to discharge[31]; or
- Contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

Vessel Deck Drainage:

- Oily and non-oily drainage and wash water will be segregated. Drainage (including deck drainage and wash-down water) will be discharged directly to sea, provided no visible sheen is observable.
- Oily water will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.

6.4.2 Underwater Sound

6.4.2.1 Event Magnitude

Description

Underwater sound, resulting from the positioning of the jack-up rig using vessels and support vessel movements over the drilling programme, drilling of the NKX01 exploration well, conductor driving and VSP surveys (and associated air gun operations) as described within Chapter 4, has the potential to impact biological/ecological receptors (specifically seals and fish) in the marine environment.

Sound can be described using various acoustic metrics, including sound pressure levels (SPL) and sound exposure levels (SEL). The former is the instantaneous pressure which can be defined as a peak, peak-to-peak, zero-to-peak or RMS (root-mean-square) value while the latter is a measure of received sound energy over some defined period of time. A glossary of acoustic terminology is presented at the end of this ESIA Chapter.

To assess potential underwater sound impacts, for the continuous sound sources (associated with rig positioning, support vessels and drilling), propagation of underwater sound was calculated using a simplified geometric spreading model to estimate distances at which impacts may occur to fish and Caspian seals. Given the different characteristics and potential for greater risk to receptors from impulsive sound in the marine environment, a detailed sound propagation model was used to estimate these distances from conductor driving and the VSP airgun operations.

The following sections provide an overview of each approach.

Simplified Geometric Spreading Model Used for Continuous Sound Estimates

The formula below accounts for source sound levels and propagation of sound over distance:

$SPL = SL - N \log_{10}®$

where SL is the acoustic source level of the sound under consideration, SPL is the sound pressure level at range R and N is a constant: 20 for spherical spreading and 10 for cylindrical spreading. In a free acoustic field (far-field) without any reflecting boundaries, N=20 as the energy is dispersed over a large area. In shallow water the bottom and water surface will reflect the sound, causing interferences and the transmission loss will be better described by N=10. Attenuation loss due to absorption, scattering and diffraction increases with increasing frequencies and is also dependent on temperature, salinity, depth and the pH value of the water.

Note that use of cylindrical spreading (N=10) is generally suited to shallow-to-mid water depths, and spherical spreading (N=20) is generally applicable to deep water depths. Although the definition of deep

[31] Designed to produce a slurry of food particles and water that washes easily through the required 25 mm screen

vs. shallow is somewhat dependent on wavelength, Richardson (1995) (Ref. 3) suggests that depths <200m are commonly regarded as “shallow” and >2000m are commonly regarded as “deep” regardless of source wavelength. Richardson (1995) (Ref. 3) also suggests using N=15 for underwater transmission in shallow water conditions where the depth is greater than 5 times the wavelength.

Water depths at the well site are approximately 22m and the acoustic energy of drilling and vessel movements is typically concentrated between 250 Hz to 2000 Hz. Previous SWAP seismic source/propagation modelling exercises (Ref. 4) have shown that for such water depths, transmission loss variability with frequency becomes a dominant effect whereby low frequency sound energy propagation distance is reduced. In these modelling exercises the use of an empirical wave mode coefficient of approximately N=15 was used, which has also been adopted in this modelling exercise to provide a reasonable estimate of sound propagation.

Due to the limitations of a simplified geometric spreading model, transmission losses due to absorption, scattering and diffraction have been excluded from these predictions. Additionally, the effect of the ambient underwater sound environment has not been considered in this assessment. The modelling has assumed that both sources and receptors are stationary relative to each other, although this will overestimate the received sound levels, as in reality sources will be moving (e.g. vessels moving to/from the jack-up rig location) and receptors would not remain stationary (e.g. species would probably move away from an obtrusive sound event and also move as part of natural foraging and other activities). The distances at which SELcum threshold criteria for marine mammals are met have included consideration of marine mammal auditory weighting functions (‘M-weighting’) the broadband weighting factor adjustments as set out in Appendix D of NOAA Technical Memorandum NMFS-OPR-59 (Ref. 12).

Detailed Sound Propagation Modelling Used for Impulsive Sound Estimates

The sound propagation computer model, Marsh-Schulkin, was used to model sound propagation from the conductor driving and operation of the airguns during the VSP activities. This is a semi-empirical model that uses a form of geometric spreading in the near field,spherical spreading in the far field and cylindrical spreading in-between. The transitional distances are based on water depth and the seabed and sea surface are accounted for in the model. The model covers the frequency of 100 Hz to 10 Hz.

Sound Sources

Jack-up Rig Positioning

Sound will be generated during the positioning of the jack-up rig, whereby the rig will be towed into position by three tugs. The jack-up rig itself would not produce any notable sound emissions during positioning; rather it is the tugs in operation that would generate sound. Source levels for tugs are summarised below in Table 6.7.

Drilling

Sound will be generated from the jack-up rig at the drilling location when the drilling programme is in progress. The sound source levels emitted during the drilling programme will consist of drill pipe operation and onboard machinery. The sound will be mainly emitted above water, with low transmission into the water from the air; however some sound will be emitted directly into the water.

Acoustic studies (Ref. 6) for similar drilling operations from shallow water jack-up rigs conclude that sound emissions during drilling operations come from onboard sources, including diesel engines, mud pumps, ventilation fans (and associated exhaust), and electrical generators. Estimated source levels from the strongest acoustic source (the diesel engines) are 137 dB_{rms} re. 1µPa-m, which has been adopted for the purposes of assessing sound from drilling operations.

Support Vessel Movements

The vessels required throughout the drilling programme to supply consumables such as drilling mud and fuel to the jack-up rig, ship solid and liquid waste to shore for treatment and disposal are presented in Chapter 4: Table 4.1. These will include support vessels and tugs. Sound from vessels is produced

by a combination of sources, with broadband sound superimposed with tonal sound at specific frequencies corresponding to propeller blade rate, engine cylinder firing and crankshaft rotation.

Example acoustic data (Ref. 7) has been used to provide proxy data for the vessels proposed to be deployed on the Project based on vessel power and overall vessel size[32]. Table 6.6 presents the derived source levels for the support vessels proposed to be used during the Project drilling programme.

Table 6-6: Derived Acoustic Source Levels for Support Vessels Anticipated to be used for the Project Drilling Programme

Vessel	Source Level dB_{rms} re 1 μ Pa-m
Tugs	177
Support during drilling (cargo vessels)	192
Standby/crew change vessel	166

Conductor Driving

Sound emissions from driving the conductor pipe will be similar to that of percussive piling; example source levels (Ref. 19) for percussive drilling are 199 dB_{peak} re. 1µPa-m and 185 dB_{SEL} re 1µPa^2s-m, which have been adopted for the purposes of assessing sound from driving of the conductor pipe.

VSP Airgun Operations

Sound will be generated by airgun operations during two VSP activities, where geophones are lowered into the well and a seismic source (comprising four airguns) is lowered over the well from a crane on jack up rig (known as zero-offset VSP). It is expected that total duration of each of the VSP surveys will be up to a maximum of 16 hours, although typically the duration is expected to be between 6 and 8 hours.

Air is released into the water, forming a bubble, which expands and contracts resulting in a change of pressure. The pressure output signature of an individual air gun consists of a short duration pulse, typically 10-20 milliseconds (ms) associated with the initial release of air, followed by longer duration, lower amplitude pulses associated with the secondary bubble oscillations.

The acoustic output of an individual air gun is directly proportional to the operating pressure of the airgun, increasing with the cube root of the volume, and for an air gun source array the acoustic output is generally directly proportional to the number of air guns in the array (Ref. 8). Based on example acoustic data for a similar sized airgun (Ref. 9) the equivalent source levels for airguns are estimated to be up to 240 dB_{peak} and 225 dB_{rms} re. 1µPa-m. The sensor frequency response will be linear from 3 to 200 Hz.

For an air gun source array sound levels are highest directly below the array, ‘on-axis’, by design, to provide optimal energy for the seismic survey. It is estimated that sound levels could be approximately 12 to 60 dB less off-axis in the horizontal directions due to directivity of the source and destructive interference due to incoherent received signals from multiple sources and surface reflections ('source ghost') (Ref. 8). For the purposes of this assessment and in order to take account of potential source directivity, off-axis (horizontal) sound levels for the VSP source have been predicted with a correction of -30 dB to the on-axis (vertical) sound levels. While sound has the potential to propagate downrange, together with reflections from the seabed and sea surface, this is considered to be a reasonably precautionary figure.

Sound Threshold Criteria Associated with Potential Impacts to Seals and Fish

Responses of marine mammals and fish to underwater sound have been studied and reported within scientific literature over many years with threshold criteria developed and revised for a number of species and groups of species. Thresholds are usually proposed in terms of one or more different sound

[32] Insufficient vessels of the same or similar class have been categorised based on sound level measurements, hence any detailed relationship between sound emissions and size of vessel is not known.

level metrics (SPL and SEL) and for different levels of potential impact ranging from mortality, physical injury and hearing impairment through to behavioural reactions denoted by changes in feeding, breeding, respiration or patterns of movement.

Thresholds for hearing impairment consider potential permanent and temporary effects on hearing where animals exposed to sufficiently intense sound exhibit an increased hearing threshold (i.e. poorer sensitivity) for some period of time following exposure.

This is called a sound-induced threshold shift and the amount of shift is determined by the distance between a sound and the individual at the time of hearing the sound in combination with the amplitude, duration, frequency content, temporal pattern and energy distribution of the sound exposure relative to the hearing sensitivity of the species and the background sound levels. Hearing threshold shifts may be permanent (PTS) or temporary (TTS) and thus hearing impairment impacts are generally considered at these two levels:

- **Permanent threshold shift (PTS)** is a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. This is considered to be auditory injury. Due to the absence of data on permanent injury in marine taxa, PTS thresholds have been extrapolated from observed TTS responses and therefore, there are high levels of uncertainty in the currently available threshold criteria for PTS in marine receptors.
- **Temporary threshold shift (TTS)** is a temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level.

Behavioural thresholds are based on observations of individuals or groups of individuals when exposed to sound at a given level. The sound levels involved are lower than those that would give rise to PTS or TTS. The nature of the sound, in terms of its frequency content as well as its duty cycle, whether continuous (e.g. sounds associated with drilling) or intermittent governs how the receptor may respond. The response of the animal is also often context-dependent (i.e. feeding, breeding, migrating etc.) and may relate to its motivation and previous experience to the perturbing sound.

Where dual metric impact thresholds are available for hearing impairment, the threshold criterion which is exceeded first (i.e. the more precautionary of the two measures) is widely used (Ref. 10, Ref. 10). In the case of drilling sound (classified as non-pulse sound (Ref. 10)), acoustic thresholds for PTS and TTS are given in terms of SEL only while thresholds for behavioural reactions are given in terms of an RMS sound pressure level.

Thresholds for Seals

Thresholds have been developed for both the onset of PTS and TTS in seals (based on data for the northern elephant seal and harbour seal) (Ref. 11). Underwater audiograms for the Caspian seal do not exist hence the hearing ability of this species remains unknown. Thresholds representing the onset of PTS and TTS must therefore be based on suitable proxy species and for this purpose data from the northern elephant seal and harbour seal are used. A recent study (Ref. 12) based on the underwater hearing ability of two captive spotted seals suggested that their hearing ability was similar to harbour seals, and lower than other Arctic species tested (i.e. harp and ringed seals).

Taking a precautionary approach, this suggests that harbour seals are an appropriate proxy for other ice seals, such as the Caspian seal for which no specific thresholds exist. Southall *et al*. (Ref. 11) reviewed published data concerning measurements of SPL and SEL together with data on hearing impacts or behavioural characteristics. The criteria for PTS and TTS were later revised (Ref. 12) and it is this later set on which the acoustic impact thresholds for PTS and TTS shown in Table 6.7 below are based.

Southall *et al*. (Ref. 11) states that the effects of non-pulse exposures on pinnipeds are poorly understood. Studies for which data are available involve harbour seals and northern elephant seals and indicate that sound levels between 90 and 140 dB_{rms} re 1μPa were unlikely to elicit strong behavioural reactions. Further it was noted that the behavioural reactions in the seals were very context-driven varying from no change in behaviour through to moderate changes indicated by changes in speed,

direction and/or dive profile; minor changes in group distribution; and moderate changes in vocal behaviour.

Table 6-7: Summary of Threshold Criteria for Seals (Received Level)

Source of information	TTS/Behaviour Threshold		PTS Threshold	
	SELcum (24hrs) M-weighted	Peak SPL Unweighted	SELcum (24hrs) M-weighted	Peak SPL Unweighted
Non-impulsive sound sources				
NOAA 2018	181	-	201	-
Southall et al 2007	-	-	203	218
Impulsive sound sources				
NOAA 2018	170	212	185	218
Southall et al 2007	171	212	186	218

This assessment has also considered additional behaviour criteria derived from Southall *et al*. (Ref. 11) for non-impulsive and impulsive sounds, summarised below:

Non-impulsive sound sources:

- Moderate behavioural reactions in pinnipeds exposed to non-pulse sounds - 130 - 140 dB_{rms} re 1µPa
- No observable reactions expected in pinnipeds exposed to non-pulse sounds - 120-130 dB_{rms} re 1µPa

Impulsive sound sources:

- Avoidance behaviour in pinnipeds exposed to impulsive sounds - 190 dB_{rms} re 1µPa
- Limited disturbance expected in pinnipeds exposed to impulsive sounds - 150-180 dB_{rms} re 1µPa

Thresholds for Fish

Popper *et al*. (Ref. 14) undertook a review and defined a set of acoustic impact criteria for fish having varying levels of sensitivity to underwater sound[33], which are summarised in Table 6.8. The PTS thresholds for fish have been developed based on the following functional hearing categories:

- High hearing sensitivity fish, particularly herring and related species (Clupeidae), which involve the use of the swim bladder in hearing;
- Medium sensitivity hearing generalist fish such as sturgeon which have a swim bladder but it is not used in hearing;
- Low sensitivity hearing generalist[34] fish, particularly flatfish, sharks and rays, which do not have any gas filled organs; and
- Eggs and larvae.

TTS has been demonstrated in some fish but there are high levels of variability in the duration and magnitude of the shift depending on many factors, including the intensity and duration of sound exposure, the species and the life stage of fish. There are no reliable thresholds for fish behavioural changes, but TTS can be used as an estimate of the point at which a significant behavioural response

[33] Note that the data set is limited, as the thresholds identified in Popper *et al.* (Ref. 14) are based on piling driving sound rather than air gun sound sources.
[34] Popper *et al*. (Ref. 14) classify fish as being hearing-specialist or hearing-generalist. In the latter case, physiological differences account for the fact that some species of hearing-generalist fish are more audiologically sensitive than other species. In order to differentiate between these two groups, the terms "low sensitivity" and "medium sensitivity" are used. It is acknowledged that the use of this specific terminology is informal and not used widely outside this ESIA. It is nevertheless considered helpful to use these terms from an environmental impact assessment perspective as a range of fish species of varying hearing sensitivity are present in the project area.

would be expected to occur. With regards to continuous sound, there are no data on exposure or received levels that enable guideline thresholds to be set.

Table 6-8: Summary of Threshold Criteria for Fish (Received Level) from *Popper et al 2014*

Sensitivity	Mortality/Mortal Injury	Recoverable Injury	TTS	Low Level Disturbance
Impulsive sound sources				
Low sensitivity fish	213 dBpeak 219 dB SELcum	213 dBpeak 216 dB SELcum	186 dB SELcum	150 dBrms
Medium sensitivity fish	207 dBpeak 210 dB SELcum	207 dBpeak 203 dB SELcum	186 dB SELcum	150 dBrms
High sensitivity fish	207 dBpeak 207 dB SELcum	207 dBpeak 203 dB SELcum	186 dB SELcum	150 dBrms
Eggs & larvae	207 dBpeak 210 dB SELcum	-	-	-
Non-impulsive sound sources				
Low & Medium sensitivity fish	(N/I/F) Low	(N/I/F) Low	(N) Moderate; (I/F) Low	(N/I) Moderate (F) Low
High Sensitivity fish	(N/I/F) Low	170 dBrms for 48 hours	150 dBrms for 12 hours	(N) High (I) Moderate (F) Low

Notes:
1 – *Popper et al*. advises that relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).
2 – *Popper et al.* advises that "near" might be considered to be in the tens of meters from the source, "intermediate" in the hundreds of meters, and "far" in the thousands of meters.

Assessment

Jack-up Rig Positioning

Using the geometric spreading model, source levels for tug support vessels (Table 6.7) and a number of exposure durations, the distances at which the threshold levels in Table 6.8 and 6.9 are met have been predicted. It has been assumed that there will be up to three tug vessels in operation at the same time. Sound from vessel movements will be non-impulsive in nature. For the purpose of applying the SEL thresholds where an exposure duration is required, it is assumed that the fish are exposed to vessel noise for periods of 1 hour and 8 hours. The results of the modelling are presented in Table 6.9.

Table 6-9: Threshold Criteria for Seals and Fish and Predicted Distance at which the Criteria is Met (Jack-up Rig Positioning)

Receptor	Effect	Threshold Level (Non Impulsive Source)	Distance at Which threshold is Met (Metres)
Seals	PTS	201 dB SELcum (24hr M-weighted) re. 1µPa^{2}s	12 (1hr exposure)
			49 (8hr exposure)
		218 dB peak (unweighted) re. 1µPa	<10
	TTS	181 dB SELcum (24hr M-weighted) re. 1µPa^{2}s	264 (1hr exposure)
			1058 (8hr exposure)
	Moderate behavioural reactions	130-140 dB rms (unweighted) re. 1µPa	609 - 2828
	No observable reactions	120-130 dB rms (unweighted) re. 1µPa	2828 - 13124
Low & medium sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low
	Recoverable injury	n/a	(N/I/F) Low
	TTS	n/a	(N) Moderate; (I/F) Low
	Low level disturbance	n/a	(N) Moderate; (I/F) Low
High sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low
	Recoverable injury	170 dB rms (unweighted) re. 1µPa, for 48 hours	<10
	TTS	150 dB rms (unweighted) re. 1µPa, for 12 hours	131
	Low level disturbance	n/a	(N) High (I) Moderate (F) Low
Note: Distances of <10m indicate that effects are unlikely to occur unless receptor is directly adjacent to the sound source.			

During the positioning of the jack-up rig, PTS may occur in seals if they remain within a distance of 12m from the tugs positioning the rig for a period of 1 hour. TTS may occur if the seals remain within 264m of the tug operations for a similar period. However, it is expected that seals are likely to move away and are unlikely to remain in the vicinity of the sound long enough to result in PTS or TTS (note however that any movement towards or away from the noise source is context-driven by the seal). Moderate behavioural reactions in seals, such as changes in swimming direction and speed, may occur at distances beyond 609m. At distances beyond 2.8km the likelihood of any observable responses to sound is expected to be low.

TTS may occur in high sensitivity fish if they remain within 131m of vessels for a period of 12 hours. Recoverable injury may only occur if they remain in close proximity (within 10m) to the operations for a period of 48 hours; although the likelihood is that they will move away from a disturbing sound source. TTS effects on low and medium sensitivity fish are estimated to be moderate within metres of a continuous sound source, and low at intermediate and greater distances. It is noted that Popper et al do not provide quantitative guidance on the terms “short distance”, “intermediate distance” and “long distance”.

Taking into account drilling activities are located adjacent to an area routinely and regularly crossed by vessels moving between Pirallahi Island, Chilov Island and Oil Rocks to transport local people, workers and supplies between these locations as well as some cargo ships and tankers moving between Pirallahi island and ports at Dubendi, Hovsan and Baku and from Oil Rocks (refer to Chapter 5: Section 5.6.5), background underwater sound levels would be typical for this type of environment. Measurements made in the coastal North Sea where oil-field related activities predominate recorded background sound levels as high as 130 dB_{rms} re 1µPa (Ref. 16). It is assumed that such levels may be typical for the region in which the project activity is taking place. It is likely therefore that marine life will have become largely habituated to such sound levels and there would be a minimal relative increase to existing levels of disturbance on pinnipeds and fish species.

Drilling (excluding Conductor Driving)

Using the geometric spreading model, estimated source levels for drilling and a number of assumed exposure durations (where appropriate), the distances at which the threshold levels in Table 6.8 and 6.9 are met have been predicted. Sound from drilling will be non-impulsive in nature. The results of the modelling are presented in Table 6.10.

Table 6-10: Threshold Criteria for Seals and Fish and Predicted Distance at which the Criteria is Met (Drilling)

Receptor	Effect	Threshold Level (Non Impulsive Source)	Distance at Which Threshold is Met (Metres)
Seals	PTS	201 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	<10 (1hr exposure)
			<10 (8hr exposure)
		218 dB peak (unweighted) re. 1μPa	<10
	TTS	181 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	<10 (1hr exposure)
			<10 (8hr exposure)
	Moderate behavioural reactions	130-140 dB rms (unweighted) re. 1μPa	<10
	No observable reactions	120-130 dB rms (unweighted) re. 1μPa	10 – 14
Low & medium sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low
	Recoverable injury	n/a	(N/I/F) Low
	TTS	n/a	(N) Moderate; (I/F) Low
	Low level disturbance	n/a	(N) Moderate; (I/F) Low
High sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low
	Recoverable injury	170 dB rms (unweighted) re. 1μPa, for 48 hours	<10
	TTS	150 dB rms (unweighted) re. 1μPa, for 12 hours	<10
	Low level disturbance	n/a	(N) High (I) Moderate (F) Low
Note to table: Distances of <10m indicate that effects are unlikely to occur unless receptor is directly adjacent to the sound source.			

In comparison to other sound sources, sound emissions from drilling are relatively low. The likelihood of any observable effects on marine species due to drilling sound is low.

Support Vessels Movements

Using the geometric spreading model and source levels for tug support, standby and crew change vessels (Table 6.7) the distances at which the threshold levels in Table 6.8 and 6.9 are met have been predicted. Sound from vessel movements will be non-impulsive in nature. The results of the modelling are presented in Table 6.11.

Table 6-11: Threshold Criteria for Seals and Fish and Predicted Distance at which the Criteria is Met (Support Vessels)

Receptor	Effect	Threshold level (non impulsive source)	Distance at which threshold is met (metres)	
			Cargo vessel	Standby/Crew change vessel
Seals	PTS	201 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	59 (1hr exposure)	<10 (1hr exposure)
			236 (8hr exposure)	<10 (8hr exposure)
		218 dB peak (unweighted) re. 1μPa	<10	<10
	TTS	181 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	1271 (1hr exposure)	23 (1hr exposure)
			5085 (8hr exposure)	94 (8hr exposure)
	Moderate behavioural reactions	130-140 dB rms (unweighted) re. 1μPa	2929 – 13594	54 – 251
	No observable reactions	120-130 dB rms (unweighted) re. 1μPa	13594 - 63096	251 - 1166
Low & medium sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low	(N/I/F) Low
	Recoverable injury	n/a	(N/I/F) Low	(N/I/F) Low
	TTS	n/a	(N) Moderate; (I/F) Low	(N) Moderate; (I/F) Low
	Low level disturbance	n/a	(N) Moderate; (I/F) Low	(N) Moderate; (I/F) Low
High sensitivity fish	Mortality/mortal injury	n/a	(N/I/F) Low	(N/I/F) Low
	Recoverable injury	170 dB rms (unweighted) re. 1μPa, for 48 hours	29	<10
	TTS	150 dB rms (unweighted) re. 1μPa, for 12 hours	631	12
	Low level disturbance	n/a	(N) High (I) Moderate (F) Low	(N) High (I) Moderate (F) Low
Note to table: Distances of <10m indicate that effects are unlikely to occur unless receptor is directly adjacent to the sound source.				

During the drilling programme, PTS may occur in seals if they remain within a distance of 59m from cargo vessel movements or 10m of standby/crew vessels for a period of 1 hour. TTS may occur if the seals remain within 1.3km from cargo vessel movements or 23m of standby/crew vessels for a similar period. Moderate behavioural reactions in seals, such as changes in swimming direction and speed, may occur at distances beyond 2.9km from cargo vessels. At distances beyond 13km the likelihood of any observable responses to sound is expected to be low.

As described above, most seals undertaking foraging dives in the vicinity of a support vessel will be able to rapidly return to the surface or move away from the vessel. Seals are likely to be foraging where high abundance of fish will be found and fish are also expected to likely move away from the sound source, thus reducing the potential for seals to be present in the close vicinity of the vessel to feed. TTS may occur in fish if they remain within 631m of vessels for a period of 12 hours. Recoverable injury may only occur to high sensitivity fish if they remain in close proximity (within 29m) to the cargo vessels for a period of 48 hours; although the likelihood is that they will move away from a disturbing sound source.

As described above, there is no data to support the establishment of thresholds for mortality, recoverable injury or TTS for fish exposed to continuous sounds. It is considered that when exposed to vessel noise there is a low risk of mortality and recoverable injury for fish of all hearing abilities and a moderate risk of TTS in hearing generalist fish at short distances. As described above, it is considered that the local underwater sound environment would be dominated by sound from existing commercial and oil industry vessel traffic and there would be a minimal relative increase to existing levels of disturbance on pinnipeds and fish species from support vessel movements.

Conductor Driving

Using the detailed sound modelling and estimated source levels for driving of the conductor pipe, the distances at which the threshold levels in Table 6.8 and 6.9 are met have been predicted. Sound from driving will be impulsive in nature. The results of the modelling are presented in Table 6.12.

Table 6-12: Threshold Criteria for Seals and Fish and Predicted Distance at which the Criteria is Met (Driving of Conductor Pipe)

Receptor	Effect	Threshold level (impulsive source)		Distance at which threshold is met (metres)
Seals	PTS	185	dB SELcum (24hr M-weighted) re. 1µPa^{2}s	<1 (1hr exposure)
				1 (8hr exposure)
		218	dB peak (unweighted) re. 1µPa	<1
	TTS	170	dB SELcum (24hr M-weighted) re. 1µPa^{2}s	2 (1hr exposure)
				6 (8hr exposure)
		212	dB peak (unweighted) re. 1µPa	<1
	Avoidance behaviour	190	dB rms (unweighted) re. 1µPa	<1
	Limited disturbance	150-180	dB rms (unweighted) re. 1µPa	2 - 70
Low sensitivity fish	Mortality/mortal injury	213	dB peak (unweighted) re. 1µPa	<10
		219	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1
				<1 (1hr exposure)
	Recoverable injury	213	dB peak (unweighted) re. 1µPa	<1 (8hr exposure)
		216	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1
				<1 (1hr exposure)
	TTS	186	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (8hr exposure)
				4 (1hr exposure)
	Low level disturbance	150	dB rms (unweighted) re. 1µPa	10 (8hr exposure)
Medium sensitivity fish	Mortality/mortal injury	207	dB peak (unweighted) re. 1µPa	<1
		210	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (1hr exposure)
				<1 (8hr exposure)
	Recoverable injury	207	dB peak (unweighted) re. 1µPa	<1
		203	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (1hr exposure)
				2 (8hr exposure)
	TTS	186	dB SELcum (24hr unweighted) re. 1µPa^{2}s	4 (1hr exposure)
				10 (8hr exposure)
	Low level disturbance	150	dB rms (unweighted) re. 1µPa	70
High sensitivity fish	Mortality/mortal injury	207	dB peak (unweighted) re. 1µPa	<1
		207	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (1hr exposure)
				<1 (8hr exposure)
	Recoverable injury	207	dB peak (unweighted) re. 1µPa	<1
		203	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (1hr exposure)
				2 (8hr exposure)
	TTS	186	dB SELcum (24hr unweighted) re. 1µPa^{2}s	4 (1hr exposure)
				10 (8hr exposure)
	Low level disturbance	150	dB rms (unweighted) re. 1µPa	70
Eggs & larvae	Mortality/mortal injury	207	dB peak (unweighted) re. 1µPa	<1
		210	dB SELcum (24hr unweighted) re. 1µPa^{2}s	<1 (1hr exposure)
				<1 (8hr exposure)

Note to table: Distances of <10m indicate that effects are unlikely to occur unless receptor is directly adjacent to the sound source.

During the driving of the conductor pipe, PTS may occur in seals if they remain within a distance of less than 1m from the operations for a period of 1 hour. TTS may occur if the seals remain within 2m of the operations for a similar period. Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 70m from the conductor driving operations.

The seals typically sense the sound from a distance and adjust their course away accordingly. Seals dive to feed on fish and so may be vulnerable during feeding. Recent telemetry research shows that although Caspian seals can dive to depths greater than 200m, with a maximum observed duration over 20 minutes, most dives (80%) were shallower than 15m and shorter than 5 minutes (Ref. 17). Thus, most seals undertaking foraging dives in the vicinity of conductor driving operations will be able to rapidly return to the surface or move away from the operation. As above seals are likely to be foraging

where high abundance of fish will be found and fish are also expected to likely move away from the sound source, thus reducing the potential for seals to be present in the close vicinity of the operations to feed.

TTS may occur in fish if they remain within 4m for a period of 1 hour. Injury (recoverable or mortal) may only occur if they remain in close proximity (<1m) to the operations for a period of 1 hour. For these and longer periods the likelihood is that fish will move away from a disturbing sound source before any injury is likely to occur. Low level disturbance to fish may occur at distances beyond the possible TTS distances. However, as described above, it is considered that the local underwater sound environment would be dominated by sound from existing commercial and oil industry vessel traffic.

VSP Airgun Operations

Using the detailed sound modelling, estimated source levels for VSP operations and a number of exposure durations (where appropriate), the distances at which the threshold levels in Table 6.8 and 6.9 are met have been modelled. Distance calculations have included a 24 hour exposure, as VSP operations may take place for this period. Southall et al (2007) (Ref. 11) and NMFS (2016) (Ref. 10) class seismic airguns as a pulse-type or multiple pulse-type sound sources; as such the threshold criteria for impulsive sources have been applied. The results of the modelling are presented in Table 6.13.

Table 6-13: Threshold Criteria for Seals and Fish and Predicted Distance at which the Criteria is Met (VSP Source Operations)

Receptor	Effect	Threshold level (impulsive source)	Distance at which threshold is met (metres)
Seals	PTS	185 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	5 (1hr exposure)
			10 (8hr exposure)
			20 (16hr exposure)
		218 dB peak (unweighted) re. 1μPa	10
	TTS	170 dB SELcum (24hr M-weighted) re. 1μPa^{2}s	30 (1hr exposure)
			80 (8hr exposure)
			120 (16hr exposure)
		212 dB peak (unweighted) re. 1μPa	20
	Avoidance behaviour	190 dB rms (unweighted) re. 1μPa	80
	Limited disturbance	150-180 dB rms (unweighted) re. 1μPa	280-8490
Low sensitivity fish	Mortality/mortal injury	213 dB peak (unweighted) re. 1μPa	20
		219 dB SELcum (24hr unweighted) re. 1μPa^{2}s	1 (1hr exposure)
			2 (8hr exposure)
			3 (16hr exposure)
	Recoverable injury	213 dB peak (unweighted) re. 1μPa	20
		216 dB SELcum (24hr unweighted) re. 1μPa^{2}s	1 (1hr exposure)
			3 (8hr exposure)
			5 (16hr exposure)
	TTS	186 dB SELcum (24hr unweighted) re. 1μPa^{2}s	40 (1hr exposure)
			120 (8hr exposure)
			170 (16hr exposure)
	Low level disturbance	150 dB rms (unweighted) re. 1μPa	8490
Medium sensitivity fish	Mortality/mortal injury	207 dB peak (unweighted) re. 1μPa	40
		210 dB SELcum (24hr unweighted) re. 1μPa^{2}s	2 (1hr exposure)
			6 (8hr exposure)
			10 (16hr exposure)
	Recoverable injury	207 dB peak (unweighted) re. 1μPa	40
		203 dB SELcum (24hr unweighted) re. 1μPa^{2}s	6 (1hr exposure)
			10 (8hr exposure)
			20 (16hr exposure)
	TTS	186 dB SELcum (24hr unweighted) re. 1μPa^{2}s	40 (1hr exposure)
			120 (8hr exposure)
			170 (16hr exposure)
	Low level disturbance	150 dB rms (unweighted) re. 1μPa	8490

Receptor	Effect	Threshold level (impulsive source)	Distance at which threshold is met (metres)
High sensitivity fish	Mortality/mortal injury	207 dB peak (unweighted) re. 1µPa	40
		207 dB SELcum (24hr unweighted) re. 1µPa^{2}s	3 (1hr exposure)
			10 (8hr exposure)
			10 (16hr exposure)
	Recoverable injury	207 dB peak (unweighted) re. 1µPa	40
		203 dB SELcum (24hr unweighted) re. 1µPa^{2}s	6 (1hr exposure)
			10 (8hr exposure)
			20 (16hr exposure)
	TTS	186 dB SELcum (24hr unweighted) re. 1µPa^{2}s	40 (1hr exposure)
			120 (8hr exposure)
			170 (16hr exposure)
	Low level disturbance	150 dB rms (unweighted) re. 1µPa	8490
Eggs & larvae	Mortality/mortal injury	207 dB peak (unweighted) re. 1µPa	40
		210 dB SELcum (24hr unweighted) re. 1µPa^{2}s	2 (1hr exposure)
			6 (8hr exposure)
			10 (16hr exposure)
Note to table: Distances of <10m indicate that effects are unlikely to occur unless receptor is directly adjacent to the sound source.			

During the VSP operations, provided that receptors are not located directly beneath the VSP source or within the main directivity of the source, PTS may occur in seals if they remain within a distance of 5m from the operations for a period of 1 hour. TTS may occur if the seals remain within 30m of the operations for a similar period. Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 8.5km from the VSP activities.

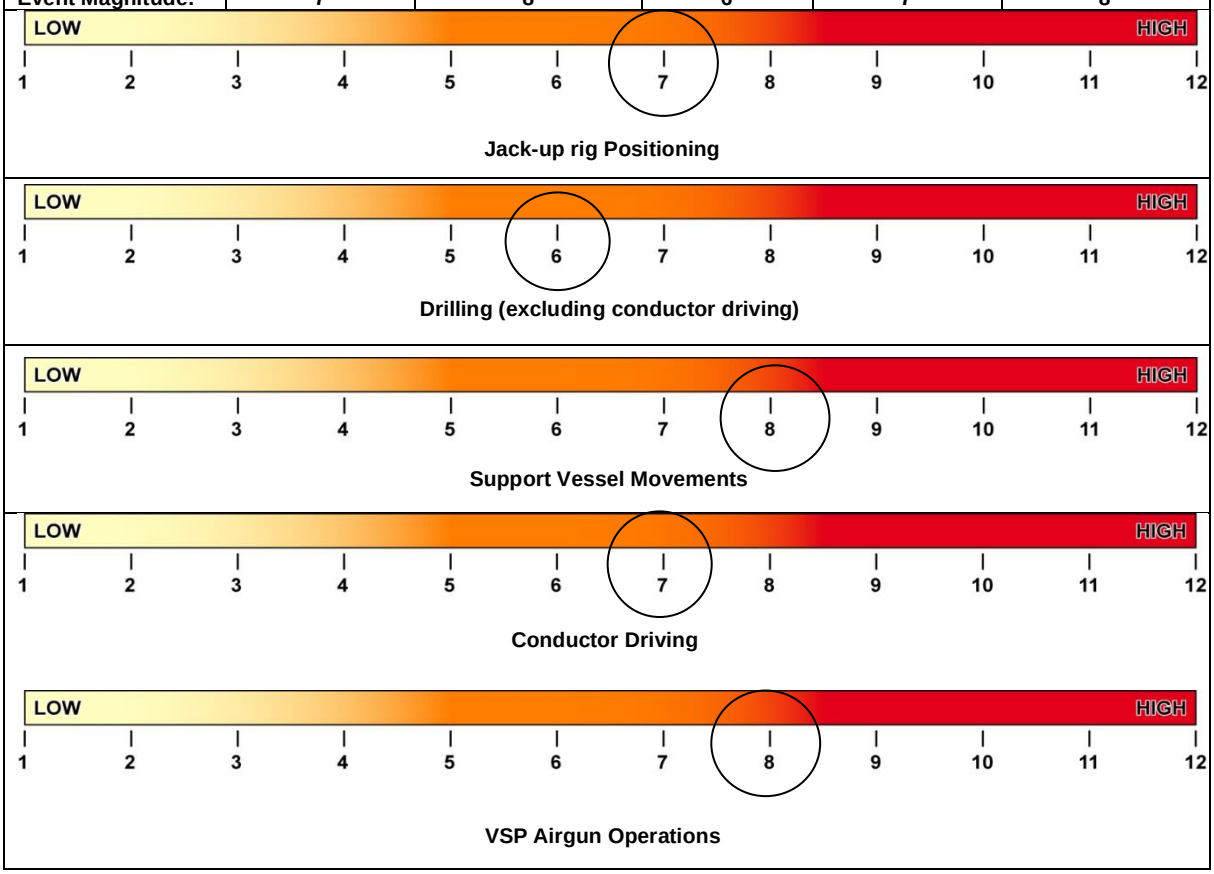
The use of soft start procedures and visual monitoring prior to start of the source and delay if a seal is observed within the defined Mitigation Buffer Zone exclusion zone, will allow time for marine mammals to move away from the source operations. Further mitigation measures relevant to VSP activities are set out in Section 6.4.1 above.

Provided that receptors are not located directly beneath the VSP source or within the main directivity of the source, TTS may occur in fish if they remain within 40m of VSP operations for a period of 1 hour. Given the likelihood that fish will move away from a disturbing sound source, and the use of a soft-start allowing sound to increase only gradually, the likelihood of any injury (recoverable or mortal) is low.

Low level disturbance to fish may occur beyond 8.5km. As described above, it is considered that the local underwater sound environment would be dominated by sound from existing commercial and oil industry vessel traffic and there would be a minimal relative increase to existing levels of disturbance on fish species. Table 6.14 presents the justification for assigning scores for underwater sound from jack-up rig positioning, drilling, support vessels, conductor driving and VSP operations. In each case a Medium Event Magnitude is anticipated.

Table 6-14: Event Magnitude

Event Parameter	Jack-up rig positioning	Support Vessel Movements	Drilling (excluding conductor driving)	Conductor Driving	VSP Airgun Operations
Extent/Scale	3	3	1	3	3
Frequency	1	1	1	1	1
Duration	2	3	3	1	1
Intensity	1	1	1	2	3
Event Magnitude:	**7**	**8**	**6**	**7**	**8**



6.4.2.2 Receptor Sensitivity

Seals

The endemic Caspian seal, *Phoca caspica,* is a threatened species with an IUCN Red List 'Endangered' status and AzRDB listed. As stated within Chapter 5: Section 5.4.6.3 the Caspian seal population has significantly declined over the 20th Century (by more than 90% since the start of the century) and has continued to decline due to a combination of factors including commercial hunting, habitat degradation (through introduction of invasive species), disease, industrial development, pollution and fishing operations. The seal population within the Caspian is therefore highly vulnerable as reflected by its International Union for Conservation of Nature (IUCN) Red List "Endangered" and Azerbaijan Red Data Book (AzRDB) listed status.

Caspian seals will be present around the Project location in greatest numbers during the spring and autumn migration periods. Seals are most likely to be seen to the east of the Absheron Peninsula and in the vicinity of the islands between Pirallahi and Chilov islands from April to May and October to mid-December, with peak numbers expected in November. The months when the highest numbers of seals are likely to be present are April, May and November.

Current information available on seal migration timing and routes are described within Chapter 5, Section 5.4.6.2, which distinguishes different levels of sensitivity within the North East Prospective Area and a summary of the reported seals sightings in the vicinity of the islands of the Absheron archipelago including between Pirallahi and Chilov islands. As described within Chapter 5 Section 5.4.6.3 it is considered that the area to the south east and east of the Absheron Peninsula including Pirallahi and Chilov Islands and the other islands in this area is of high importance for Caspian Seals, with seals known to be present in these locations, sometimes in large groups during migration periods (April to end of May and from October to mid-December, with peak numbers expected in November). In addition to seal presence during migration periods, there is also the potential for seals that have not migrated to the southern Caspian to be present from May to September for foraging with peak numbers coinciding with the peak kilka numbers in July. The smallest numbers of seals are expected be present between January and March, when the Project exploration drilling is programmed to take place.

The base case drilling programme has been scheduled to avoid the most sensitive times with Project activities scheduled to be completed during Q1 (i.e. January to March). However, should there be any delay for logistical or operational reasons, and based on prior experience and best estimates, a delay of up to 2 months may occur. As set out above seals and fish within the area are expected to be largely habituated to the nature of sound and sound levels arising from vessels given current activity in the area and there would be a minimal relative increase to existing levels of disturbance on pinnipeds and fish species. Sound levels associated with the drilling activity itself will be localised to the well location itself and similarly impulsive sound from conductor driving is predicted to potentially result in no more than disturbance and behavioural reactions in seals at distances at up to 70m from the driving activity. As such seals migrating south and using the islands and surroundings water of the Absheron archipelago during spring are expected to be largely unaffected by these activities taking into account the existing controls incorporated into the Project design. With regard to shallow VSP given the potential for disturbance and behavioural reactions in seals at distances up to 8.5km the further mitigation incorporated into the Project design is designed to avoid the potential for disturbance to seals which may affect their ability to reach the haul out sites and waters of the Absheron Peninsula where they are routinely observed during spring when they are at their most vulnerable. In the event the well is successful and the need for conventional VSP is identified further information will be provided to the MENR on the characteristics of the survey, timing, potential impacts and additional mitigation measures where required

Fish

In general, the main distribution of fish species in the Caspian Sea is within the shallow water shelf areas. Maximum concentrations of fish are typically found at depths of up to 75m for the majority of the year. It is common for Caspian fish species to migrate to warmer southern waters for overwintering and migrate to nutrient rich shallow areas of the north or river deltas in the spring/summer for spawning and feeding.

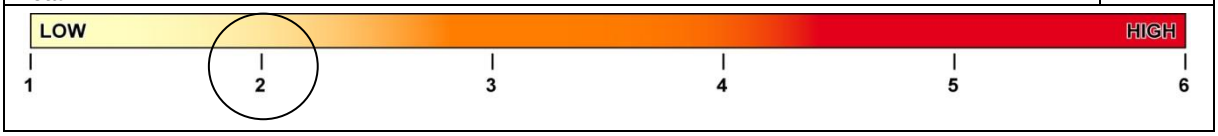
The species most likely to be present within the shallow waters surrounding the Absheron Peninsula and specifically within the vicinity of the Project location are resident species including gobies in addition to species such as sand smelt, Caspian pipefish and stickleback, in addition to common kilka during spring.

While present in water depths of 20m or more year round, these species typically breed in waters of up to 10m deep, more commonly in shallow waters of up to 4m deep. It is very unlikely that migratory species (other than kilka during spring) will be present in the waters surrounding the Project location as these species usually migrate through deeper waters (up to 50m deep). As described above fish present are expected to be largely habituated to underwater sound from vessels and will move away from these sound sources. The distances over which injury or significant disturbance to fish are all predicted to be within tens to hundreds of metres at most from the NKX01 well location.

Table 6.15 presents the justification for assigning a score of 2, which represents Low Receptor Sensitivity.

Table 6-15: Receptor Sensitivity (Seals and Fish)

Parameter	Explanation	Rating
Presence	**Fish:** Assuming the base case schedule it is unlikely that hearing specialist or endangered fish species will be present in the vicinity of the proposed Project location during the drilling activities. Species present are expected to comprise resident species which are widely distributed and do not use this area exclusively. During spring kilka may be present during migration but are widely distributed and do not use this area exclusively. **Seals:** Seals are known to be present around the proposed Project location throughout the year with greatest numbers during the spring and autumn migration, with spring being the period when they are at their most sensitive. Assuming the base case schedule drilling activities are scheduled to avoid the spring and autumn migration periods. Outside of these periods seals do not use the area exclusively and have been observed as individuals and in small numbers only. During spring seals migrating south and using the islands and surroundings water of the Absheron archipelago during spring are expected to be largely unaffected by vessel, drilling and conductor driving activities taking into account the existing controls incorporated into the Project design which includes not undertaking VSP activities during periods when migrating seals are present.	1
Resilience	**Fish:** Individual fish are at very low risk of injury or significant behavioural disturbance and therefore the risk to populations is considered to be even lower and ecological functionality will be maintained. **Seals:** Seals may be present in the vicinity of the Project location in small groups or individuals only assuming the base case schedule. Risk of injury or significant behavioural disturbance is expected to be very low given the existing activity within the area (e.g. vessel movements) which the seals have been shown to be habituated to and their typical behavioural response which is to sense the sound from a distance and adjust their course away accordingly. The risk to the overall population is considered to be very low and ecological functionality is expected to be maintained. This remains the case for vessel, drilling and conductor driving activities undertaken in spring should this be required.	1
Total		**2**



6.4.2.3 Impact Significance

Table 6.16 summarises underwater sound impacts to marine biological receptors (seals and fish) associated with jack-up rig positioning, drilling (excluding conductor driving), support vessel movements, conductor driving and VSP airgun operations.

Table 6-16: Impact Significance

Event	Event Magnitude	Receptor Sensitivity	Impact Significance
Jack-up rig positioning	Medium	(Biological/Ecological) Low	**Minor Negative**
Drilling (excluding conductor driving)	Medium	(Biological/Ecological) Low	**Minor Negative**
Use of Support vessels	Medium	(Biological/Ecological) Low	**Minor Negative**
Conductor Driving	Medium	(Biological/Ecological) Low	**Minor Negative**
VSP airgun operations	Medium	(Biological/Ecological) Low	**Minor Negative**

The following monitoring and reporting activities will be undertaken related to seals during VSP and conductor driving activities:

- Ongoing visual observations of Caspian seals and Caspian seal sightings will be recorded by the trained MMO or Caspian seal expert throughout conductor driving and VSP activities;
- Daily logs of Caspian Seal sightings will be completed by the trained MMO/ Caspian Seal Expert using the relevant Joint Nature Conservation Committee (JNCC) marine mammal forms; and
- A final report summarising the Caspian seal observations over the duration of the Project and including all the daily log forms will be completed by the trained MMO/ Caspian Seal Expert and submitted to BP within eight weeks of completion of the activities.

It is considered that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures and no additional mitigation is required.

6.4.3 Jack-up Rig Cooling Water Intake and Discharge

6.4.3.1 Event Magnitude

Description

The jack-up rig that will be used for the Project exploration drilling programme will be designed to draw seawater for indirect cooling via an intake and discharge the seawater at a rate of up to 180m^3/hr via a flexible hose located approximately 5m below sea level and at a maximum discharge temperature of approximately 31°C (during summer) and 15°C (during winter).

It is anticipated that the seawater indirect cooling system will be protected by a standard anodic biofouling and corrosion control system. These systems typically result in very small concentrations of metal ions (e.g. copper, iron, aluminium) being introduced into the seawater at levels significantly below predicted no effect concentrations.

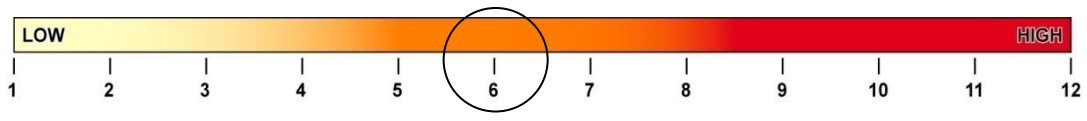
Assessment

The seawater intake depth is relatively shallow and as such it is anticipated that the lifted seawater will be at the same ambient temperature as the receiving water at all times of the year. The jack-up rig seawater intake velocity will be low and the intake will be fitted with a screen to prevent fish entering the seawater system. Modelling of the cooling water discharge (refer to Appendix 6A) shows that the temperature difference between the discharge plume and ambient conditions will return to zero within 100m of the discharge location with an increase of 0.5-1°C only occurring within the first few metres of the discharge point for both summer and winter conditions under both low and a high current velocity scenarios. The modelling results also indicated that cooling water discharge thermal plume remains within the main water column and neither the sea surface nor seabed are predicted to be significantly affected.

Table 6.17 presents the justification for assigning a score of 6, which represents a Medium Event Magnitude.

Table 6-17: Event Magnitude

Parameter	Explanation	Rating
Extent/Scale	Affects an area less than 1-2m from the source.	1
Frequency	Once.	1
Duration	Discharge will occur continuously through drilling activities.	3
Intensity	Low intensity.	1
Total		**6**



6.4.3.2 Receptor Sensitivity

While the intake will be fitted with a screen prevent fish entering the seawater system, plankton will, however, be entrained due to their small size. The area and volume of water within which any potentially harmful exposure might occur is limited to within the first few metres of the intake and hence impacts are expected to be insignificant to the water column. With regard to the cooling water discharge, the modelling has indicated that the discharge thermal plume would be very small in size. The temperature gradient at the edge of the plume is likely to be reasonably abrupt, provoking an avoidance reaction in fish and seals (although the probability of encounter with the plume for either group is very low given the plume dimensions and the project activity).

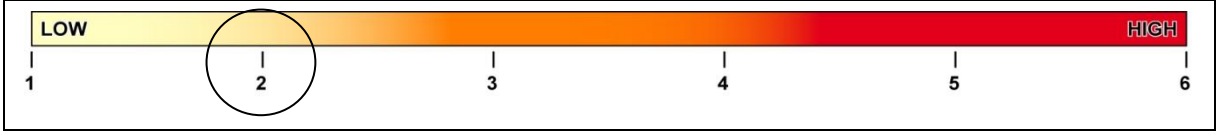
For all plankton, interaction with the plume depends on entrainment from the surrounding water and the process will ensure that individual plankton organisms do not remain in the discharge plume for more than a few tens of seconds.

The cooling water discharge takes place 5m below the sea surface and therefore does not have the potential to interact with benthic invertebrates.

Table 6.18 presents the justification for assigning a score of 2, which represents Low Receptor Sensitivity.

Table 6-18: Receptor Sensitivity (All Receptors)

Parameter	Explanation	Rating
Presence	Exposure is negligible, so resilience is, in effect, high.	1
Resilience	No significant presence of rare, unique or endangered species.	1
Total		**2**



6.4.3.3 Impact Significance

Table 6.19 summarises the impact of cooling water discharges to sea on seals and fish, zooplankton and phytoplankton.

Table 6-19: Impact Significance

Event	Event Magnitude	Receptor Sensitivity	Impact Significance
Jack-up Rig Cooling Water Intake and Discharge to Sea	Medium	Low (Seals/Fish)	**Minor Negative**
		Low (Zooplankton)	**Minor Negative**
		Low (Phytoplankton)	**Minor Negative**

The assessment has demonstrated that Minor Negative impacts to seals, fish, zooplankton and phytoplankton are predicted from cooling water intake and discharge. Therefore, no additional mitigation beyond existing control measures is deemed to be necessary.

6.4.4 Other Discharges to Sea

Other discharges to sea will result from the operation of support/supply vessels throughout the Project exploration drilling programme. These discharges comprise treated black water and grey water and deck drainage water (refer to Chapter 4: Section 4.5.2). With the exception of deck drainage there are no planned discharges from the jack-up rig.

6.4.4.1 Event Magnitude

Description and Assessment

Discharges to sea associated with the Project are anticipated to comprise:

Black Water:

- **Support/supply vessels -** based on the total POB on all support/supply vessels and a forecasted generation rate of 0.1m^3/person/day, it is expected that approximately 7m^3/day of black water will be generated by the support vessels during the Project exploration drilling

programme. Black water generated by vessels will be treated according to the MARPOL 73/78 Annex IV[35] or MARPOL 73/78 Annex IV MEPC 159 (55)**Error! Bookmark not defined.** requirements.

- Daily visual checks will be undertaken during the discharging process in order to confirm that no floating solids or visible sheen is observable.

Grey Water:

- **Support/supply vessels** - based on the total POB on all support/supply vessels and a forecasted generation rate of 0.22m^3/person/day, it is expected that approximately 15m^3/day of grey water will be generated by the support/supply vessel fleet during the Project exploration drilling programme. Grey water will either be sent to the vessel sewage treatment plant with the black water or discharged directly to sea without treatment.

It is anticipated that the low volumes and flowrates of treated black water and grey water discharged to sea over the drilling programme duration will be rapidly diluted close to the point of discharge. The discharge of biologically treated black water and grey water offshore does not pose any risk of environmental impact.

Drainage:

Jack-up rig - rig floor runoff, including WBM spills, collected via rig floor drains will be recycled to rig mud system with no discharge of drill cuttings or drilling fluids. Drainage (including deck drainage and wash-down water) will be discharged directly to sea, provided no visible sheen is observable.

- **Support/supply vessels** - drainage (including deck drainage and wash-down water) will be discharged directly to sea, provided no visible sheen is observable. No contaminated water will be discharged and therefore no environmental impact is anticipated.

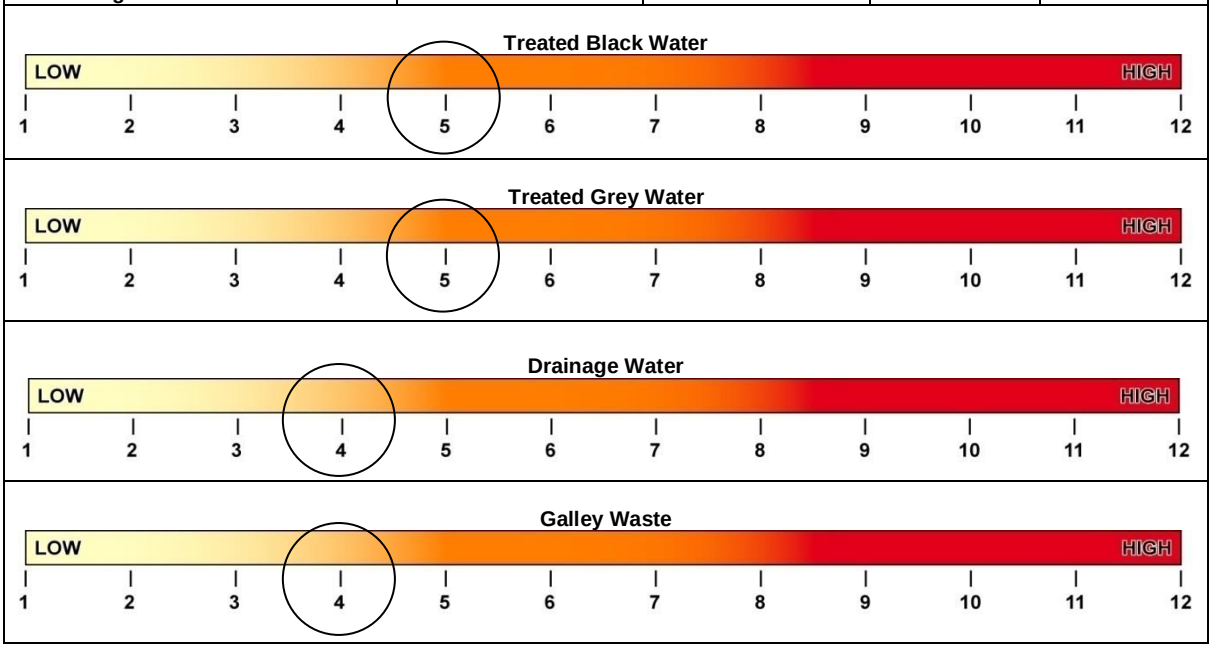
Galley Waste:

- **Support/supply vessels** – galley waste will be either sent to vessel maceration units designed to treat food wastes to applicable MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships particle size standards prior to discharge or contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures and therefore no environmental impact is anticipated.

Event Magnitude is summarised in Table 6.20.

Table 6-20: Event Magnitude

Event Parameter/Discharge	Treated Black Water	Treated Grey Water	Drainage	Galley Waste
Scale	1	1	1	1
Frequency	1	1	1	1
Duration	2	2	1	1
Intensity	1	1	1	1
Event Magnitude	**5**	**5**	**4**	**4**



6.4.4.2 Receptor Sensitivity

All of the discharges are low in volume, do not contain toxic or persistent process chemicals and are considered to pose no threat to the environment or the identified biological/ecological receptors.

Table 6.21 present the justification for assigning a score of 2, which represents Low Receptor Sensitivity.

Table 6-21: Receptor Sensitivity (All Receptors)

Parameter	Explanation	Rating
Presence	The extremely low level of exposure is equivalent to high resilience.	1
Resilience	There is no significant presence of rare, unique or endangered species (i.e. the risk of exposure for any such species is close to zero).	1
Total		**2**

6.4.4.3 Impact Significance

Table 6.22 summarises the impact of other discharges to sensitive marine receptors including seals, fish, zooplankton, phytoplankton and benthic invertebrates.

Table 6-22: Impact Significance

Event	Event Magnitude	Receptor Sensitivity	Impact Significance
Other Discharges to Sea: **Treated Black Water**	Medium	Low	**Minor Negative**
Other Discharges to Sea: **Grey Water**	Medium	Low	**Minor Negative**
Other Discharges to Sea: **Drainage Water**	Low	Low	**Negligible**
Other Discharges to Sea: **Galley Waste**	Low	Low	**Negligible**

Monitoring and reporting requirements associated with discharges from support vessels of black and grey water during the Project exploration drilling programme include:

- Black Water:
  - During periods when the vessel Sewage Treatment Plant (STP) is in use, sewage samples will be taken from the sewage discharge outlet and analysed monthly for relevant parameters to confirm compliance with the applicable MARPOL 73/78 Annex IV[35] or MARPOL 73/78 Annex IV MEPC. 159 (55)**Error! Bookmark not defined.** standards;
  - Support vessel sewage sampling analysis results, recorded floating solids observations and estimated volumes of treated black water discharged daily (based on a generation rate of 0.1m^3 per person per day) will be reported to the MENR upon completion of drilling.

- Grey Water:
  - Daily visual checks undertaken when discharging from support/supply vessels to confirm no visible sheen is observable;
  - Daily estimated volumes of grey water discharged from support/supply vessels will be recorded monthly and reported to the MENR on an annual basis. Estimates will be based on generation rates of 0.22m^3 per person per day (grey water).

It is considered that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures and no additional mitigation is required.

6.4.5 Seabed Disturbance

6.4.5.1 Event Magnitude

Description and Assessment

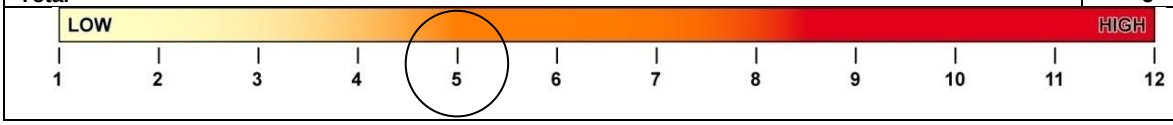
As stated within Chapter 4 Section 4.5.1 the rig will be towed and positioned using three tugs. Once positioned over the desired location the legs will be jacked down to the seabed and stabilised on the seabed using the spud cans. At the time of writing, the jack-up rig that will be used for the Project has not been identified, however based on the specifications of the jack-up rigs operating within the Caspian Sea it is assumed that the jack-up rig legs will each be equipped with a spud can with a cross sectional area on the seabed of approximately 155m^2 (Ref. 17). In total the spud cans will therefore occupy an area of seabed of approximately 460m^2 for the duration of the drilling programme (approximately 3 to 4 months).

Table 6.23 presents the justification for assigning a score of 5, which represents a Medium Event Magnitude.

[35] Five day BOD ≤50mg/l, total suspended solids ≤50mg/l (in lab) or ≤100mg/l (on board) and thermotolerant coliform ≤250MPN per 100ml. Residual chlorine as low as practicable where chlorine is added (vessels) or below 0.5mg/l for Istiglal (for vessel STP plants installed prior to January 2010)

Table 6-23: Event Magnitude

Parameter	Explanation	Rating
Extent/Scale	The area affected by the disturbance is anticipated to be relatively small e.g. an area of less than 500m^2 around the Project location.	1
Frequency	Once.	1
Duration	The spud cans will be in position for a period of 3-4 months.	2
Intensity	There will be no discharges associated with these activities, the seabed disturbance is expected to be of low and very limited nature, therefore intensity is anticipated to be low.	1
Total		**5**



6.4.5.2 Receptor Sensitivity

The benthic invertebrate communities both within and in the vicinity of the Project location are very similar to those across the rest of the Azerbaijan sector of the southern Caspian. There are no rare, unique or endangered species known to be present.

The benthic community across the southern Caspian is dominated by native amphipod, gastropod, polychaete and oligochaete species, most of which have the potential to reproduce several times a year. In areas of high disturbance (with mobile sediments or elevated presence of contaminants for example), the benthic communities are dominated by species which are particularly resilient to local conditions, particularly polychaetes and oligochaetes.

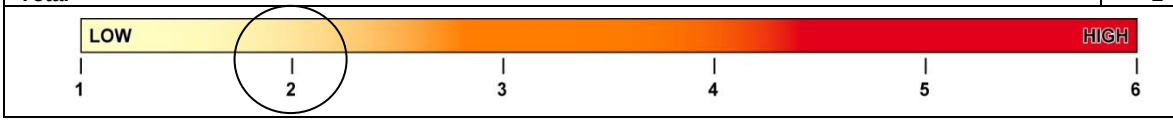
While the effect may be that a small proportion of organisms within the benthic environment may be buried too deeply to recover to a position near the sediment surface, the majority of organisms will be able to re-establish themselves once the jack up rig has demobilised from the location.

As described within Section 5.4.2, the survey conducted around the Project location in 2018 showed that all species found in this area were native species except for one decapod species. Although the variety of species recorded around the Project location during the 2018 survey was greater as compared to the SWAP 2015 (stations 20 to 24) and SOCAR Gurgan-Deniz surveys carried out to the southwest from the Project location, the lowest abundance was recorded at the Project location.

Table 6.24 presents the justification for assigning a score of two, which represents a Low Receptor Sensitivity.

Table 6-24: Receptor Sensitivity

Parameter	Explanation	Rating
Resilience	The benthic environment is considered to be relatively tolerant to disturbance with evidence showing that invertebrates, which are generally short-lived, reproduce rapidly and re-establish following disturbance.	1
Presence	No rare, unique or endangered species present. Species are assessed at the community level only.	1
Total		**2**



6.4.5.3 Impact Significance

Table 6.25 summarises impacts to benthic fauna associated with the temporary disturbance to seabed, based on the impact significance criteria presented in Chapter 3.

Table 6-25: Impact Significance (Benthic Communities)

Event	Event Magnitude	Receptor Sensitivity	Impact Significance
Seabed Disturbance	Medium	Benthic Communities (Low)	**Minor Negative**

It is considered that impacts are minimised as far as practicable and no discernible impact to the marine environment due to seabed disturbance will occur.

6.5 Summary of the Project Activities Residual Environmental Impacts

With regard to the Project activities, it has been concluded that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures. No additional mitigation measures are required.

Table 6.26 summaries the residual impacts associated with the Project.

Table 6-26: Summary of Residual Environmental Impacts Associated with the SWAP Exploration Drilling Project

	Event/Activity	Significance Rating		
		Event Magnitude	Receptor Sensitivity	Impact Significance
Atmosphere	Jack-up Power Generation	Medium	Low	Minor Negative
	Support Vessel Engines	Medium	Low	Minor Negative
Marine Environment	Jack-up Rig Positioning	Medium	Low	Minor Negative
	Drilling (excluding conductor driving)	Medium	Low	Minor Negative
	Use of Support vessel	Medium	Low	Minor Negative
	Conductor Driving	Medium	Low	Minor Negative
	VSP Airgun Operations	Medium	Low	Minor Negative
	Jack-up Rig Cooling Water Intake and Discharge to Sea	Medium	Low	Minor Negative
	Drainage Water Discharge	Low	Low	Negligible
	Support Vessel Treated Black Water Discharge	Medium	Low	Minor Negative
	Support Vessel Grey Water Discharge	Medium	Low	Minor Negative
	Support Vessel Galley Waste Discharge	Low	Low	Negligible
	Seabed Disturbance	Medium	Low	Minor Negative

6.6 Glossary of Acoustic Terminology

Term	Description
Ambient sound	Background environmental noise not of direct interest during a measurement or observations.
dB	Decibel, unit used in the logarithmic measure of sound strength. The decibel expression for a sound pressure level is = 20 log {p(*t*)/p_0}, where p_0 is a reference pressure of 1 µPa (micropascal) and p(*t*) is the instantaneous pressure at time *t*.
dB_{peak}	Peak sound pressure over the measurement period, expressed in dB re 1 µPa.
$dB_{peak\text{-}peak}$	Minimum to maximum peak sound pressure over the measurement period, expressed in dB re 1 µPa.
dB_{rms}	Root mean square sound pressure over the measurement period, expressed in dB re 1 µPa.
Hz	Hertz. The number of cycles per second and refers to the frequency of the particular sound.
M-weighting	Frequency weightings designed to best reflect the hearing sensitivity of marine mammals, similar to the use of the A-weighting for measuring sound impacts on humans.
PTS	Permanent Threshold Shift. Irreversible and permanent reduction in auditory sensitivity.
SEL	Sound Exposure Level. Sound energy over the measurement period expressed in dB re 1 μPa^2s. SEL is commonly used for impulsive underwater sound sources because it allows a comparison of the energy contained in impulsive signals of different duration and peak levels. The measurement period for impulsive signals is usually defined as the time period containing 90% of the sound energy.
SEL_{cum}	Cumulative Sound Exposure Level. Summation of the sound energy of multiple impulsive or transient signals over a defined assessment period expressed in dB re 1 μPa^2s i.e. SEL_{cum} = SEL + 10 log (*number of events* or *time of exposre*).
SPL	Sound Pressure Level. The sound pressure averaged over the measurement period, expressed in dB re 1 µPa; applicable to peak, peak-peak and rms sound pressure levels.
SL	Source Level. The intensity of underwater sound sources is compared by their source level, expressed in dB re 1 µPa at 1 m for peak, peak-peak and rms sound pressure levels, and dB re 1 μPa^2s for SEL. The source level is defined as the sound pressure (or energy) level that would be measured at 1 metre from an ideal point source radiating the same amount of sound as the actual source being measured. Where a source level is defined, the sound level indicator will be denoted with *'-m'* i.e. dB_{rms} re. 1µPa-m, dB_{peak} re. 1µPa-m, or dB_{SEL} re 1μPa^2s-m.
TTS	Temporary Threshold Shift. Short-term reversible reduction in auditory sensitivity. TTS will be gradually reversed upon removing exposure to the high sound levels that cause the change in hearing sensitivity.

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7 Cumulative and Transboundary Impacts and Accidental Events

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7.1 Introduction

This Chapter of the Environmental and Socio-Economic Impact Assessment (ESIA) discusses:

- Cumulative and Transboundary Impacts; and
- Accidental Events that could potentially occur during the Project activities and the control, mitigation and response measures designed to minimise event likelihood and impact.

A detailed assessment of Project environmental and socio-economic impacts, based on expected activities and events, is presented in Chapter 6 of this ESIA.

7.2 Cumulative and Transboundary Impacts

As discussed within Chapter 3, cumulative impacts can arise from:

- Interactions between separate project-related residual impacts; and
- Interactions between project-related residual impacts in combination with impacts from other planned projects and their associated activities.

Transboundary impacts are impacts that occur outside the jurisdictional borders of a project's host country.

7.2.1 Approach to the Cumulative Assessment

As described in Chapter 1: Introduction it is planned to drill three wells in the SWAP Contract Area; one well in each of the three Prospective Areas. The approach taken to assessing the cumulative impacts between the three wells focuses on assessing the potential temporal and geographic overlap between environmental impacts based on the current schedule (refer to Chapter 4: Section 4.3) and the results of modelling assessments demonstrating the expected geographic extent of the impacts (refer to Chapter 6).

The assessment takes into account each activity and the existing controls and additional mitigation measures identified to minimise and manage impacts. An analysis of the potential for these impacts to overlap and result in additive or synergistic effects within the marine environment and social environment is presented in Sections 7.2.3 below with potential cumulative and transboundary impacts associated with emissions to atmosphere discussed in Section 7.2.4.

The potential for cumulative impacts with other planned projects[36] has been determined based on a review of available information and taking into account geographic and temporal scope of the individual Project impacts and hence the potential to result in cumulative impacts in combination with the Project impacts.

7.2.2 Cumulative Impact between Separate Project Impacts

Due to the nature of the predicted residual impacts from the Project, the potential for individual Project activities to interact synergistically or in-combination and result in cumulative impacts on the receiving environment is considered very unlikely.

7.2.3 Cumulative Impact with Other Projects

In general, potential Project impacts are expected to be both of a short duration and concentrated to mostly within a few hundred metres to several kilometres of the NKX01 well location. Due to the localised

[36] The cumulative assessment does not take into projects or facilities that are currently operational as the effects of these projects are captured within the existing baseline against which the NKX01 Project impacts have been assessed and is focused on other proposed BP projects within the vicinity of the proposed NKX01 Project.

nature of the Project's impacts and the absence of other development projects in the area, no cumulative or synergistic impacts are expected.

7.2.4 Transboundary Impacts Associated with Greenhouse Gas Atmospheric Emissions

Transboundary impacts are those that may affect countries other than the country in which a project will be developed. The potential transboundary impacts associated with the Project activities are considered to be limited to greenhouse gas (GHG) emissions contributing to the global greenhouse effect.

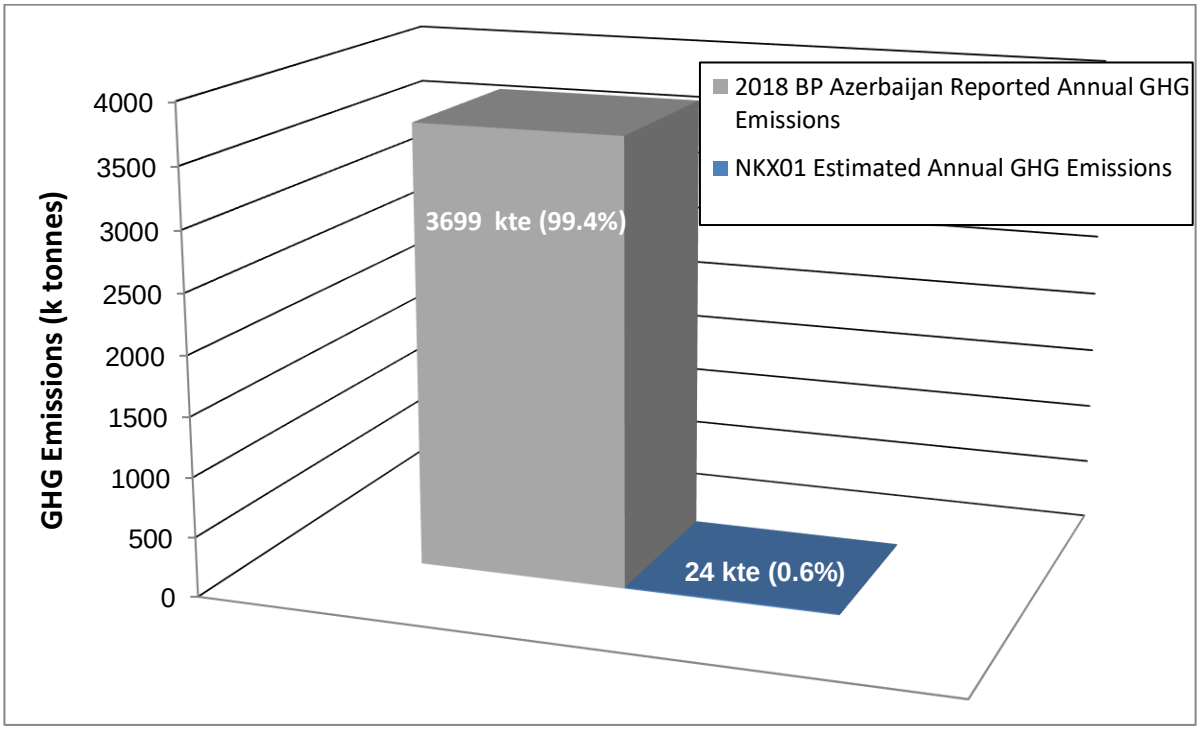
7.2.4.1 Greenhouse Gas Atmospheric Emissions

The estimated volume of GHG emissions (carbon dioxide, methane, nitrous oxide) generated by defined Project activities are presented in Chapter 4 Table 4.10 of this ESIA.

Figure 7.1 presents the estimated volume of Project activities total GHG emissions compared with the annual BP Azerbaijan operation's emissions volumes reported in 2018 (Ref.1). Figure 7.1 demonstrates that the estimated Project GHG emissions represent approximately 0.6% of the annual operational GHG emissions from BP's upstream activities in Azerbaijan based on GHG emissions data from 2018.

The most recently published GHG emissions data for Azerbaijan estimated a total of 61842 kilotonnes (ktonnes) of GHG emissions were emitted in 2013; 80% of which was estimated to be generated by the energy sector (Ref.2). As a proportion, the estimated GHG emissions for the Project activities are expected to contribute approximately 0.039% to the national total GHG emissions based on the 2013 data.

Figure 7.1: Estimated Project Exploration Drilling Total GHG Emissions Compared to Reported 2018 BP Azerbaijan Annual GHG Emissions



7.3 Accidental Events

Accidental Events are considered separately from routine and non-routine activities as they only arise as a result of a technical failure, human error or as a result of natural phenomena such as a seismic event. High operational performance and compliance with good industry practices will be maintained at

all times by BP and their contractors. However, as with most projects of this nature, a low probability of an accidental event does exist.

Potential accidental events that may result in potentially significant environmental impacts during the Project have been identified and include:

- Vessel collision with other marine users;
- Release of chemicals/ waste from the Project vessels; and
- Hydrocarbon spills (e.g. small spills resulting from refuelling, large spill of marine diesel resulting from a vessel collision or well blowout of crude oil).

Drilling muds will be used throughout the drilling activities. The locations on the rig where the equipment and pipework associated with drilling muds are located are within areas equipped with appropriate containment. Prior to mobilisation the rig will undergo a containment audit to document and confirm the control measures in place to prevent accidental spills from any potential equipment failure, tank overflows, etc. to sea. Any deficiencies will be identified and any additional measures required will be addressed and implemented prior to acceptance.

The likelihood of a spill associated with a riser failure is considered extremely unlikely. The rig to be used for drilling the Project exploration well will be a stationary jack-up rig. This, along with the shallow water depth at the drilling location, limits the stress on the riser meaning failure is highly unlikely.

7.3.1 Vessel Collision

As described in Chapter 5: Section 5.6.5 the Project is located outside of the main shipping routes with the closest shipping route located approximately 10 km away from the Project location. Shipping activities in the waters of the Central and Southern Caspian Sea include commercial trade, passenger, scientific and supply vessel operations to the offshore oil and gas industry. There is known to be regular vessel movements between Pirallahi Island, Chilov Island and Oil Rocks using smaller vessels. A range of maritime and navigation safety measures outlined in Chapter 6: Table 6.1 are expected to minimise the risk of collision. The likelihood of a collision between vessels is considered to be very low given the preventative measures in place. However, in the event of a collision there is the potential for significant impacts on other marine users and infrastructure depending on the scale and nature of the collision.

7.3.2 Release of Chemicals / Waste

There will be chemicals and drilling fluids (e.g. drilling mud chemicals) prepared on shore and supplied to the jack-up rig via certified marine hose connections from the supply vessels to support the drilling operation. In addition, chemicals for cleaning and maintenance purposes, e.g. cleaning fluids, will be used on board the vessels throughout the drilling programme. All chemicals on the vessels will be labelled and stored appropriately in areas with secondary containment. Waste generated during the Project will be managed in accordance with the existing BP AGT Region management plans and procedures.

The likelihood of an accidental release of chemicals or waste to the marine environment is considered to be very low given the control and mitigation measures are implemented as set out in Chapter 6: Section 6.4.4. In the unlikely event of loss of containment and release of hazardous substances overboard, the BP AGT Region spill reporting procedures described within Section 7.3.4.3 will be followed.

7.3.3 Hydrocarbon Spills and Releases

Potential accidental discharges of hydrocarbons that may lead to pollution of the marine environment during the proposed Project include:

- Spills during vessel collision, fuel tank failure, fire or explosion; and
- Well blowout of crude oil following loss of well control.

The resulting potential discharges can be broadly categorised as follows:

- Spill of diesel from the jack-up rig or support vessels; and
- Major spill of crude oil from a well blowout.

Accidental release of drilling mud from the rig has not been modelled as well blow-out discharges and accidental diesel spills from vessels are the worst case scenario spills / discharges. Further to this, the accidental spill of mud is highly unlikely to occur given that the rig will undergo a containment audit prior to acceptance that will identify any higher risk areas and document the control measures in place to prevent accidental spills from equipment failure, tank overflows, etc.

7.3.3.1 Spill of Marine Diesel

As described in Section 7.3.1 the likelihood of a vessel collision occurring during the Project is considered to be very low. Analysis of water transport accident statistics by the International Association of Oil & Gas Producers (IOGP) (Ref. 3) shows that ship to ship collisions represent 12% of total ship losses and that the likelihood of this occurring is extremely low. The likelihood that such an incident would result in a loss of the vessel's fuel inventory is even lower, as a high-energy collision would be required to damage a vessel to such an extent that fuel tank integrity is compromised releasing its content into the sea.

Fuel on vessels is typically stored in a series of small tanks which are double bottomed and connected by valves and it is unlikely that contents of all the tanks would be lost simultaneously in the event of a collision. The jack-up rig will be equipped with diesel tanks to provide fuel for on board use. The largest volume of diesel stored on either the jack-up rig or support vessels used during the Project programme will be 600m^3. In the unlikely event of a release of the full diesel tank inventory the diesel will spill overboard. A description of the vessel diesel tank spill scenario and the modelling undertaken to predict the potential impact of the spill is presented in Section 7.3.3.6.

7.3.3.2 Well Blowout Scenario

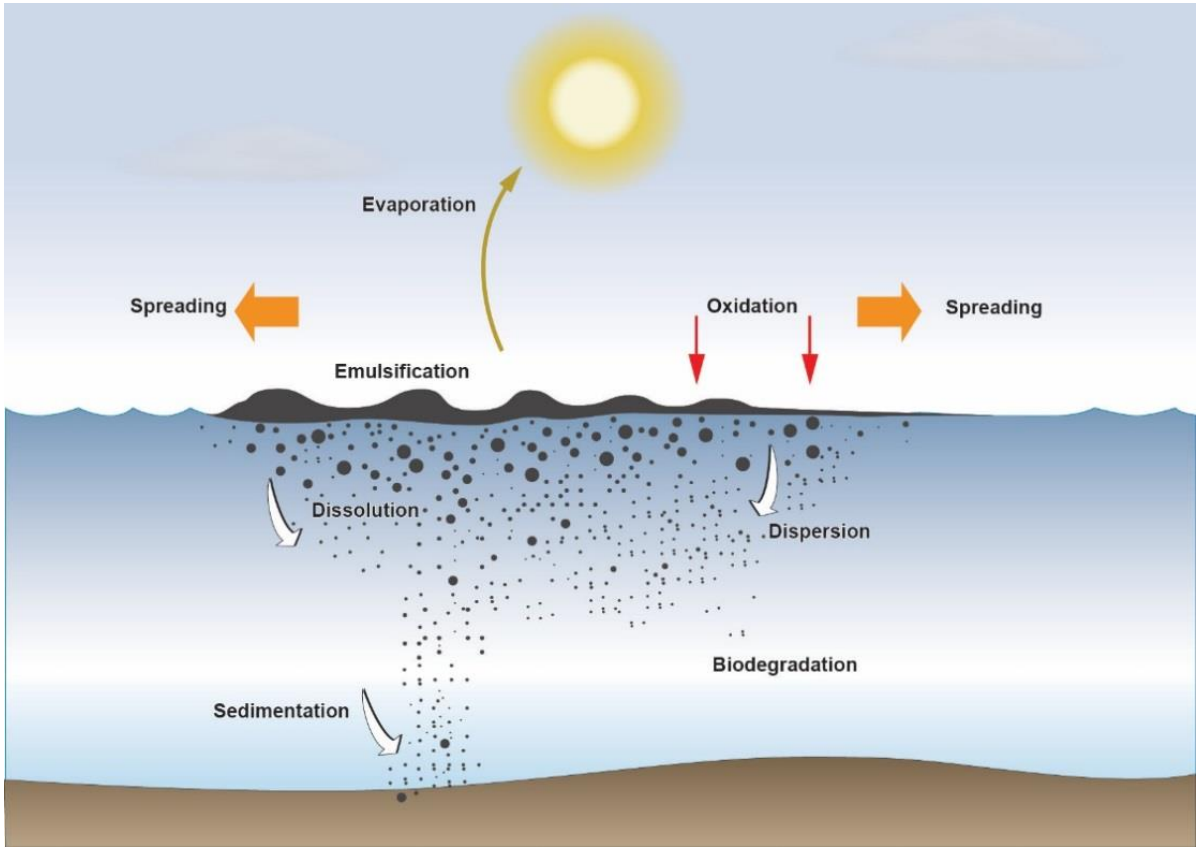
A well blowout, as a consequence of loss of well control, is an uncontrolled influx of liquids or gas from the formation into the wellbore which may result in an uncontrolled release into the environment. This influx can either be oil, gas, water or a combination of liquids and gas. Well blowout is considered to be the worst case scenario for oil spills.

Well blowouts are very low probability but high consequence events, which occur where all primary and secondary control failures occur together. A review of wells drilled in the period 2000-2015 in regulated countries across the world found that the probability of a well blowout that would result in a spill of 500 barrels or more of oil is 1 blowout per 3985 wells drilled (0.025% per well drilled) for exploration wells and 1 blowout per 14,444 wells drilled (0.007% per well drilled) for development wells, respectively (Ref. 4). Similarly, a review conducted by the IOGP found a blowout occurs in approximately 1 out of every 4000 exploration wells operated at North Sea standards and 1 out of every 588 exploration wells operated at non-North Sea standards (Ref. 5). A description of a potential blowout scenario of the Project exploration well and the modelling undertaken to predict the potential impacts of the blowout is presented in Section 7.3.3.6.

7.3.3.3 Fate of Hydrocarbons in the Marine Environment

The key processes that govern the fate of hydrocarbons at sea are shown in Figure 7.2. When oil is released into the marine environment it undergoes a number of physical and chemical changes as a result of evaporation, dissolution, dispersion, emulsification, sedimentation, photo-oxidation and bio-degradation processes, collectively known as weathering. These changes are dependent upon the type and volume of oil spilt and the prevailing weather and sea conditions.

Figure 7.2: Weathering Processes Acting on Spilled Oil



Marine Diesel

Diesel fuel is a light, refined petroleum product, and what is commonly referred to as "marine diesel" is a blend of gasoil and heavy fuel oil with a low viscosity (up to 12 centistokes (cSt)/400°C). When spilled on water, diesel fuel spreads very quickly to a thin film of rainbow and silver sheens, whereas marine diesel may form a thicker film of dull or dark colours and persist on the surface for longer.

Evaporation and dispersion are the two main mechanisms that act to remove diesel type fuels from the sea surface, whilst oxidation and biodegradation break down hydrocarbons into basic elements over a longer time period. Marine diesel is readily dispersed into the water column when wind speeds reach 5 to 7 knots, or the sea state is approximately Force 2 Beaufort scale or higher. It is much lighter than water, therefore it is not possible for the diesel to sink and accumulate on the seabed as pooled or free oil. However, diesel may be physically mixed into the water column by wave action, forming small droplets that are carried and kept in suspension by the currents. Diesel dispersed in the water column can adhere to suspended sediments, which then settle out and are deposited on the seabed. This process is more likely to occur in near shore areas or river estuaries rather than in the open marine environment.

Compared to unrefined crude oils, marine diesel is not sticky or viscous. When stranded on the shoreline, diesel tends to penetrate porous sediments quickly whereas if it is deposited on hard surfaces, it will be quickly washed off by wave action. In both situations, marine diesel is readily degraded by naturally occurring microbes, typically within one to two months.

In terms of toxicity to marine organisms, diesel is considered to be one of the most acutely toxic oil types (Ref. 7).

Crude Oil

Crude oil is an unrefined mixture of naturally occurring hydrocarbons that exists as a liquid in underground geologic formations and remains a liquid when brought to the surface. Crude oils of different origin vary widely in their physical and chemical properties. The main physical characteristics that affect the behaviour and persistence of an oil spill at sea includes specific gravity, vapour pressure, distillation characteristics, viscosity and pour point. The chemical composition of the oil, such as the proportion of volatile components and the content of asphaltenes, resins and waxes, will also affect the behaviour of the oil.

The major processes contributing to crude oil weathering are:

- **Loss of more volatile oil components by evaporation:** Spilled crude oil rapidly spreads out to form a thin oil slick on the sea surface. The more volatile components then evaporate at a rate proportional to their individual volatilities (associated to boiling points) and the prevailing water temperature. The loss of these hydrocarbon fractions decreases the volume of oil that remains at sea. Crude oils with a higher proportion of volatile components will decrease in volume more than crude oils that contain less volatile components. Evaporation slows and eventually stops as the volatile components are progressively lost. The oil that remains at sea will have a higher viscosity than the original oil because the volatile components that are lost by evaporation are of low viscosity.
- **Incorporation of water into the oil to form water-in-oil emulsions:** Most crude oils will form water-in-oil emulsions when spilled at sea. Water-in-oil emulsification is caused by the prevailing wave action; spilled oils will emulsify faster in rougher seas than in calm conditions as water droplets become incorporated into the oil by the action of breaking waves. Water-in-oil emulsions are inherently unstable and will rapidly revert to oil and water unless they are stabilised by asphaltenes precipitated from the crude oil. The precipitated asphaltenes form an elastic skin around the water droplets in the oil and prevent them from coalescing and separating from the oil. Crude oils with a high asphaltene content form more stable emulsions than crude oils with low asphaltene content. The formation of water-in-oil emulsions greatly increases the volume of the emulsified oil on the sea surface. Emulsified oils typically contain a maximum of 60% to 75% volume of water and this causes a 3- to 4-fold increase in volume, compared to that of the volume of oil from which the emulsion is formed. Emulsification ceases when the maximum water content has been achieved. Formations of water-in-oil emulsions reduce the rate of other weathering process and are the main reason for the persistence of light and medium crude oils on the sea surface and shorelines (Ref. 8).
- **Natural dispersion:** Natural dispersion is driven by breaking waves. As a breaking wave crest passes through the oil slick, the oil is broken into oil droplets of various sizes and pushed into the water column. The larger oil droplets rapidly float back to the surface, but the very smallest oil droplets are retained in the water column by the prevailing turbulence. The rate of natural dispersion is driven by the prevailing sea state and limited by the viscosity of the emulsified oil; rough seas cause a high rate of natural dispersion, but high emulsified oil viscosity resists this process.

The relative rates of evaporation, water-in-oil emulsification and natural dispersion depend on the prevailing oceanographic conditions (temperature, wind speed and sea state) and the properties of the spilled oil (as described by the boiling point curve, density, viscosity and asphaltene content).

7.3.3.4 NKX01 Crude Oil Properties

Since oil has yet to be produced from the Project target reservoir location, no crude oil has been available for characterisation. Based on the anticipated physical-chemical properties of the oil targeted at the NKX01 well an analogous oil (Hago 2ss HA (IKU)) was selected from Stiftelsen for Industriell og Teknisk Forskning (SINTEF)'s Oil Spill Contingency and Response (OSCAR) modelling database to most closely represent the anticipated oil characteristics of the NKX01 well. Table 7.1 below presents the predicted main oil properties of the NKX01 well oil.

Table 7-1: Analogous Oil Properties for NKX01 Well

Property	BP provided value (analogous oil selected from OSCAR database)	Notes
Name of oil type	Absheron oil (Hago 2ss HA (IKU))	Oil type identified as most closely representing the anticipated NKX01 well oil.
Specific gravity	0.887 – 0.925 (0.915)	Oil is buoyant and classed as Group IV by The International Tanker Owners Pollution Federation Limited (ITOPF).
Pour Point	30°C (30°C)	Oil is liquid above the pour point. The crude has a high pour point and is likely to be semi-solid at ambient temperatures.
Viscosity	3.5-34 (390 centipoise at 13°C)	Further analysis is recommended to understand the oil viscosity and how readily it flows and spreads.
Asphaltene content	- (not recorded)	The presence of asphaltene would indicate the potential of the oil to form an emulsion.
Wax content	0.05 – 0.4% (not recorded)	Relatively low wax content.

7.3.3.5 Oil Spill Modelling

To assess the potential impact of a hydrocarbon release during the Project (i.e. the NKX01 diesel inventory loss and a well blowout), modelling was undertaken using SINTEF's OSCAR modelling software (version 11.0). The locations of the spill events considered in the modelling study are shown in Figure 7.3. A summary of the diesel spill and crude oil blowout scenarios modelled is shown in Table 7.2.

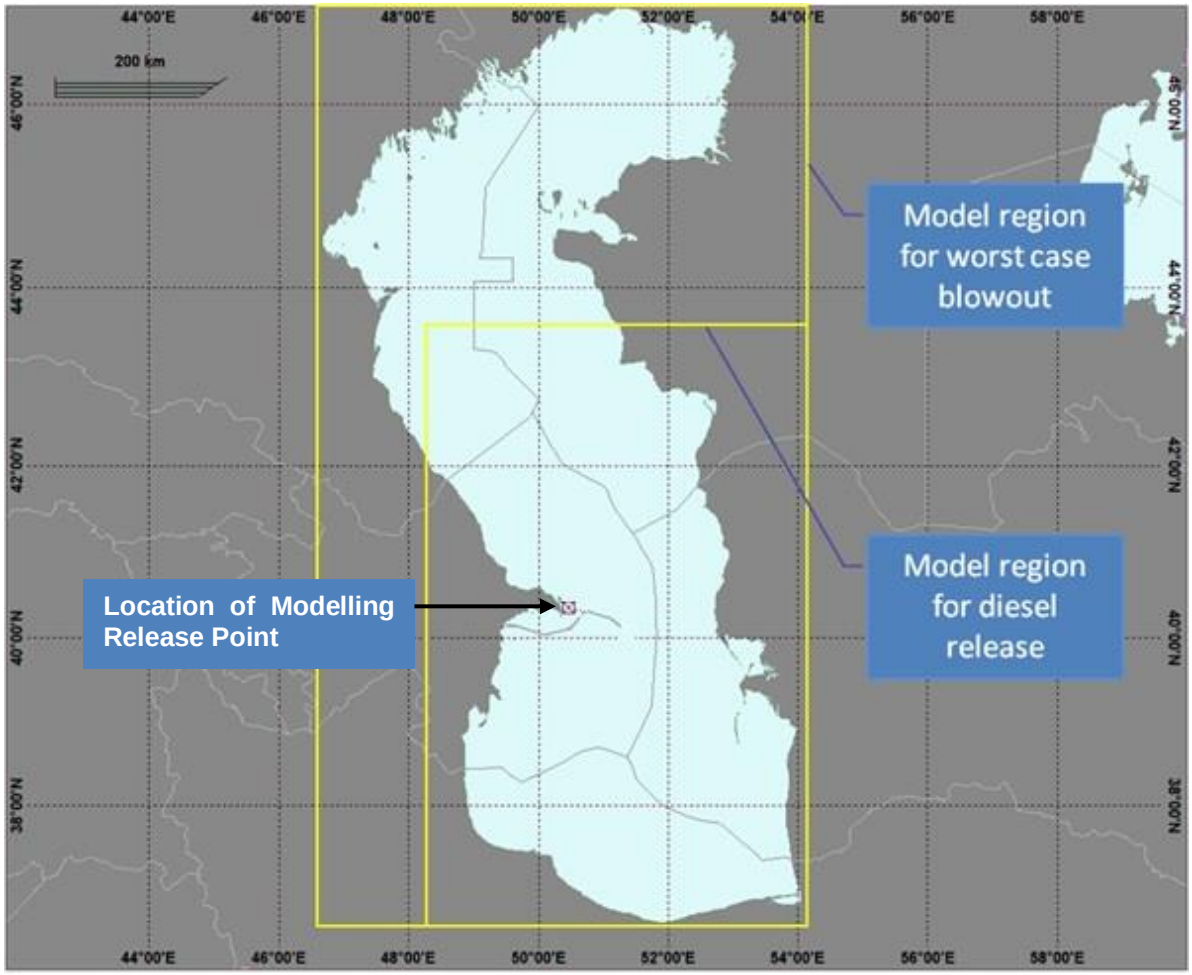
The following scenarios were modelled (refer to Appendix 6A for full details):

- Scenario 1: Drilling programme supply vessel inventory loss of 600m^3 of diesel; and
- Scenario 2: A surface blowout of crude oil (810,019 m^3) over 81 days duration.

Table 7-2: Oil Spill Modelling Scenarios

Scenario ID	Spill Site	Spill Event	Oil Type	Spill Rate		Spill Duration	Total Spilled Volume
1	NKX01	Surface release of diesel fuel from diesel storage tank	Diesel	600 m3/hr		1 hour	600m^3
2	NKX01	Surface blowout release - worst case, declining release rate	Hago 2ss HA (IKU)	Oil[1]	Rate 1: 65,431 bbls/day	81 days (time to drill relief well)	810,019m^3
					Rate 2: 62,492 bbls/day		
					Rate 3: 59,846 bbls/day		
				Gas[1]	Rate 1: 26.17 MMscf/day		
					Rate 2: 25 MMscf/day		
					Rate 3: 23.94 MMscf/day		
Note 1: Rate 1 for 30 days, Rate 2 for 30 days, Rate 3 for 21 days							

Figure 7.3: Extent of Regions Used Within Spill Modelling



Scenario 1 has been modelled assuming loss of 600m^3 of marine diesel from the vessel storage tank. It has been assumed that the diesel would be spilled directly onto the sea surface over a period of one hour at a rate of 600m^3/hour.

Scenario 2 is the "worst case" estimate for a blowout from the Project exploration well and assumes the blowout would flow for 81 days, based on the anticipated time it would take to drill a relief well and therefore cease the blowout release. Scenario 2 has assumed a flowrate which declines over time ranging from 65,431 barrels per day (bbls/day) to 59,846 bbls/day, which is estimated to result in a total spill volume of 5,094,866 bbls (equivalent to 810,019m^3) of oil. The release includes a mixture of oil and associated gas and the well is expected to be dry with no water anticipated to flow.

Spill scenarios were probabilistically (stochastic) analysed with time series weather and current data, demonstrating how the behaviour of the hydrocarbons change in variable metocean conditions. Stochastic outputs were generated as composites of all results obtained from 102 runs; and represent much larger areas than would be affected as a result of a single release scenario. Deterministic modelling (single scenario) was undertaken for the worst case scenario identified by stochastic modelling in both summer and winter conditions to predict the behaviour and fate of the plume over time in terms of surface accumulation, oil reaching the shore and water column concentrations.

Both stochastic and deterministic scenarios were run for the spill scenarios described above. From stochastic simulations the worse-case scenarios in terms of shoreline impact (greatest volume of hydrocarbon reaching shoreline) were identified and re-run as single deterministic simulations so that the fate of the release can be analysed in greater detail.

Section 7.3.3.6 provides a summary of the modelling undertaken while Appendix 6A provides a detailed overview of the fate of diesel and crude oil in the marine environment as a function of time, probabilities of surface and shoreline oiling and extent of the affected areas. It must be noted that modelling has not taken into account any spill response mitigation measures, meaning that the results should be only interpreted as indication of theoretical spill consequences without an implementation of the oil pollution prevention strategy. In reality, spill mitigation measures such as chemical dispersant application, containment, recovery and shoreline protection measures would be implemented to reduce adverse effects to marine and coastal resources. Section 7.3.4 below provides an overview of the spill prevention and response planning to be adopted for the Project which will outline all necessary preventative and mitigation measures for minimising the consequences of any spills.

7.3.3.6 Spill Modelling Results

Scenario 1 – Vessel Inventory Loss of Diesel

This section presents the modelling results for Scenario 1, which are summarised in Table 7.3.

Table 7-3: Summary of Vessel Diesel Inventory Loss Spill Modelling Results

Release location	Maximum surface extent of sheen above 0.04 µm (km)		Minimum time to beaching (days)[1]		Time until water column dissolved concentration >58 ppb (days)[1,2]		Maximum mass onshore (tonnes)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
NKX01	37.2	49.8	0.25	0.5	2	9	275	184

Notes:
1. Time from start of release.
2. Dissolved and dispersed oil in water column.

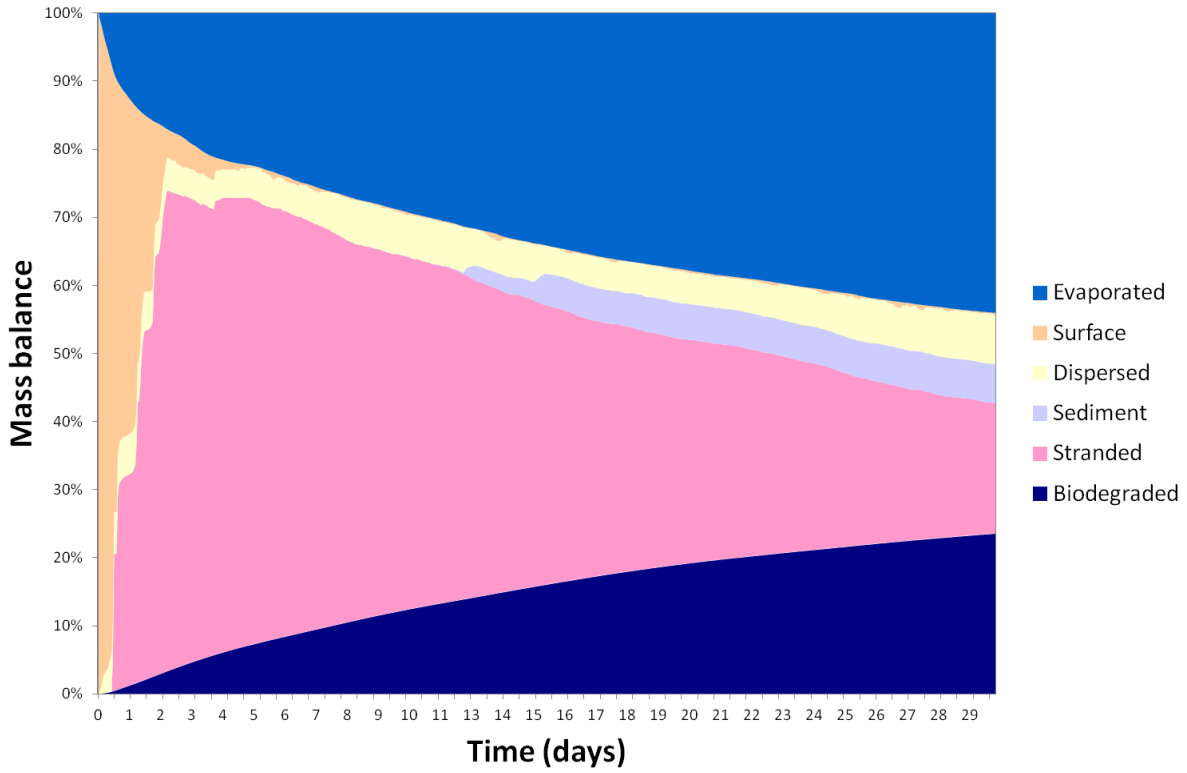
Under the worst case scenario (during summer conditions), diesel is predicted to reach the shoreline within approximately 6 hours with up to 275 tonnes predicted to be on the shoreline, although the 50th percentile value[37] is 12.9 tonnes.

As shown in Figure 7.4, initially the majority of the diesel is present on the sea surface, and over the first two days around 20% evaporates and an increasing percentage reaches the shore. Dispersion and dissolution into the upper water column takes place very close to the release point. Biodegradation also progresses relatively quickly such that only a very small fraction of diesel on the water surface is left after 30 days (less than 0.44 %). Ultimately, stochastic modelling analysis shows 44% of the diesel evaporates, 24% is biodegraded, 7% is in the water column, 19% comes ashore and 6% is deposited in sediments. Diesel can reach the shore approximately 6 hours after the initial release.

The resultant slick is relatively small and short-lived. Although it will tend to move in a single direction dependent on the exact metocean conditions at the time, the analysis of over 100 different sets of metocean data suggest that there are no dominant directions. Figure 7.4 represents the spill during winter conditions, but the result is generally representative of the fate of diesel released at any point in the year.

[37] Means that in 50% of scenarios modelled, this value or less would result.

Figure 7.4: Modelled Fate of Vessel Diesel Inventory Release (Winter)



Following the release of 600m^3 of diesel the diesel is predicted to travel less than 50 km from the point of release in both summer and winter conditions before it drops below the lowest recognised visible thickness under ideal viewing conditions of 0.04 micrometres (µm). Figures 7.5 and 7.6 present the modelling results for summer and winter. In winter, the break in sheen (as shown in Figure 7.6) is a result of change in wind and wave conditions that disperse the diesel briefly and then allow it to re-emerge and form a new sheen separate to the first area. Thicker areas of diesel are restricted to a small radius around the spill location.

Figures 7.7 and 7.8 shows the maximum area of the water column where the diesel in water concentration is above the 58 parts per billion (ppb) threshold[38]. The area is affected for approximately 9 days in winter and 2 days in summer after the release before the diesel concentration disperses below the 58ppb threshold levels. In each figure, the output is the total area the diesel slick has covered as it has moved away from the release location. The cross section through the water column shows that the release remains in the upper sections of the water column, particularly in the case presented for winter.

The probability of diesel reaching the shoreline (based on the results of stochastic modelling for winter conditions) following the spill is presented in Figure 7.9 and the accumulation of diesel predicted on the shore following the spill under winter conditions is shown in Figure 7.10. This represents the deposition of diesel on the shore at the end of the simulation when the maximum length of coastline is affected. The summer case results in diesel reaching shoreline along the Azeri coast. The case presented in Figure 7.10 for winter results in more localised shoreline deposition with a mixture of areas of very light(<0.1mm), light (0.1-1mm) and moderate (1-10mm) deposition of diesel are predicted as can be seen in Figure 7.10.

[38] Concentration of total oil (dispersed and dissolved) in the water column above 58ppb threshold.

Figure 7.5: Modelled (Deterministic) Cumulative Area Thickness of Diesel on the Sea Surface (Summer)

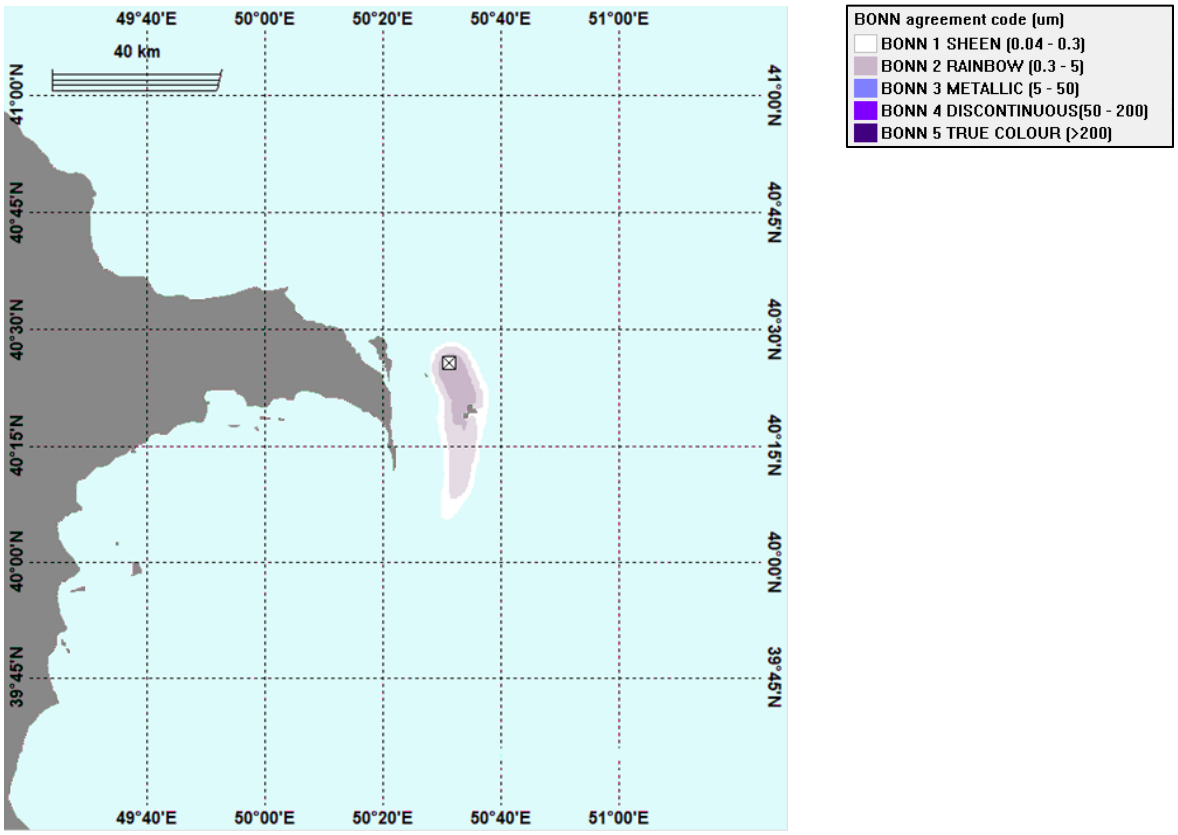


Figure 7.6: Modelled (Deterministic) Cumulative Area Thickness of Diesel on the Sea Surface (Winter)

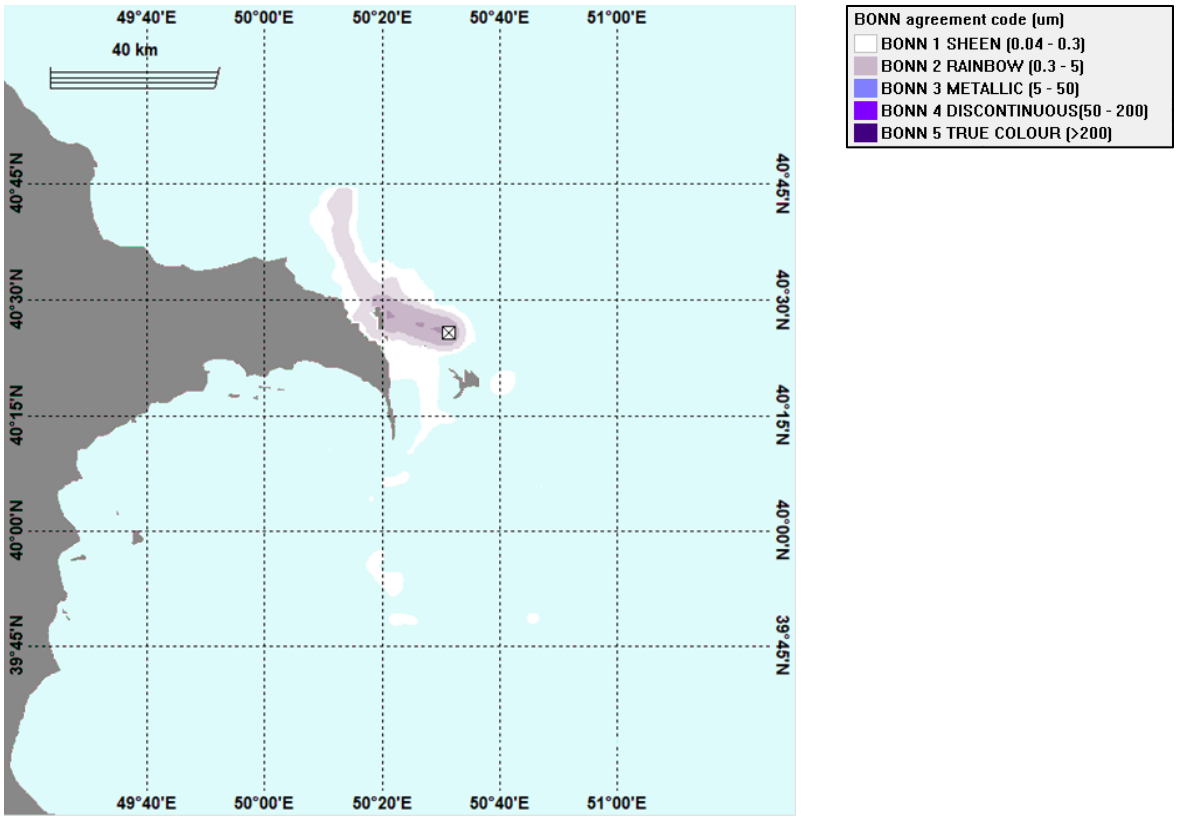


Figure 7.7: Modelled (Deterministic) Concentration[38] of Diesel Within the Water Column (Summer)

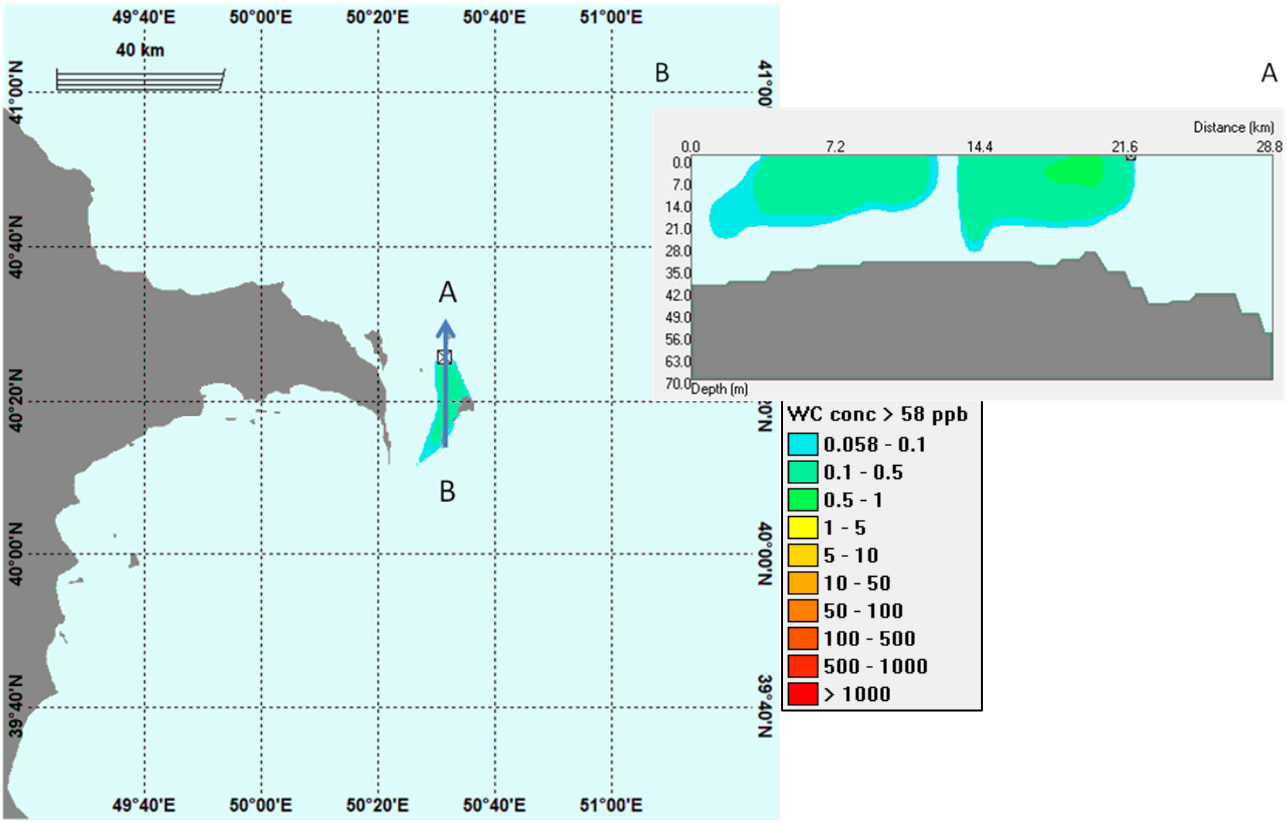


Figure 7.8: Modelled (Deterministic) Concentration[38] of Diesel Within the Water Column (Winter)

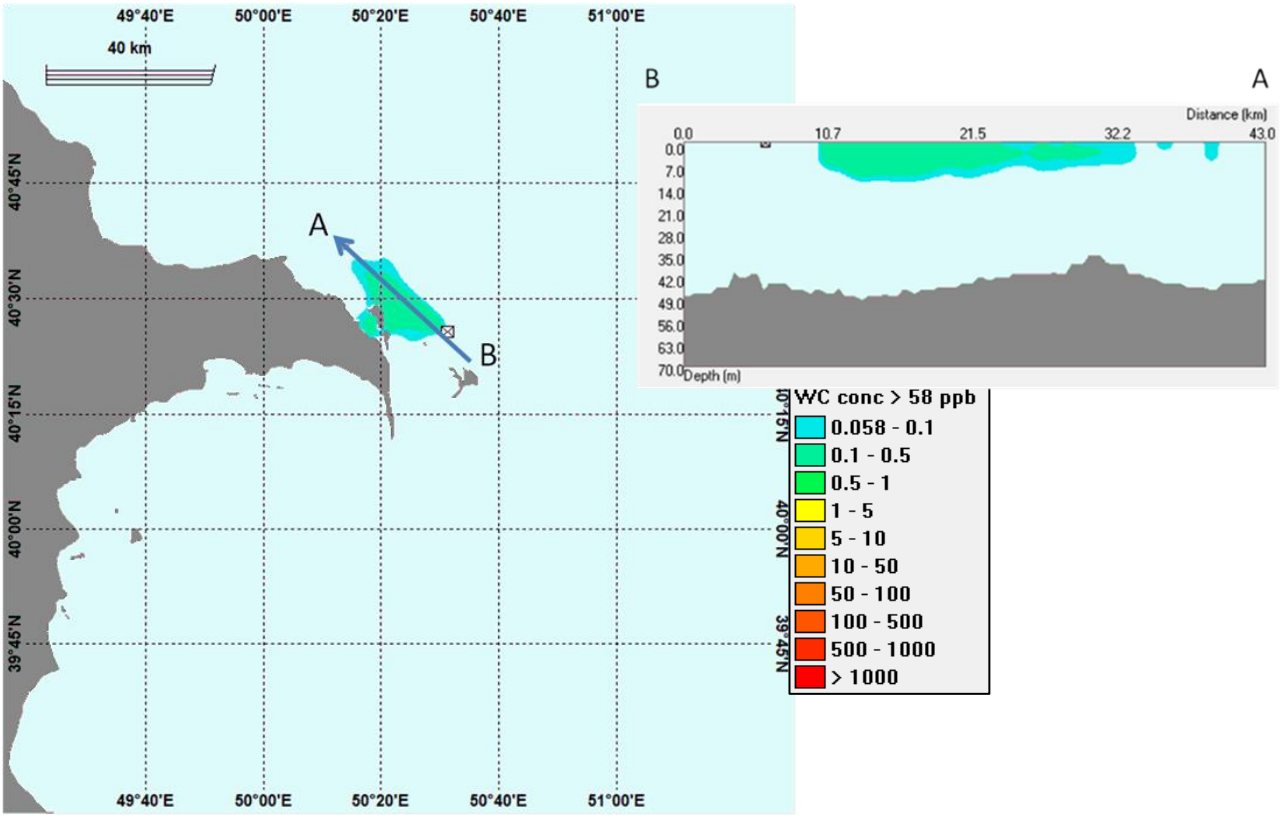


Figure 7.9: Modelled (Stochastic) Probability of Shoreline Oiling Above 0.1 litres/m^2 for Diesel Spill Scenario in Winter

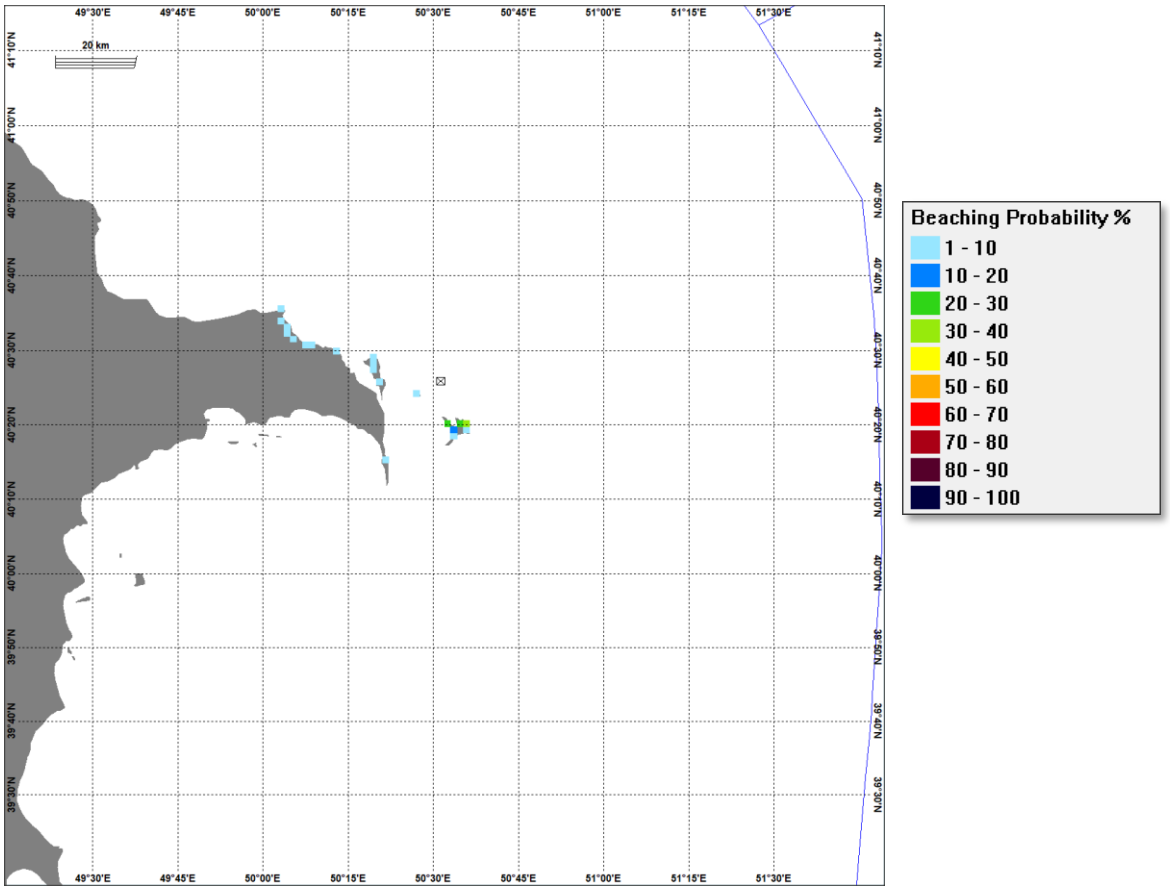
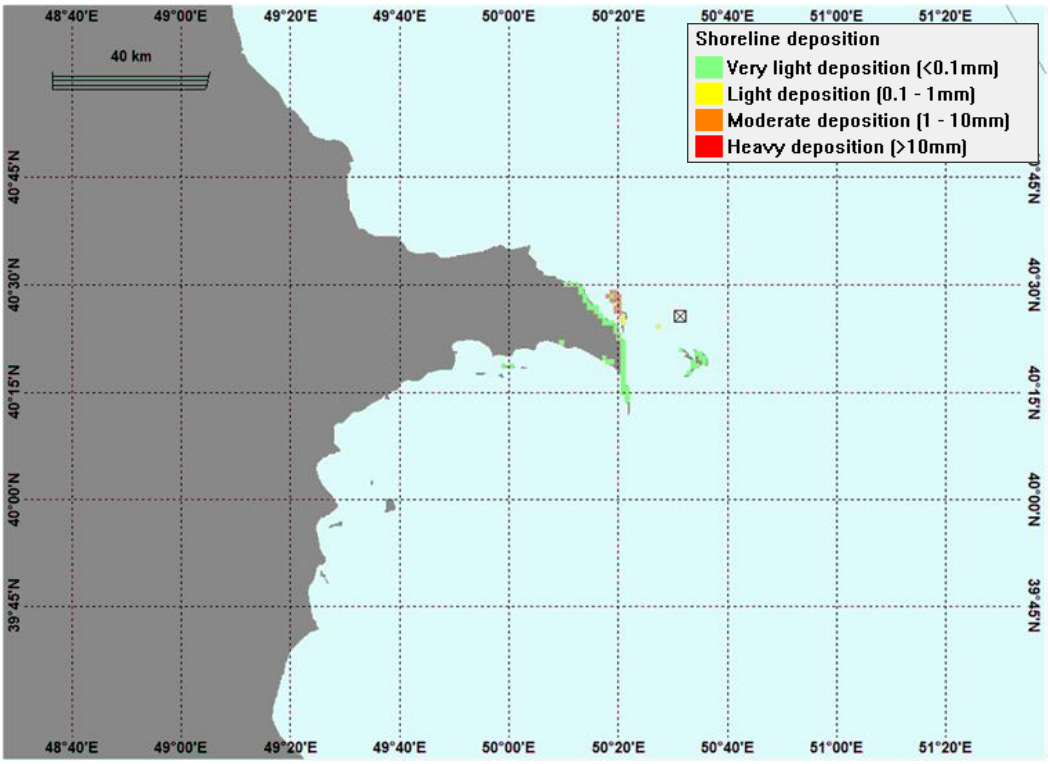


Figure 7.10: Modelled (Deterministic) Shoreline Deposition Resulting from Diesel Spill Scenario in Winter



Scenario 2 – Blowout of Crude Oil

This section presents the modelling results for Scenario 2, which are summarised in Table 7.4.

Table 7-4: Deterministic Results Summary for Hydrocarbon Release in Blowout Scenario

Release location	Maximum surface extent of sheen above 0.04 µm (km)		Minimum time to beaching (days)[1]		Time until water column dissolved concentration >58 ppb (days)[1,2]		Maximum mass onshore (tonnes)[3]	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
NKX01	462.8	456.4	0.5	6.25	> 120	> 120	50,681	64,684

Notes:
1. Time from start of release.
2. Dissolved and dispersed oil in water column.
3. Mass of oil onshore excludes associated water. Crude oil is predicted to be present in an emulsion, and the mass of emulsion is expected to be around 3.3 times the mass of oil.

The results of the worst case deterministic modelling (Table 7.4) shows that, during summer conditions, oil is predicted to reach the shoreline within half a day. A blowout during winter conditions is predicted to result in up to 64,684 tonnes of oil reaching the shoreline, although the 50th percentile value[37] is 34,675 tonnes.

As shown in Figure 7.11, during winter conditions, the majority of the oil is initially present on the sea surface following the release. During the blowout period of 81 days, oil is continually supplied to the surface, and oil on the surface remains significant until after the end of this period. Dependent on the wind and waves, oil can be mixed into the water column and some oil can subsequently re-surface during calmer periods. After approximately half a day, oil starts to deposit in sediments. The analysis of the stochastic model shows that ultimately 7% of the oil evaporates, 26% is biodegraded, 20% remains in the water column, 38% is deposited in sediments with approximately 3% reaching the shoreline and a relatively high 6% remains on the sea surface.

The probability of surface oiling above 0.04µm threshold is shown in Figure 7.12. The crude oil on the sea surface is predicted to travel around 400-500km before it drops below the lowest recognised visible thickness under ideal viewing conditions. There is a distinct difference in oil movement between summer and winter with the oil more likely to remain closer to the coast in summer, while in the winter it is more

likely to spread a further distance from the coast. The thickest areas of oil (>0.2mm) are predicted to cover a greater area during winter rather than summer (refer to Figure 7.13). The majority of oil initially moves south towards southern Azerbaijan. After day 19, however, the winds and currents shift and oil is moved northwards, oiling the north Azerbaijan coast and travelling into the northern Caspian. Although the precise movement of the surface oil is dependent on the exact metocean conditions at the time, the analysis of over 100 different sets of metocean data suggest that these two directions are dominant, and that the most likely locations to receive oil on shore are Azerbaijan, Russia and northern Iran.

The extent of oil in the water column above the 58ppb concentration threshold tracks the path of the surface release can extend 400-500km from the source as shown in Figure 7.14 for a spill in winter conditions. Figure 7.14 shows the total area the oil has covered as it has moved away from the release location. The cross section through the water column shows that the released oil remains in the top 70m of the water column. The modelling predicts the oil will remain closer to the surface for a spill in summer compared to a spill in winter. The oil moves outwards and disperses via the action of circulation currents, winds and waves and its presence in the water column is dominated by the presence of the surface slick. Some of the surface oil dissolves into the upper water column and some disperses in droplet form during stronger wind and wave conditions and can then re-appear on the surface in calmer conditions. Wave mixing and diffusion of the dissolved components gives rise to appreciable concentrations in the upper 20m of the water column, and occasionally deeper to around 50m depth, although the maximum concentrations remain immediately below the surface oil which is persistent.

The probability of oil reaching the shoreline during summer conditions is presented in Figure 7.15 and the accumulation of oil predicted on the shore following the blowout under summer and winter conditions is shown in Figure 7.16. Figure 7.16 represents the deposition of oil on the shore at the end of the simulation when the maximum length of coastline is affected. Both summer and winter spill cases result in oil reaching southern Azerbaijan, northern Iran and the Absheron Peninsula. The summer case is also predicts oil reaching the Russian coast. The eastern coastline of the Caspian is unaffected. A mixture of areas of very light (<0.1mm), light (0.1-1mm), moderate (1-10mm) and heavy (>10mm) oil deposition are predicted as can be seen in Figure 7.16.

Figure 7.11: Modelled Fate of Oil From Blowout Scenario (Winter)

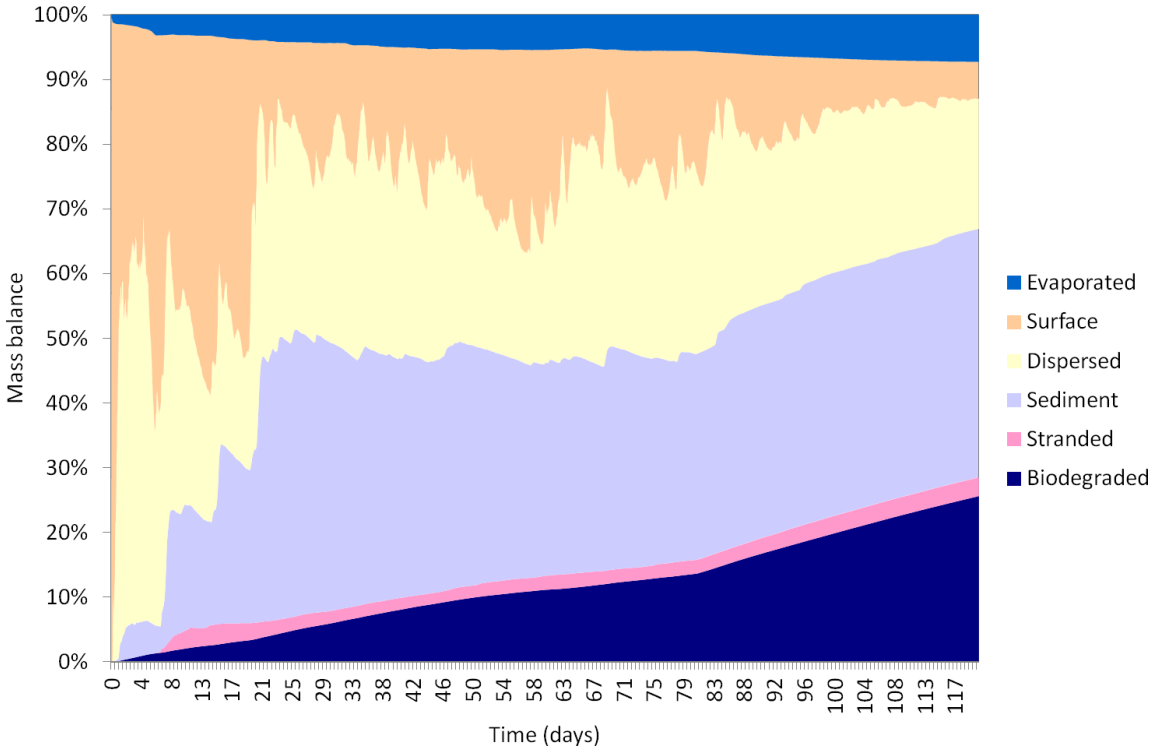


Figure 7.12: Modelled (Stochastic) Probability of Surface Oil Thickness Above 0.04µm Threshold for Blowout Scenario

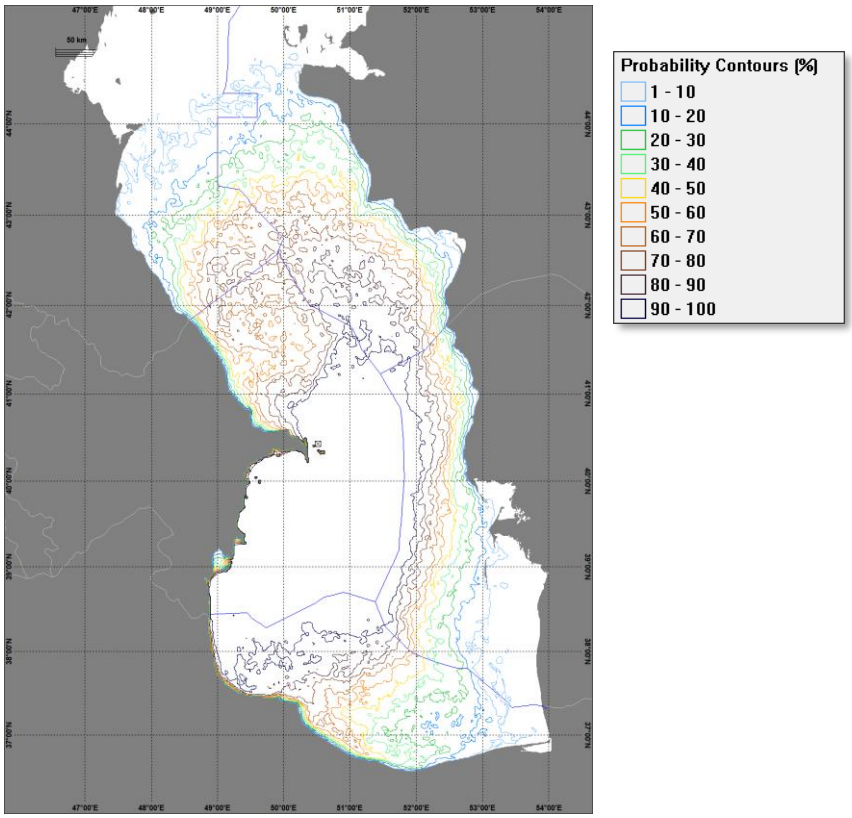


Figure 7.13: Modelled (Deterministic) Cumulative Area Thickness of Oil on the Sea Surface for Blowout Scenario (Winter)

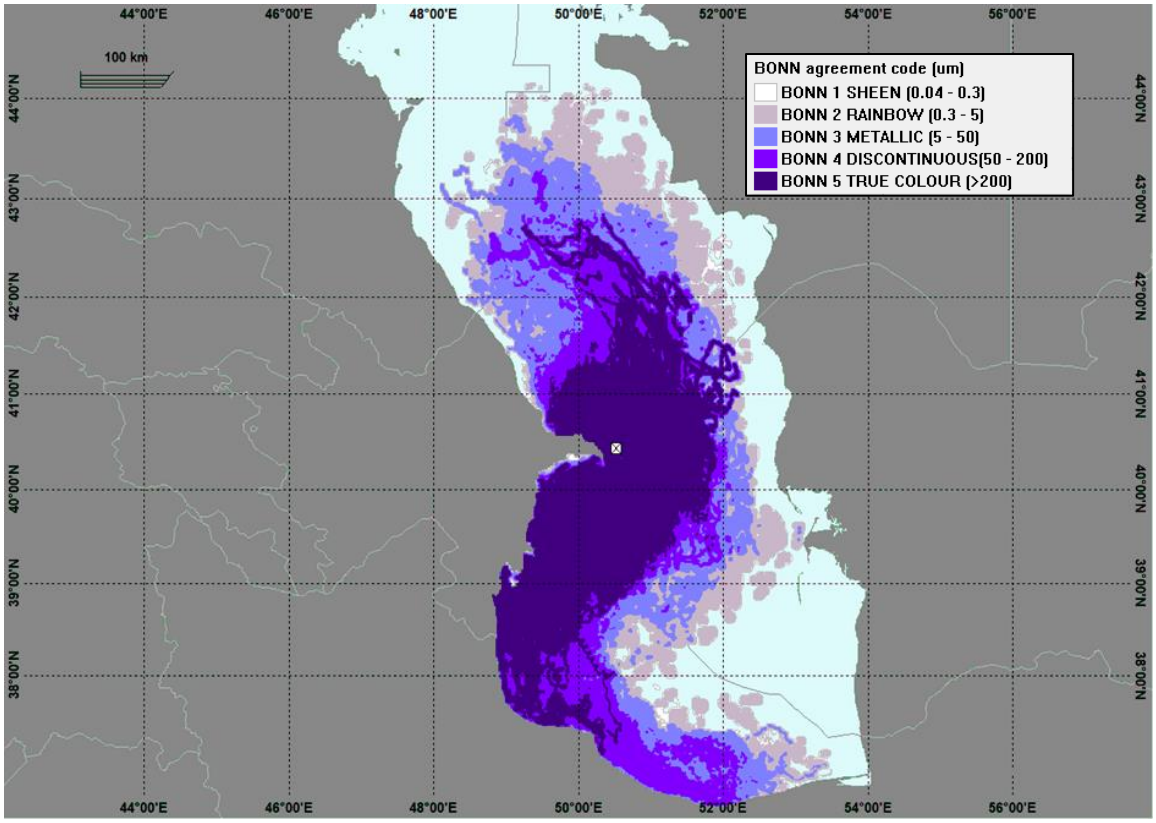


Figure 7.14: Modelled (Deterministic) Maximum Affected Area of Water Column[38] for Blowout Scenario (Winter)

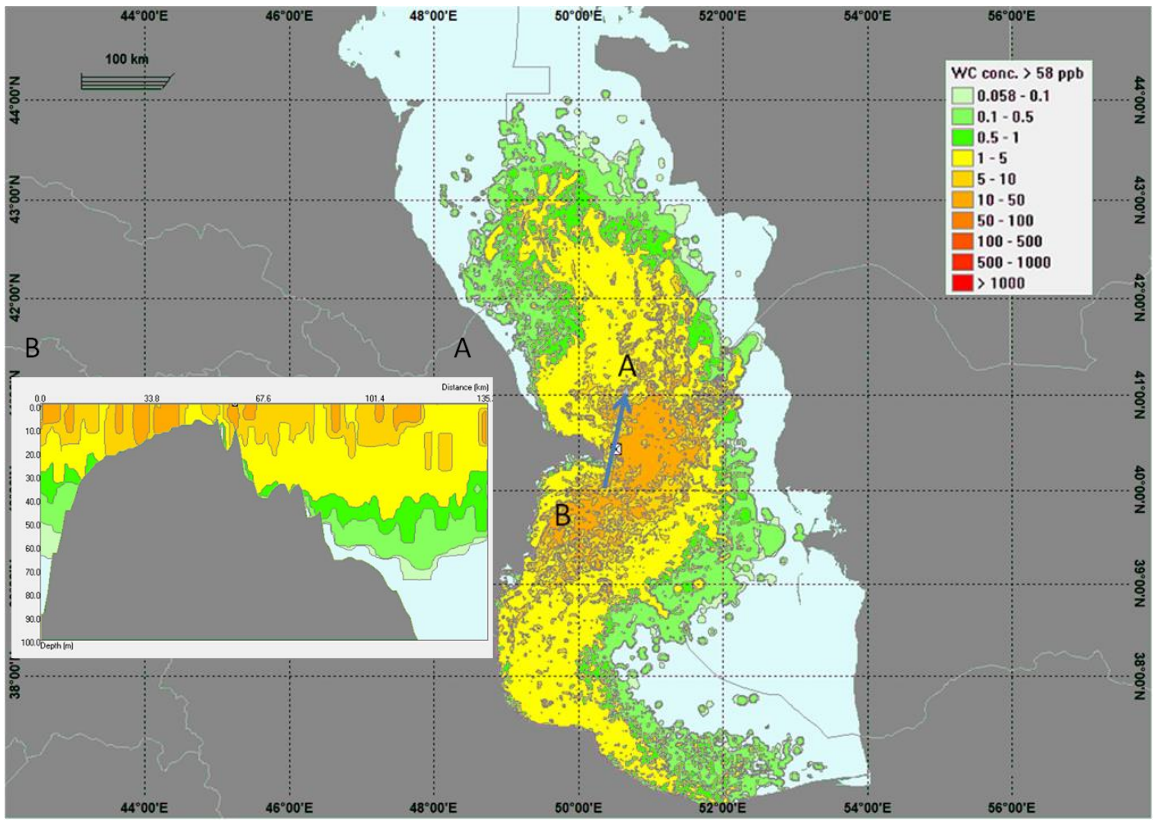
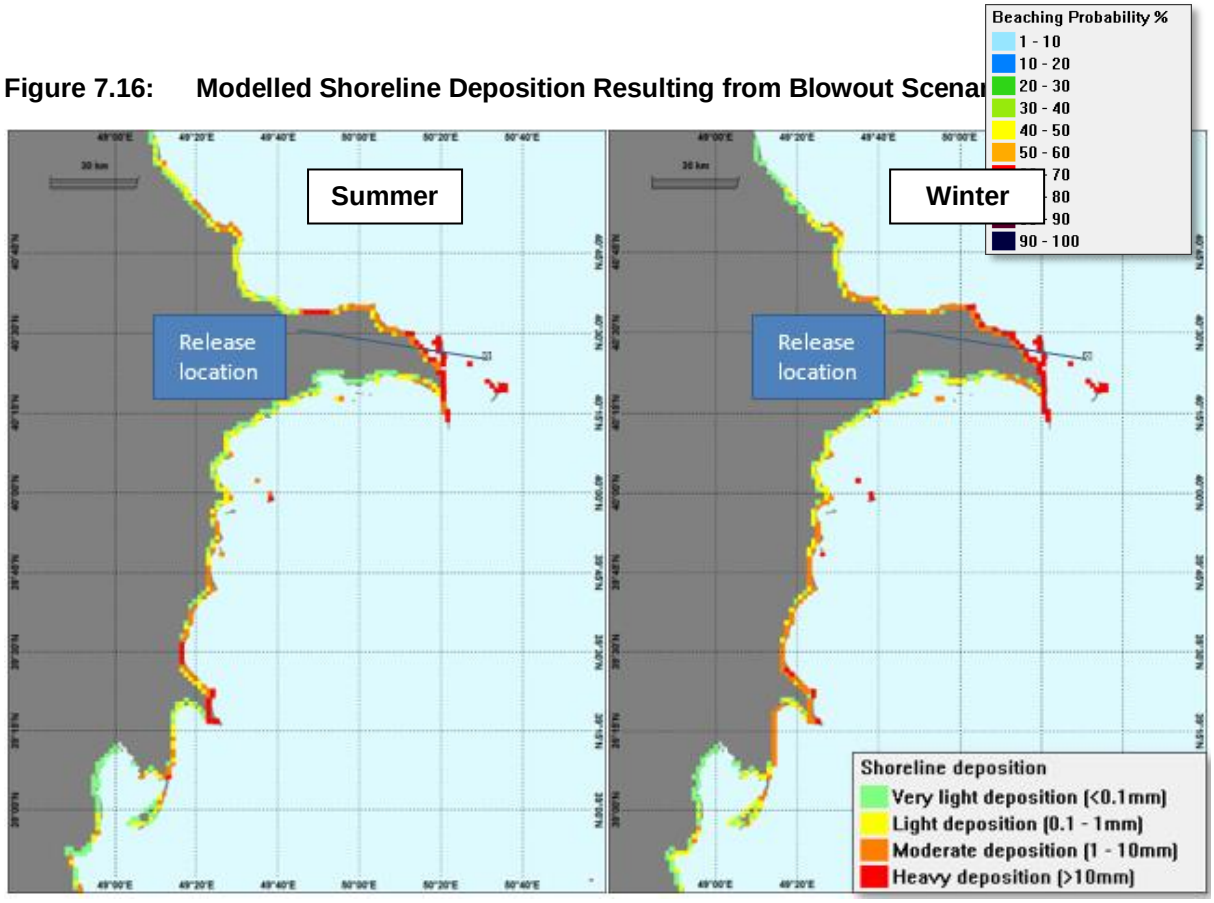
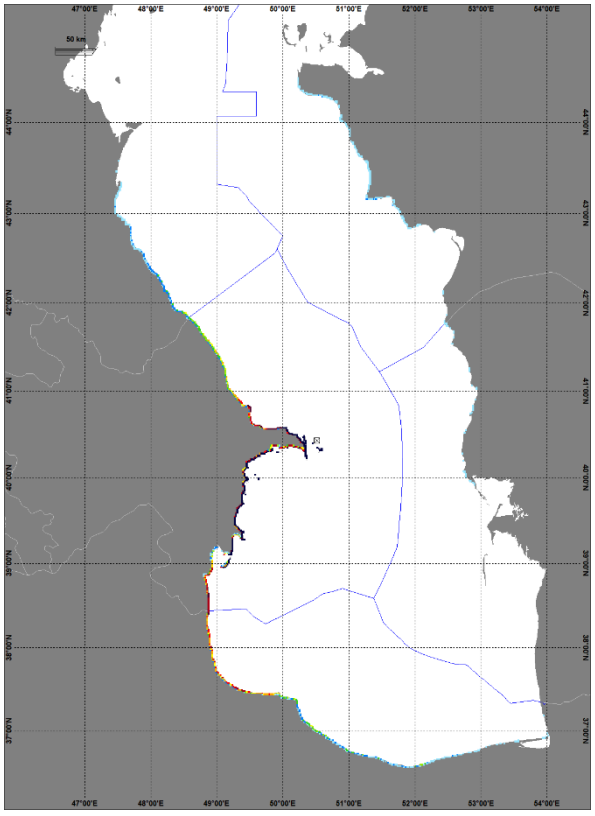
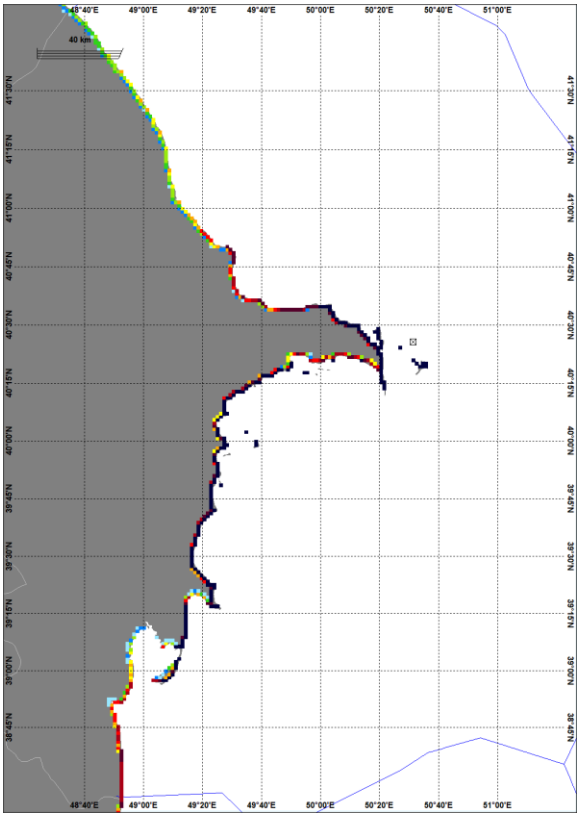


Figure 7.15: Modelled (Deterministic) Probability of Shoreline Oiling Above 0.1 litres/m² Threshold for Blowout Scenario in Summer

Figure 7.16: Modelled Shoreline Deposition Resulting from Blowout Scenar







7.3.3.7 Potential Impact of Hydrocarbon Release

Hydrocarbons have the potential to cause detrimental effects to water and sediment quality, marine and coastal flora and fauna, including plankton, benthic invertebrates, fish, birds and marine mammals that may come into contact with a spill. An impact on fisheries and an indirect impact on human health via the food chain is also possible, depending on the scale of the spill and its proximity to fishing grounds. The vulnerability of marine and coastal receptors to hydrocarbon spills is summarised in Table 7.5 below.

Spilled hydrocarbons undergo a weathering process once they are released into the marine environment. The fate of diesel and crude oil in the marine environment is described in Section 7.3.3.3 and Appendix 6A and is dependent on the type and volume of oil spilled and the prevailing weather and sea conditions. The spill modelling described in Section 7.3.3.6 above has estimated the trajectory of hydrocarbons in the marine environment for a range of scenarios including a loss of diesel inventory from a vessel at the proposed NKX01 well location and a blowout of the NKX01 well. A brief description of the potential impacts of the spills, taking into account the modelling results on marine and coastal receptors is presented below. Further details on the environmental and socio-economic receptors potentially impacted by a spill are provided in Chapter 5 of this ESIA.

Table 7-5: Vulnerability of Marine and Coastal Receptors to Hydrocarbon Spills

Receptor	Vulnerability to Hydrocarbon Spills
Plankton	• Abundance of phytoplankton may increase after a hydrocarbon spill due to increased nutrient availability, while zooplankton, fish larvae and eggs may suffer increased mortality due to toxicity in the water column, and therefore can affect the food chain of other fish species. • Although localised mortality is likely, the overall effect on plankton communities is not statistically significant and generally short-term. Shallow water areas have been found to have higher concentrations of phytoplankton compared to the open ocean. • Following a spill, plankton biomass may fall, however, after a few weeks, population often returns to baseline levels as a result of high reproductive rates and redistribution of species from outside the affected area.
Benthic Invertebrates	• Effects on the benthos include acute toxicity and organic enrichment. Sub-tidal regions generally have lower hydrocarbon concentrations after a spill than inter-tidal regions as often the hydrocarbon is carried and spread at the sea surface. • Recovery times are variable, and for light hydrocarbons are generally in the region of a few months to a few years. • Impacts can include rapid mortality of sensitive species such as crustaceans and amphipods; a period of reduced species population and abundance; a period of altered community structure with increased abundance of opportunistic species.
Fish	• Evidence suggests that fish are able to detect and avoid hydrocarbon-contaminated waters. This avoidance may cause disruption to migration or spawning patterns. • Hydrocarbon exposure in fish can lead to mortality or sub-lethal impacts on growth, physiology, behaviour and lowered disease resistance. • Fish populations are more sensitive to hydrocarbon pollution in shallow waters than in deep waters, with hydrocarbon concentrations being typically higher in the upper column. An oil spill in the vicinity of the Project would introduce higher risks to fish communities. • Fish may ingest large amounts of hydrocarbons through their gills. Fish that have been exposed to hydrocarbons may suffer from changes in heart and respiratory rate, enlarged livers, reduced growth, fin erosion and a variety of effects at biochemical and cellular levels. Hydrocarbons toxicity can also affect reproductive capacity negatively and/or result in deformed fry. • Fish eggs and larvae are more vulnerable to hydrocarbon pollution than adults. In many fish species, these stages float to the surface where contact with spilt hydrocarbons is more likely. However, as most fish species have extensive spawning grounds and produce large numbers of eggs, there is unlikely to be any effect on numbers in the adult populations. Stocks may be at risk from a spill if it is large and coincides with spawning periods. • Longer term impacts of a hydrocarbon spill have shown genetic damage, physical deformities, reduced abundance and growth, and compromised survival of some life stages.
Seals	• Seals are very vulnerable to hydrocarbon pollution because they spend much of their time on or near the surface of the water. They need to surface to breathe, and regularly haul out onto beaches. During the course of a hydrocarbon pollution incident, they are at risk both when surfacing and when hauling out. • Seals may be damaged through the ingestion of food contaminated by hydrocarbons or the inhalation of hydrocarbon droplets and vapours. Oil, especially light oils and hydrocarbon vapours, will attack exposed sensitive tissues. These include mucous membranes that surround the eyes and line the oral cavity,

Receptor	Vulnerability to Hydrocarbon Spills
	respiratory surfaces, anal and urogenital orifices. This can cause corneal abrasions, conjunctivitis and ulcers. Consumption of contaminated prey can lead to the accumulation of hydrocarbons in tissues and organs.
Birds	• The spilled hydrocarbon can penetrate into the plumages of sea birds, reducing its insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. This can lead to death from hypothermia or drowning. • In their efforts to clean themselves from hydrocarbon, the birds may inhale or ingest the hydrocarbon. As hydrocarbons are toxic, this may result in serious injuries/health effects such as pneumonia, congested lungs, intestinal or lung haemorrhage, liver and kidney damage. • Hydrocarbons may also affect the reproductive success of the birds as hydrocarbons from feathers of a bird that is laying on eggs may pass through the pores in the eggshells and either kill the embryos or lead to malformations.
Fisheries	• Fish exposed to hydrocarbons may become tainted, defined as giving the product a petroleum taste or smell. Commercial fish species rarely become tainted in open deep waters, as they are able to avoid the affected area. However, major spills can result in loss of fishing days and exclusion zones and bans on certain species lasting for a whole season may be enforced.
Sources: Ref. 7, Ref. 12, Ref. 13, Ref, 14 & Ref. 15	

Plankton

The spill modelling indicates that for a diesel release (Scenario 1) the concentrations of diesel in the water column above the 58ppb threshold are limited in extent from the point of release and are not expected to persist for longer than 2 days (summer) and 9 days (winter), respectively. The exposure of plankton (excluding fish larvae) to toxic levels of hydrocarbons from this scenario is therefore expected to be short term and localised. However, the modelling of the well blowout scenario (Scenario 2) estimates the maximum area of water column with a concentration of oil in the water column above the 58ppb threshold[38] would be extensive and the concentration would remain above the 58ppb concentration threshold for greater than 120 days following the release.

Plankton (particularly zooplankton, fish larvae and eggs) are likely to suffer high levels of mortality through exposure to hydrocarbons. However, plankton already experience very high levels of natural mortality, predominantly the result of predation. Plankton are generally short-lived, rapidly reproducing often releasing very high numbers of eggs and/or larvae and are also widely distributed, so that recovery, even from significantly detrimental impacts, can be relatively short (weeks or months) (Ref. 11).

During the peak period of phytoplankton production (spring and autumn) the biomass exposed to a hydrocarbon spill would increase resulting in reduced growth levels and mortality. However, this is not expected to be significant in comparison to the total production level over the long term. Zooplankton may also suffer mortality as a result of a hydrocarbon spill, but the large number of early life stages produced and short reproductive cycles, will act as a buffer for recruitment from areas outside the spill affected region. Thus, plankton concentrations are expected to return to baseline levels after a relatively short period of time. As a result, the overall impact on the plankton communities is not considered to be significant.

Benthic Invertebrates

As detailed in Chapter 5: Sections 5.4.4.2, the Environmental Baseline Survey (EBS) conducted around the Project location in 2018 showed that all species found in this area were native species except for one decapod species. Although the variety of species recorded around the Project location during the 2018 survey was greater as compared to the SWAP 2015 (stations 20 to 24) and SOCAR Gurgan-Deniz surveys carried out to the southwest from the Project location, the lowest abundance was recorded at the Project location. Benthic invertebrate communities both within and in the vicinity of the Project location are very similar to those across the rest of the Azerbaijan sector of the southern Caspian. There are no rare, unique or endangered species known to be present in the vicinity of the Project location. Nevertheless, benthic communities do play an important role in supporting critical functions of the local ecosystem, particularly as prey items for other species, including fish such as sturgeon. There are a number of taxa that are important prey e.g. amphipod crustaceans, which are known to be sensitive to hydrocarbons.

As shown in Figure 7.4, it is predicted that a release of diesel from a vessel will result in approximately 6% of the spilled diesel ending up in sediments and thus benthic environments are less likely to suffer the impacts of a surface hydrocarbon spill. The spilled hydrocarbons become mixed into the water column, subsequently combining with suspended sediments. This then sinks to the seabed where its toxic components can be lethal to benthic organisms (Ref. 11). As shown in Figure 7.11, the spill modelling predicts that approximately 38% of the spilled oil from the blowout scenario (Scenario 2) will sink to the seabed. Furthermore, the predicted maximum amount of oil beached ashore is predicted to be 64,684 tonnes for the worst case blowout scenario.

Potential impacts to the benthic invertebrates can include: (i) rapid mortality of sensitive species such as crustaceans, amphipods, and bivalves; (ii) a period of reduced species population and abundance and (iii) a period of altered community structure with increased abundance of opportunistic species.

In the case of a well blowout, where the hydrocarbon initially disperses rapidly, the impact to the benthic environment in the vicinity of the release will be dependent upon weather conditions and levels of suspended sediment within the water column at the time. A significant volume of oil is anticipated to reach the coastline and an estimated 38% of the released oil is predicted to deposit in sediments, predominantly in the shallow waters east of the Absheron peninsula, by the end of the simulation period. Modelling of the predicted impacts of the oil released during the blowout on sediments (refer to Appendix 6A Section 5.2.3.4) shows acute toxic effects would be expected mainly within 35km of the well based on an acute toxic effect threshold of 1,000mg/kg[39] and sub-lethal effects (100-1,000mg/kg) potentially being experienced at a distance of up to 170km from the well. As such, the potential impacts to benthic species in the areas sediment affected by the spilled oil from a blowout is likely to be significant in the short term to medium term. The recovery times for benthos would vary depending on the environmental conditions and species affected. Although a large percentage of the spilled oil (38%) will be deposited within sediments, over time the oil will biodegrade and the effects of wave action and currents will naturally disperse the oil particularly along rocky and sandy shores. However, benthic species present in areas of fine sand or mud may suffer longer term effects as the oil that penetrates fine sediments can persist for many years and can often be released back into the water column if disturbed.

Given the water depths in the vicinity of the well location (approximately 22m), it is unlikely that a surface spill of diesel would give rise to highly significant effects to benthic invertebrates, particularly as the diesel will rapidly evaporate. Modelling of the effect of the diesel release on sediments (Refer to Appendix 6A Section 5.1.3.4) shows only small areas of sediments will experience deposition above the no effect concentration of 10mg/kg. This is likely to have a short term and localised impact on the benthic organisms present. Taking into account the limited area of sediments affected by stranded diesel and short term recovery rates, the overall impact to benthic invertebrates is expected to be low. However, in terms of a worst case well blowout scenario, the potential for a large amount of oil to end up in sediments on the seabed and beach along a significant length of coastline is expected to lead to a potentially significant impact on benthic species present in areas impacted by the oil. There is potential for recovery to take a number of years and for changes to the community structure due to the increased abundance of opportunistic species.

Fish

As discussed in Chapter 5: Section 5.4.6.2, the key locations for fish species in the southern Caspian are within the shallow water shelf areas. It is common for Caspian fish species to migrate to warmer waters for overwintering and migrate to nutrient rich shallow areas of the north or river deltas in the spring / summer for spawning and feeding however, maximum concentrations of fish are typically found at depths of up to 75m for the majority of the year. The coastal region is important for non-migratory species as it provides breeding and nursery habitat for a number of species during spring, summer and autumn. The species most likely to be present within the shallow waters surrounding the Absheron Peninsula and specifically within the vicinity of the Project location are resident species including gobies in addition to species such as sandsmelt, Caspian pipefish and stickleback. While present in water depths of 20m or more year round, these species typically breed in waters of up to 10m deep, more

[39] Patin (Ref. 17) recommends threshold of 10 milligrams of oil per kilogram of sediment (mg/kg) as a level that would be below the no effect concentration for most species; 10-100mg/kg where reversible effects would be expected; 100-1,000mg/kg where sublethal effects would be expected and above 1,000mg/kg as a level where acute toxic effects would begin to be observed.

commonly in shallow waters of up to 4m deep. The area south of the Absheron Peninsula is a known nursery area for the main commercial fish species. Pelagic species such as kilka are likely to be found in the waters of the Southern Caspian all year round (in depths of 20-40m), although in smaller numbers in winter, outside the main spawning and migration periods while migration of sturgeon and grey mullet takes place along the coast in water depths up to 100m.

The potential impacts of an oil spill on fish may include physical damage (e.g. through oiling of gills) and toxic effects (e.g. due to uptake of volatile toxic components of the crude). Fish have the ability to detect hydrocarbons in water through olfactory (smell) or gustatory (taste) systems and tend to avoid contaminated areas). Depending on the time of year that a spill was to occur, different groups of fish species may be affected. It can be assumed therefore that the majority of adult fish would avoid the area of a spill, although in very shallow waters fish may be more restricted between the seabed and the hydrocarbons on the sea surface and the concentrations of dispersed oil in the water column may also be higher. In the vicinity of the Project location, the risk to fish potentially increases as the exploration well is located within relatively shallow water (approximately 22m water depth). In addition, spill avoidance behaviour can disrupt migration routes for some fish species. This has the potential to impact the migration of species of sturgeon and shad and semi-migratory species such kilka and mullet. Where mortalities linked to oil spills have been recorded they have generally been associated with high levels of surface oiling in storm conditions when mixing increases the presence of oil compounds in the water column. Juveniles and larvae are more vulnerable to oil spills as they have limited ability to move away from the contaminated zone, which may have implications for the reproduction of these species. It should be noted that protected sturgeon species do not spawn within Azerbaijani waters but will be migrating in spring and summer and may be feeding during summer in coastal waters up to 100m water depth.

Oil spill modelling for Scenario 1 indicates that diesel concentrations in the water column that have the potential to cause toxic effects on fish are non-persistent, with a large proportion of the diesel evaporating within two days of the release and diesel concentrations within the water column dispersing below the 58ppb threshold levels within 9 days in winter and 2 days in summer. In the event of a blowout (Scenario 2), a large proportion of the oil will evaporate, with the remaining oil expected to persist over a longer period compared to diesel (weeks and months compared to days for diesel). With the blowout scenario, the probability of the dispersed oil in water concentration exceeding the 58ppb threshold is 90-100% over an extensive area of the Central Caspian around the Absheron Peninsula and the modelling predicts it will take more than 120 days for the concentration to fall below 58ppb in impacted areas. Although adult fish have the ability to move away from affected areas, juveniles and larvae have limited ability. Considering that these are focused on shallow depths and areas near islands, populations of juveniles may be at higher risk. Coupled with the extensive area impacted by the oil spill and the duration of contamination there will likely be significant impacts to fish populations in the short to long-term.

Seals

If Caspian seals are within the area of a spill, or if the spill affects any resting or haul out sites, there could be irreversible impacts from a hydrocarbon spill through coating, inhalation and ingestion.

As discussed within Chapter 5: Section 5.4.6.3 seals may not always be present in the SWAP Contract Area, but there are evidence confirming that migrating seals still use the route passing the waters between Pirallahi Island, Chilov Island and Oily Rocks; during the Autumn (October-November) migration. Evidence of this includes seal observations recorded during the SWAP 3D seismic survey in 2015 and 2D survey in 2016. In addition to seal presence during the migration period, there is also the potential for seals that have not migrated to the Southern Caspian to be present for foraging from May to September with peak numbers coinciding with the peak kilka numbers in July. The scientific opinion is that seals are showing signs of adaptation to anthropogenic disturbances. It is understood that, following increased disturbances within the Dagestan coastal area of Russia (including reported mass poaching), seals tended to avoid coastal areas during the autumn and spring migrations and use routes located away from the coast. Thus, the latest research has shown it is not possible to assume the seals will always follow the previously defined migratory paths close to the east and west coastline and may travel through the centre of the Caspian. Recent research indicates that a significant proportion of seals

remain to feed in the Central Caspian (to the north and south of the Absheron Peninsula) throughout summer and autumn.

With regard to a release of diesel from a Project vessel at the Project location (Scenario 1), the spill modelling confirmed that surface diesel thicknesses will be greatest near the spill location, dispersing and thinning out with distance and time. The duration of diesel remaining on the sea surface in most areas is not predicted to exceed nine days and there is a low probability of diesel above the 0.1 litres/m^2 threshold accumulating on the shoreline of mainland Azerbaijan and surrounding islands. Therefore, exposure of seals to spilled diesel is possible but they would likely avoid the area or have limited contact with the diesel.

In the event of a blowout (Scenario 2) there will be a significant volume of oil released to the sea surface. Over time, the volume of oil on the surface will reduce through evaporation, dispersion in the water column and biodegradation. However, under worst case conditions up to 64,684 tonnes of oil may reach the shoreline with the first oil reaching shore within 6 hours of the blowout commencing. The stochastic modelling indicates that different times of year can make a significant difference to the amount of oil that reaches the shore with blowout start times of February - May likely to result in much larger volumes of oil arriving on shore than at other times of the year. The probability of oil reaching the Azerbaijan coastline varies from 5 - 100% with oil most likely to come ashore around the Absheron Peninsula, Pirallahi Island, Chilov Island and from the Kura Delta to the border with Iran.

Caspian seals are an International Union for Conservation of Nature (IUCN) endangered species and are under pressure from various natural and anthropogenic stressors. Seals are known to be highly sensitive to oiling and are most vulnerable during the breeding season (December to February) and feeding periods (May to November). Therefore, even small-medium scale exposure to toxic effects of diesel, within sensitive areas for seals, could result in a potentially significant impact. The anticipated larger volume of a major spill (i.e. blowout) and relative larger size of slick would increase the potential for contact with seals in the offshore waters and along the coastline meaning a significant impact to seals is highly likely in the event of a blowout.

Protected Areas of Sites of Ornithological Importance

As described in Chapter 5: Table 5.14 there are a number of Protected Areas (IUCN Categories II and IV), Important Bird and Biodiversity Areas (IBAs), and Key Biodiversity Areas (KBAs) located along the coastline of Azerbaijan.

The shoreline oiling probabilities predicted by modelling in the event of a diesel spill from a Project supply vessel at the Project exploration well location (Scenario 1) or a well blowout (Scenario 2) for each of the areas of ornithological importance are summarised in Table 7.6. In the event of a diesel spill (Scenario 1) there is a low probability (5-30%) of diesel reaching parts of the coastline within the Absheron National Park (including Shahdili Spit and Pirallahi Island). In the event the diesel does reach the coastline there will only be very light deposition (<0.1mm) of diesel and any impacts would be limited in duration and extent. However, in the event of a blowout (Scenario 2), the modelling predicts a range of probabilities of shoreline oiling for some of the important ornithological areas due to the extensive length of coastline they occupy, therefore the highest probability predicted for any part of the important ornithological area is presented as a worst case. Each of the important ornithological sites listed in Table 7.6 for a blowout (Scenario 2) have at least a 60% probability of being impacted be shoreline oiling while for a number of sites including the Absheron National Park (including Shahdili spit and Pirallahi Island) the probability is 80-100%. The recovery of different habitats from an oil spill varies but for hydrocarbons such as crude oil the recovery typically takes place within a few seasonal cycles for most habitats within one to three years although the recovery in more sheltered areas may take up to five years (Ref. 14). Based on this medium to long term recovery and considering international conservation status and ecological importance of these areas, the potential impacts are assumed to be significant.

Table 7-6: Shoreline Oiling Probabilities for Designated Areas along the Absheron to Gobustan Coastline

Sites of Ornithological Importance	Designation	Probability of Shoreline Oiling Under Worst Case Conditions (Winter)	
		Diesel loss (Scenario 1)	Blowout (Scenario 2)
Absheron National Park (including Shahdili spit and Pirallahi Island)[5]	KBA[1]/IBA[2] IUCNII[3]	5 - 30%	80 - 100%
Red Lake	KBA/IBA	None	60 - 70%
Sahil Settlement – 'Shelf Factory	KBA/IBA	None	60 - 80%
Sangachal Bay	KBA/IBA	None	60 - 80%
Gil Island (or Glynanyi Island) State Nature Sanctuary	KBA/IBA IUCN IV[4]	None	70 - 90%
Pirsagat Islands and Loc Island	KBA/IBA	None	80 - 100%
Bandovan (or Byandovan) State Nature Sanctuary	IUCN IV	None	80 - 100%
Shirvan National Park	KBA/ IBA/ IUCN II	None	60 - 100%

Birds and Important Bird and Biodiversity Areas

The Caspian region supports a high diversity of bird species, with a large number of endemic and protected species present. There are 15 birds on the IUCN Red List or in the Azerbaijan Red Data Book (AzRDB) known to be present along the Absheron to Neftchala coastline. The Azerbaijan coastline of the Caspian Sea from the Absheron region moving south is an area of international and regional importance providing habitat for breeding, nesting, migratory and overwintering birds, which is reflected in the designation of a number of IBAs (see Chapter 5: Table 5.14).

The distribution and abundance of birds in the coastal region changes significantly during the migration and overwintering periods. A large number of overwintering and migrating birds will be present offshore and along the Central and Southern Caspian coastline within a number of IBAs identified as areas at risk of potential impact from an oil spill (Table 7.6 above). Bird species that spend most of their time on water are most at risk, including a number of overwintering birds (i.e. ducks) which dive in shallow waters to feed on small fish/ benthic invertebrates.

There are some key periods and areas along the Absheron coastline of higher sensitivity. Ducks and coots are overwintering from December to February and the presence of migrating species peaks in March and November. The IBAs are the key habitats for these groups of birds, particularly for nesting and breeding, with the Shahdili Spit being particularly important for a wide variety of nesting species. The bird nesting season begins at the end of April/beginning May and continues until mid-July. Limited information is available regarding the offshore distribution and abundance of birds in the Southern Caspian; however it is anticipated that there may be small numbers of gulls and birds such as terns that plunge dive to feed and species.

An accidental release of hydrocarbons, particularly crude oil, can impact birds offshore and in the nearshore / coastal areas. The oiling of their plumage is the most obvious impact. When this occurs, the important layer of insulation is disrupted, which results in the skin coming into direct contact with the seawater. In this condition birds lose buoyancy and the ability to take off in search of food and/or escape predation. Smothered plumage also leads to loss of body heat putting the birds at risk of hypothermia as fat reserves beneath the skin are depleted during attempts to keep warm. Ultimately, birds that suffer from cold, exhaustion and loss of buoyancy, may drown (Ref. 11).

Should the birds return to a nest, this can transfer the oil to live young or hatching eggs, which can then suffer eggshell thinning, failure of the egg to hatch and developmental abnormalities. Ingestion of oil can lead to congested lungs, intestinal or lung haemorrhages, pneumonia and liver and kidney damage. Birds are likely to ingest oil whilst attempting to clean their plumage.

A small spill during breeding seasons could prove more catastrophic for birds than a larger spill at a different time of the year. The modelling indicates a blowout starting in February to May is likely to result in much larger volumes of oil arriving on shore than at other times of the year, including areas with IBA status. In some locations the oil is likely to persist for a number of months exposing birds and their habitats to the impacts of oil for an extended period.

It is considered that the impacts to birds and IBAs from a release of diesel from the vessel (Scenario 1) will be minor as the diesel is not expected to reach long stretches of coastline and there is a low

probability (less than 30%) of diesel concentrations in the water column above the 58ppb threshold reaching the shallower coastal areas important to birds as the diesel evaporates and disperses relatively quickly. In the event of a blowout (Scenario 2), it is considered that the impact of a crude oil spill on birds at sea and the IBAs and KBAs could be significant for the reasons described above and due to the spill potentially occurring during the most sensitive time of year for nesting birds in the region.

Fisheries and Other Marine Users

Socio-economic receptors such as fisheries and coastal tourism could be exposed to the risk from an accidental spill. As described above, for Scenario 1, the modelled maximum exposure of the water surface to diesel is generally limited to five days, and water column exposure to diesel concentrations exceeding the 58ppb threshold is not expected to exceed 9 days. The probability of oil from a blowout (Scenario 2) reaching coastal areas or commercial fishing grounds within Azerbaijan varies with some areas around Baku Bay ranging from 40 to 100% while further south the probability near Neftchala and Lankaran is in the range of 30 to 100% and 30 to 80%, respectively (refer to Appendix 6A). Although a large percentage of the oil will evaporate, biodegrade or disperse within the water column it is anticipated that up to 275 tonnes of diesel (during summer conditions) and 64,684 tonnes of oil (during winter conditions) could reach the shoreline following a blowout. Areas of the Azerbaijan coastline that are predicted to receive moderate (1-10mm) or heavy (>10mm) depositions of oil include Chilov Island, Pirallahi Island, Absheron Peninsula, Baku Bay, along the coast between Alat and Neftchala as well as the coast of Lankaran (refer to Figures 7.10 and 7.16 and Appendix 6A). A blowout of oil will also result in a significant amount of oil on the sea surface which would slowly reduce over several months (blowout). The concentration of oil in the water column is expected to remain above the 58ppb threshold for greater than 120 days for a blowout in some areas impacted by the spill as illustrated in Figure 7.14.

In the unlikely event of a large spill such as a blowout, in addition to the significant effect on the marine and coastal receptors the negative public perception and media attention can have reputational implications. There is potential for tourist businesses located within the spill area to be affected, particularly during the early summer period when the geographic extent of a spill is predicted to be greatest and tourist activities are at their peak. While offshore oil will largely evaporate, disperse and biodegrade, any oil reaching the coastline may remain stranded for months on the affected recreational beaches, hence potentially having impacts on the recreational businesses within the affected area.

Chapter 5: Section 5.6.3 describes how commercial fishing is primarily undertaken in relatively shallow water of the Caspian up to 50m water depth. Due to gradual decline of fishing stocks (particularly of anchovy kilka), fishing vessels have adjusted their methods to catch fish at shallower depths. However, there is the potential that a worst case spill from a blowout could have much wider impacts on fishing including to important commercial fishing grounds such as Oil Rocks and the Makarov Bank and smaller scale fishing areas (with fishing taking place within 2-3 nautical miles from the coastline) and landing sites located along the Azerbaijan coastline. The closest fishing ground to the Project exploration drilling location is Chilov Island (located approximately 12km away). Areas along the coastline between the Absheron Peninsula and Gobustan where the majority of licences have been issued for small-scale fishing include Zira, Hovsan, Shikh, Bayil, Zygh and Sangachal-Gobustan. It is understood that the high season for commercial fishing is during March to April whereas the peak fishing period for small scale fishing occurs in March-April and September-November, although fishing takes place throughout the year.

The impact on fisheries would reflect the impact on fish and the presence of juvenile stages at the time of a spill as they are more susceptible to relatively low levels of oil within the water column and are less likely to be able to move away. Any impact on juvenile stages could impact short to medium term recruitment to future stocks. Despite the susceptibility of fish larvae and juveniles to relatively low concentrations of hydrocarbons in the water column, adult free swimming fish and wild stocks of commercially important species are likely to detect and avoid hydrocarbon contaminated areas. Following a spillage, the reproductive success of unaffected fish, as well as the influx of larvae from unaffected areas should lead to the recovery of stock numbers. Given that many marine species produce vast numbers of eggs that are widely distributed by sea currents this means that species can recover from small mortality events relatively quickly.

However, fish can become tainted and contaminated with hydrocarbons. If there are signs of fish oil tainting or contamination, in the event of a hydrocarbon spill, any resultant imposed authority restrictions on fishing activities could result in detrimental financial impact upon local fisheries. Equally, a lack of timely restrictions, or illegal fishing, can create a risk to human health from contaminated product consumption. A release of diesel (Scenario 1) is unlikely to have an impact on small scale fishing although in the event of a blowout (Scenario 2) the impact from oil reaching the shoreline in areas of small scale fishing is likely to be significant as fishing represents the primary source of household income for the majority of fishermen. Commercial fishing can also be impacted in the event of a hydrocarbon spill but in the case of a diesel release it is highly unlikely that the spill will impact important commercial fishing grounds. However, in the event of a blowout (Scenario 2) there is high probability that the spilled oil will result in the concentration of oil in the water column exceeding the 58ppb threshold at important commercial fishing grounds such as Oil Rocks, Makarov Bank and Kornilov-Pavlov Bank leading to the potential for toxic effects to fish and indirectly on human health that could trigger a temporary fishing ban. Therefore, the impact to the commercial fishing industry in the unlikely event of a blowout is considered to be potentially significant.

In the longer term, fishery products that consumers associate with areas affected by a large spill would become less marketable. This is only likely to occur for more substantial spills that endure over a long period and that receive broad media attention. In an extreme case where there are enduring concerns about food safety there could be restrictions placed by national regulators on all commercial fishing across an affected area.

Summary of Hydrocarbon Spill Impacts

Considering the spill scenarios assessed, the following conclusions can be drawn with regard to the impact of oil spills on the marine and coastal environment:

- A spill of diesel from a vessel located at the Project location will have a limited impact to the marine environment as the majority of spilled diesel evaporates, disperses or biodegrades relatively quickly. Although in an absolute worst case 275 tonnes of spilled diesel may reach the shoreline the 50th percentile value[40] predicted is 12.9 tonnes. However, the probability of the spilled diesel reaching the coastline is low and is unlikely to directly impact designated areas with the exception of the Absheron National Park (5-30% probability of diesel reaching shore).
- A major spill from a well blowout has the greatest potential for impact in terms of the volume of hydrocarbons discharged into the marine environment. In the event of a blowout, species in the immediate vicinity of the spill that cannot actively avoid the oil such as plankton, benthic invertebrates, birds and seals are likely to suffer the greatest impacts. Highly mobile species such as fish are anticipated to avoid the spilled oil in most areas. The modelling of the blowout predicts that a number of IBAs and KBAs, and associated bird species may be exposed to elevated hydrocarbon concentrations as a result of surface or dispersed / dissolved oil beaching on the shoreline following a blowout. Given the persistence and volume of oil predicted to beach in some IBAs and KBAs the potential impact on IBAs and KBAs (and the birds present there) could have a potentially significant impact, especially if the release occurs during the bird nesting period (April to July). The blowout scenario may also affect small scale fishing grounds along the coast, and commercial fishing.

7.3.4 Spill Prevention and Response Planning

7.3.4.1 Oil Spill Contingency Planning - Azerbaijan Offshore

A standalone Offshore Facilities Oil Spill Contingency Plan (OSCP) will be developed for the SWAP Contract Area exploration activities. It provides guidance and actions to be taken during a hydrocarbon spill incident associated with SWAP operations. The OSCP will include a tactical response plan, specific to the SWAP exploration activities based on relevant oil spill scenarios.

[40] Means that in 50% of scenarios modelled, this value or less would result.

The OSCP is designed to:

- Establish procedures to control a release or the threat of a release, that may arise during offshore operations and associated facilities;
- Establish procedures to facilitate transition of response operations from a Tier 1 incident to a Tier 2/3 release or threat of release;
- Minimise the movement of the hydrocarbon spill from the source by timely containment;
- Minimise the environmental impact of the oil spill by timely response;
- Maximise the effectiveness of the recovery response through the selection of both the appropriate equipment and techniques to be employed; and
- Maximise the effectiveness of the response through trained and competent operational teams.

BP's response strategy is based on an in-depth risk assessment of drilling and platform operations and subsea pipelines; analysis of potential spill movement; environmental sensitivities and; the optimum type and location of response resources. BP supplements its dedicated resources with specialist spill response contractors.

Under the BP AGT Region spill procedures, spill incidents are categorised according to the level of resource required to mitigate them. BP has adopted the internationally recognised tiered response concept to oil spill response as shown in Table 7.7.

Table 7-7: Oil Spill Response Tiers

Tier 1	Tier 1 spills are defined as small operational spills that can be can be handled immediately by on-site personnel. In most cases, the response would be to clean up using on site resources.
Tier 2	Tier 2 spills are defined as spills that require additional local (in-country) resources and manpower that are not available on the site that the spill occurs. The site response team would carry out clean up, aided by the dedicated Tier 2 oil spill contractor.
Tier 3	Tier 3 spills are very large, possibly ongoing spills, which will require additional resources from outside the country of spill origin and is likely to impact the community for an extended period and may arouse national or international media interest. Such spills are very rare and would only occur through events such as a well blowout or full diameter pipe rupture. All available spill contractors (from within and outside Azerbaijan) would carry out the physical response, with extensive support from the BP Incident Management Team and the Business Support Team.

BP has contracted an independent oil spill response contractor in Azerbaijan to provide a response to a Tier 2 oil spill incident originating from BP's offshore operations. BP also have Tier 2 oil spill response capability in Georgia and Turkey and these resources may be accessed for larger spills in Azerbaijan. Oil Spill Response (Ltd) (OSRL) is a Tier 3 responder who has bases in both the UK and Singapore and will provide Tier 3 services to BP in the event of a major release and/or highly sensitive Tier 2 incident. In addition to the supply of equipment, they can also provide response technicians and supervisors.

BP will also coordinate with local emergency services and government agencies in Azerbaijan, both prior to, and during oil spill incidents, and additional resources are available from the Ministry of Emergency Situations (MES). The OSCP describes how BP will utilise these resources to protect the environment in which it resides.

7.3.4.2 BP Capping Resources - Azerbaijan Offshore

BP is developing a Capping and Containment (C&C) Plan for the SWAP wells. The well locations for the SWAP drilling program are in 22, 7 and 5 metres of water. The C&C Plan sets out the stages of responding to a blow out incident from initial incident assessment to final capping stack deployment methods.

7.3.4.3 Reporting

Under the BP AGT Region spill reporting procedures, all accidental and non-authorised releases (liquids, gases or solids), including releases exceeding approved limits or specified conditions during all phases of the Project, will be internally reported and investigated. Existing external notification

requirements agreed with the Ministry of Ecology and Natural Resources (MENR) will be adopted for the Project which are:

- For liquid releases to the environment exceeding a volume of 50 litres, notification will be made to the MENR within 24 hours after the incident verbally and within 72 hours in the written form; and
- If the release to the environment is less than 50 litres, then information about the release will be included into the BP AGT Region Report on Unplanned Releases and sent to the MENR on a monthly basis.

It will be the responsibility of the contractors to report to BP any spills that occur from vessels used for Project related activities. BP will then proceed through their notification process to the MENR to report any unplanned releases.

A Protocol "On Agreeing the Main Principles of Cooperation for Regulation of Unplanned Material Releases" signed between BP and MENR in December 2012 defines an approved release as "a release that is permitted by applicable PSA, MENR permitted and/or approved documents including ESIA, EIA, Technical Note, Technical Letter, individual discharge request letters to MENR or any other written agreement with the MENR". Unapproved releases are those that do not fall into this definition.

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8 Environmental and Social Management

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8.1 Introduction

Under the Shallow Water Absheron Peninsula (SWAP) Contract Area Production Sharing Agreement (PSA), BP as Operator, is responsible for the environmental and social management to ensure that Project commitments are implemented, and conform to applicable environmental and social legal, regulatory and corporate requirements. This Chapter of the Environmental and Socio-Economic Impact Assessment (ESIA) provides an overview of the system that will be used to manage the environmental and social issues associated with the Project.

8.1.1 Overview of BP Operating Management System

BP have an established Operating Management System (OMS) that provides a single framework for operations, people, plant and performance. This system forms BP requirements on health, safety, security, environment, social responsibility and operational reliability etc. into a common management system. The requirements address eight focus areas – the Elements of Operating – under people, plant, process and performance. OMS also provides a process for improving the quality of operating activities – the Performance Improvement Cycle. The structured framework of BP Operating Management System is set out in Figure 8.1.

Figure 8.1: BP Operating Management System Framework

8.2 Implementation

The jack-up rig to be used to drill the Project exploration well will be operated by a Drilling Contractor who has their own independent Health, Safety & Environmental (HSE) Management System (MS) already in place. BP will have overall responsibility for managing the Project activities and will be monitoring and verifying the implementation of environmental and socio-economic mitigation measures detailed in this ESIA.

Separate from the rig operations, vessel activities will be managed in accordance with the existing relevant BP AGT Region HSE MS requirements as part of BP AGT Region's OMS.

8.2.1 HSSE Bridging Document

Alignment of the plans, procedures and reporting requirements between the Drilling Contractor's HSE MS and the BP AGT Region HSE MS will be achieved through the implementation of the Health, Safety, Security and Environment (HSSE) Bridging Document developed by BP and aligned with the Drilling Contractor's HSE MS. The purpose of the HSSE Bridging Document is to provide an interface between the two companies HSSE management systems and to ensure that the Drilling Contractor implement Project activities in conformance with the BP AGT HSSE requirements.

The HSSE Bridging Document is a live document and will be reviewed on a regular basis. Both BP's HSE MS and the Drilling Contractor's HSE MS monitor the same targets and objectives which are separately audited as part of their internal review process. Communications lines exist to ensure the effective sharing of the findings and action lists.

8.2.2 Roles and Responsibilities

The Drilling Contractor will be responsible for performing the Project activities under their own HSE MS, the BP AGT Region HSE MS (through the implementation of the HSSE Bridging Document) and in accordance with the requirements of this ESIA. The latter will be achieved through the implementation of a number of environmental and social management plans developed for the Project (refer to Section 8.3).

A summary of the key roles and responsibilities for BP and the Drilling Contractor with regard to the development and implementation of these plans is provided below:

BP

- Development of the management plans for the Project;
- Ensure compliance with applicable environmental legislation;
- Ensure systems are in place to enable compliance with the plans to be achieved;
- Provide support to the Drilling Contractor in the implementation of the plans;
- Provide environmental and social awareness training to rig personnel; and
- Ensure all environmental incidents are reported, investigated, root cause identified and action plan developed.

Drilling Contractor

- Implement the procedures set out within the plans relevant to the exploration drilling activities;
- Ensure rig personnel have sufficient training to implement the requirements of the plans;
- Report any environmental incidents; and
- Undertake monitoring and reporting relevant to the rig activities as set out within Section 8.2.5.

8.2.3 Training

Training is fundamental to the successful delivery of environmental and socio-economic aspects of the Project. The Project activities will be of relatively short duration, so establishing key environmental and social requirements at the outset is important to the provision of effective training.

Jack-up rig and vessel crews will be capable of undertaking drilling operations in compliance with national and international requirements. All training material under both the BP and the Drilling Contractor's HSE MS will be reviewed by BP and any gaps specific to the Project will be ascertained. Should any gaps in training be identified, BP will ensure additional training is provided to raise the environmental and social awareness of the Drilling Contractor's personnel in areas such ecological and social sensitivities, waste management, hazardous materials management handling, spill prevention and recording and reporting requirements.

8.2.4 Inspection and Review

Both BP and the Drilling Contractor have systems in place to inspect their respective HSE MS. Individuals from each company are tasked with the responsibility of sharing the findings. Where necessary, additional inspections and reviews may be undertaken to address identified areas of concern. Joint inspections are undertaken to ensure that procedures are being followed appropriately. Both BP and the Drilling Contractor have systems in place to control communication, tracking and follow up of inspection and review recommendations.

In addition to the routine inspections undertaken under BP AGT Region 's HSE MS and the Drilling Contractor's HSE MS, BP will undertake periodical environmental checks and reviews specific to this Project to ensure compliance with the commitments of this ESIA.

8.2.5 Monitoring and Reporting

Monitoring and reporting will be undertaken in accordance with the requirements set out within the environmental and social management plans developed for the Project. These plans will be developed in alignment with the BP Environmental Operating Procedure which details the method and frequency of reporting for the following categories:

- Deck drainage and wash water, garbage disposal unit effluent, volumes of treated black water in sewage treatment plant, grey water volumes, oily water, and fuel usage records;
- Volume of drilling fluids and cuttings discharged;
- Wastes shipped to shore;
- Drilling/cementing/testing chemicals;
- Mud sampling;
- Rig chemical inventory;
- Use of new or substituted chemicals not included on an approved list;
- Seabed Remotely Operated Underwater Vehicle (ROV) monitoring;
- Material release reporting; and
- Environmental drilling report.

It will be the responsibility of BP to report any material release to the Ministry of Ecology and Natural Resources (MENR). Other external reporting requirements and responsibilities will be set out within the management plans.

8.3 Project Environmental and Social Management Framework

Environmental and socio-economic mitigation and management measures discussed in this ESIA will form the Environmental and Social Management Framework for managing socio-economic and environmental issues throughout the duration of the Project.

8.3.1 Management Plans

The Project specific environmental and social management plans will be developed by BP before the Project commences. The plans, procedures and reporting requirements for the rig and those relevant to drilling activities will be aligned to the existing BP and Drilling Contractor HSE MS, the HSSE Bridging Document and the BP Environmental Operating Procedure and associated Environmental Monitoring & Reporting Forms. The plans will cover the following topics:

- Environmental Management;
- Pollution Prevention Management;
- Waste Management; and
- Communication Management.

The plans will identify key criteria (e.g. waste volumes, discharge parameters, communication frequency, etc.) that will be used to measure environmental and social performance.

BP will verify that mitigation measures and commitments set out in this ESIA are implemented. This will be achieved through periodical environmental checks and reviews, the results of which will be

documented within “Site Inspection Reports”. An action-tracking system will be maintained to monitor close-out actions and the effectiveness of actions taken in response to findings.

The sections below provides an overview of the environmental and social management plans, which will be developed specifically for the Project. A summary of the key design controls and mitigation measures set out in Chapters 4, 6, 7 and 8 of this ESIA are presented in Tables 8.1 to 8.3, which also include references to the location of these measures within this document.

8.3.1.1 Environmental Management Plan

A Project specific Environmental Management Plan will set out the necessary measures (presented in this ESIA and summarised in Table 8.1) to prevent pollution and limit impacts to the marine environment. The plan will also detail Caspian seal observation protocols to be adopted prior to and during VSP and conductor driving activities with reference to Joint Nature Conservation Committee (JNCC) Guidelines.

8.3.1.2 Pollution Prevention Management Plan

A Pollution Prevention Management Plan will cover issues such as sewage treatment and disposal, chemical selection management, spill response and notification procedures, monitoring and reporting and will include the measures outlined in Chapters 6 and 7 of this ESIA, summarised in Table 8.1.

Offshore Facilities Oil Spill Contingency Plan

As described in Chapter 7: Section 7.3.4.1 of this ESIA, a standalone Offshore Facilities Oil Spill Contingency Plan (OSCP) will be developed for the SWAP Contract Area exploration activities. The OSCP will include a tactical response plan, specific to the SWAP exploration activities based on relevant oil spill scenarios.

8.3.1.3 Waste Management Plan

The Waste Management Plan (aligned to applicable national regulatory requirements, good international industry practices, existing BP HSE MS and Drilling Contractor’s HSE MS and the associated HSSE Bridging Document) will address the anticipated waste streams, likely quantities, disposal routes and any special handling requirements as presented in this ESIA (refer to Table 8.2).

Key aspects of the Plan will include the following points:

- Waste will only be routed to authorised waste disposal facilities that have been approved for use by the BP in AGT Region.
- Non-hazardous waste generated offshore will be segregated, compacted and stored on-board the jack-up rig and vessels, and then transferred to shore to authorised waste management facilities for disposal or recycling.
- Hazardous waste streams will be segregated and stored separately to prevent contact between incompatible waste streams. Hazardous waste generated offshore will be stored on board the jack-up rig and vessels in fit for purpose containers and in designated areas and transferred onshore to authorised waste facilities for treatment and disposal.
- All waste generated offshore will be tracked and controlled. Waste Transfer Notes (WTNs) will be completed for every waste shipment to shore from the jack-up rig and vessels. The WTNs will detail the waste type, quantity, waste generator, consignee, consignor (if different from the generator) and, in the case of hazardous wastes, both Waste Passports and, where required, Material Safety Data Sheet (MSDS) documentation. A final visual inspection of all waste consignments will be made prior to sign-off and uplift. All parties involved in transporting wastes will retain a copy of the waste transfer documentation.

8.3.1.4 Communication Management Plan

A Communication Management Plan will set out the communication protocols and key requirements as presented in this ESIA (Chapters 4 and 6) and set out in Table 8.3 below. This includes communicating the drilling programme to the relevant authorities and stakeholders both prior to and during the drilling programme.

Table 8-1: Summary of Key Design Controls, Mitigation Measures, Monitoring and Reporting Requirements for Environmental Management and Pollution Prevention

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage[41]
Chapter 4 Project Description, Section 4.5.1 Jack-Up Rig Positioning	A mandatory 500 metre (m) exclusion zone will be established (for non-project related vessels) around the rig while drilling is in progress.	Jack-Up Rig	DD
Chapter 4 Project Description, Section 4.5.2 Logistics and Utilities, Table 4.2 Summary of Jack-Up Rig Utilities and Table 4.3 Summary of Support Vessel Utilities Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.1 Mitigation Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.4.1 Event Magnitude	Sewage sludge will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Both	DD
	• Grey water will either be sent to the vessel sewage treatment plant with the black water or discharged directly to sea without treatment as long as no floating matter or visible sheen is observable. • Under routine conditions black water will be treated within the sewage treatment system to MARPOL 73/78 Annex IV: Prevention of Pollution by Sewage from Ships standards. No chlorination of the effluent will be required under routine conditions, however when chlorine is used for disinfectant purposes, it is planned to maintain the concentration of residual chlorine in the effluent below 0.5mg/l and discharge to sea. In the event it is not practicable to achieve this concentration, the effluent will be contained and shipped to shore. • When vessels' sewage treatment system is not available, black water will be contained and shipped to shore. • Oily and non-oily drainage and wash water will be segregated. Drainage (including deck drainage and wash-down water) will be discharged directly to sea, provided no visible sheen is observable. • Oily water will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Support Vessels	DD
	• Rig floor runoff, including WBM spills, collected via rig floor drains will be recycled to mud system with no discharge of drill cuttings or drilling fluids. • Non oily drainage (deck drainage and wash water) may be discharged to sea as long as no visible sheen is observable.	Jack-Up Rig	DD
Chapter 4 Project Description, Section 4.5.2 Logistics and Utilities	Consumables such as drilling mud and diesel will be provided to the jack-up rig by vessels from the existing onshore facilities previously used during Azeri, Chirag and Gunashli (ACG) and Shah Deniz (SD) pre-drilling programmes.	Both	DD
Chapter 4 Project Description, Section 4.6.3 Drilling Fluids and Cutting Generation	Measures to avoid discharges to the marine environment during mud transfers include: • Appropriate design of the mud pumping system and connections between the jack-up rig and supply vessels; • Preventative maintenance of transfer equipment; and • Appropriate procedures will be used; • Conduct appropriate training/ awareness sessions for the relevant personnel, where required.	Both	DD
Chapter 4 Project Description, Section 4.11.2 Summary of Discharges to Sea	There will be no planned discharges to sea of drilling muds and cuttings, chemicals (including pipe dope) or cement during drilling of the Project exploration well.	Both	DD

[41] Pre-Drilling (Pre-D), During Drilling (DD) and Post Drilling (PD)

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage[41]
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.3.1 Mitigation	Existing controls associated with emissions to atmosphere from jack-up rig power generation and support vessel operations include: • Jack-up rig diesel generators and engines and support vessel engines will be maintained in accordance with written procedures based on the manufacturers' guidelines or applicable industry code or engineering standards to ensure efficient and reliable operation; and • Good quality, low sulphur fuel will be used.	Both	DD
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.1 Mitigation	• Plan to undertake conductor driving and VSP activities outside of the spring and autumn Caspian seal migration periods. • When undertaking conductor driving and VSP activities outside of the spring and autumn Caspian seal migration periods then: o Prior to and during VSP and conductor driving activities taking place: - Determine a Mitigation Buffer Zone of 500m around the Project drilling location for visual observations of seals. - Deploy a trained MMO or Caspian seal expert to the jack-up rig or a standby vessel in the immediate vicinity of Project location from where they can conduct visual observations within the Mitigation Buffer Zone. - Prior to activating to the VSP or conductor driving equipment using a soft-start (or ramp up) procedure[42], conduct marine mammal monitoring for 30 minutes to observe whether there are any seals within the Mitigation Buffer Zone If seals are sighted, the soft-start procedure should be delayed for at least 20 minutes to ensure no seals are within the Mitigation Buffer Zone. - Implement soft-start (or ramp up) procedures for the VSP and conductor driving activities each time the air guns are activated or conductor driving equipment recommences after a period of inactivity (greater than 20 minutes). **Further Mitigation Measures** • In the event a delay occurs in the drilling programme, causing the shallow VSP activity to be delayed to commencing no earlier than mid-March: o Develop a Caspian Seal Observation Protocol in liaison with a local seal expert, which will include the following: ▪ Monitor available information relating to timing of the ice melt in the Northern Caspian (typically during March) and compare to previous years (particularly 2011 and 2014). ▪ Gather available seal observations from the Northern Caspian to give an indication of when seal migration is expected to commence in Azerbaijani waters	Jack-Up Rig	DD

[42] A risk mitigation measure employed by some users of underwater sound is a soft start or "ramp-up" procedure, whereby the source level is increased gradually before use at full power/. The expectation is that nearby seals respond by avoiding the sound source.

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage[41]
	▪ Gather available seal observations from the Northern Azerbaijani waters (e.g. from fishermen located in the vicinity of Yalama and Mukhtahir) (approximately 100km north of the well location) to determine when the seals migration has reached Azerbaijani waters and provide feedback to the rig operator on likely arrival of migrating seals in the NKX01 area.. ▪ Based on timing provided by the local seal expert using the information and observations collected, establish an observation point approximately 10km north of the well location and record seal observations such as to confirm the commencement of the spring migration at this location. o Once spring migration has been confirmed at the observation point, the local seal expert will inform the jack-up rig operator to either immediately cease VSP activities in progress or prohibit commencing VSP activities. o In the event VSP activities are not complete before the seal spring migration is complete, the local seal expert will continue to monitor the presence of the seals through the spring in the vicinity of the Absheron Peninsula. The VSP survey activities will be permitted to re-commence subject to existing controls once the seal expert has confirmed the spring migration has finished. o In the event the well is successful and the need for conventional VSP is identified further information will be provided to the MENR on the characteristics of the survey, timing, potential impacts and additional mitigation measures where required. • Should it become necessary to plan conductor driving activities to occur within the spring and autumn Caspian seal migration periods due to a delay in the drilling programme then: o Prior to and during conductor driving activities taking place: - Determine a Mitigation Buffer Zone of 800m around the Project drilling location for visual observations of seals; - Deploy a trained MMO or Caspian seal expert to the jack-up rig or a standby vessel in the immediate vicinity of Project location from where they can conduct visual observations within the Mitigation Buffer Zone for up to two days prior to conductor driving activities taking place to record the presence of seals within the Mitigation Buffer Zone; - Prior to activating to the conductor driving equipment using a soft-start procedure conduct marine mammal monitoring for an 1 hour to observe whether there are any seals within the Mitigation Buffer Zone If seals are sighted, the soft-start procedure should be delayed for at least 20 minutes to ensure no seals are within the Mitigation Buffer Zone. • If ramp up or soft start procedures are not considered feasible for conductor driving or VSP activities, an Acoustic Deterrent Device (ADD) (specifically set for the hearing range of pinniped seals) should be obtained and the following procedure implemented: o The trained Marine Mammal Observer (MMO) or Caspian seal expert deployed to the jack-up rig or a standby vessel should begin seal observations. The ADD should be activated, and if possible, gradually increased to full intensity to allow any nearby seals to exit the Mitigation Buffer Zone: - 30 minutes prior to the start of the conductor driving or VSP activities (when undertaken outside of the spring and autumn Caspian seal migration periods) or		

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage[41]
	- 1 hour prior to the start of the conductor driving activities (when undertaken within the spring and autumn Caspian seal migration periods). o When VSP/driving starts the ADD should be turned off. The MMO should continue observations for the entire period to ensure accurate records are maintained; o If VSP/driving activity stops for less than 30 minutes for any reason the ADD should be immediately activated. For planned pauses of greater than 30 minutes the device shall be switched on 30 minutes prior to re-commencement of the activity as outlined above to allow any nearby seals to exit the Mitigation Buffer Zone. The ADD is to be stopped once the activity re-commences.		
	Vessels will not intentionally approach seals for the purposes of casual (recreational) marine mammal viewing which may result in disturbance;	Support Vessels	Pre-D, DD, PD
	Support vessels are subject to periodical performance review, which includes environmental performance. Corrective actions will be undertaken to address any performance gaps.	Support Vessels	Pre-D, DD
	Cooling Water Intake - the intake will be fitted with a screen to prevent fish entering the seawater system	Jack-Up Rig	DD
Chapter 7: Cumulative and Transboundary Impacts and Accidental Events Section 7.3.2 Release of Chemicals / Waste	All chemicals on the vessels will be labelled and stored appropriately in areas with secondary containment.	Both	Pre-D, DD, PD
Chapter 7: Cumulative and Transboundary Impacts and Accidental Events Section 7.3.4.1 Oil Spill Contingency Planning - Azerbaijan Offshore	A standalone Offshore Facilities Oil Spill Contingency Plan (OSCP) will be developed for the SWAP Contract Area exploration activities.	Both	Pre-D
Chapter 8: Section 8.2 Implementation	Vessel activities will be managed in accordance with the existing relevant BP AGT Region HSE MS requirements as part of BP OMS.	Support Vessels	Pre-D, DD, PD
Chapter 8: Section 8.2.1 HSSE Bridging Document	Alignment of the plans, procedures and reporting requirements of the Drilling Contractors' HSE MS and the BP AGT Region's HSE MS will be achieved through the implementation of the Health, Safety, Security and Environment (HSSE) Bridging Document developed by BP and aligned with the Drilling Contractors' HSE MS.	Jack-Up Rig	Pre-D
	The HSSE Bridging Document is a live document and will be reviewed on a regular basis.	Jack-Up Rig	Pre-D, DD, PD
Chapter 8: Section 8.2.2 Roles and Responsibilities	The Drilling Contractor will be responsible for performing the Project activities under their own HSE MS, the BP AGT Region HSE MS (through the implementation of the HSSE Bridging Document) and in accordance with the requirements of this ESIA.	Jack-Up Rig	DD

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage[41]
Chapter 8: Section 8.2.3 Training	All training material under both the BP and the Drilling Contractor's HSE MS will be reviewed by BP and any gaps specific to the Project will be ascertained. Should any gaps in training be identified, BP will ensure additional training is provided to raise the environmental and social awareness of the Drilling Contractor's personnel in areas such ecological and social sensitivities, waste management, hazardous materials management handling, spill prevention and recording and reporting requirements.	Jack-Up Rig	Pre-D
Chapter 8: Environmental and Social Management Section 8.2.5 Monitoring and Reporting	Monitoring and reporting will be undertaken in accordance with the requirements as set out within the environmental management plans developed for the Project. These plans will be developed in alignment with BP Environmental Operating Procedure which details the method and frequency of reporting for the following categories: • Deck drainage and wash water, garbage disposal unit effluent, volumes of treated black water in sewage treatment plant, grey water volumes, oily water, and fuel usage records; • Volume of drilling fluids and cuttings discharged; • Wastes shipped to shore; • Drilling/cementing/testing chemicals; • Mud sampling; • Rig chemical inventory; • Use of new or substituted chemicals not included on an approved list; • Seabed Remotely Operated Underwater Vehicle (ROV) monitoring; • Material release reporting; and • Environmental drilling report.	Jack-Up Rig	DD,PD
	It will be the responsibility of BP to report any material release to the Ministry of Ecology and Natural Resources (MENR). Other external reporting requirements and responsibilities will be set out within the management plans.	Jack-Up Rig	Pre-D, DD, PD
Chapter 8: Section 8.3.1.1 Environmental Management Plan	A Project specific Environmental Management Plan will be developed and will set out the necessary measures (presented in this ESIA) to prevent pollution and limit impacts to the marine environment.	Jack-Up Rig	Pre-D
Chapter 8: Section 8.3.1.2 Pollution Prevention Management Plan	A Pollution Prevention Management Plan will cover issues such as sewage treatment and disposal, chemical selection management, spill response and notification procedures and monitoring and reporting and will include the measures outlined in Chapters 6 and 7 of the ESIA.	Jack-Up Rig	Pre-D, DD

Table 8-2: Summary of Key Design Controls, Mitigation Measures, Monitoring and Reporting Requirements for Waste Management

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
Chapter 4 Project Description, Section 4.5.2 Logistics and Utilities, Table 4.2 Summary of the Jack-Up Rig Utilities and Table 4.3 Summary of Suport Vessel Utilities	Galley waste will be contained and shipped to shore for disposal in accordance with the existing BP AGT waste management plans and procedures.	Jack-Up Rig	DD
	Depending on the availability of the vessel system, galley food waste will either be:	Support Vessels	DD

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.1 Mitigation & Section 6.4.4.1 Event Magnitude	• Sent to vessel maceration units designed to treat food wastes to applicable MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships particle size standards prior to discharge[43]; or • Contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.		
Chapter 4 Project Description, Section 4.5.2 Logistics and Utilities, Table 4.2 Summary of the Jack-Up Rig Utilities and Table 4.3 Summaty of Support Vessel Utilities	• Grey water and treated black water will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. • In the event of a spill, the main jack-up rig deck drainage will be diverted to the hazardous drainage tank designed to contain spills including synthetic oil based mud (SOBM) / low toxicity material oil based mud (LTMOBM), oil/diesel/cement and oily water. The contents of the hazardous waste tank will be shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures. • Onboard the rig, waste oil collected from the drainage system will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Jack-Up Rig	DD
Chapter 4 Project Description, Section 4.6.1 Well Design and Drilling Fluid Types, Table 4.4: NKX01 Exploration Well Design Chapter 4 Project Description, Section 4.6.3.1 Conductor Section Chapter 4 Project Description, Section 4.6.4 Summary of Mud and Cuttings, Table 4.7: Estimated Well Cuttings and Mud Volumes Per Hole Section	Drilling muds and cuttings will be returned to the jack-up rig from the well. Muds will be separated from the cuttings on-board of the rig. Recovered muds and cuttings will be contained and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Jack-Up Rig	DD
Chapter 4 Project Description, Section 4.6.5 Casing and Cementing	Any excess cement generated during the cementing activities will be circulated out from the well and returned to the jack-up rig and contained in the Drill Cutting Boxes (DCB) for transportation to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Jack-Up Rig	DD
Chapter 4 Project Description, Section 4.6.3 Drilling Fluids and Cutting Generation	Once mud has been transferred to the dedicated mud tanks onboard the supply vessel it will be transported to shore for disposal in accordance with BP AGT Region management plans and procedures.	Support Vessels	DD
Chapter 4 Project Description, Section 4.6.6 Drilling Hazards and Contingency Chemicals	Along with SOBM / LTOBM and cuttings, unused contingency chemicals remaining in the mud system will be returned to the jack-up rig and shipped to shore for disposal in accordance with the existing BP AGT Region waste management plans and procedures.	Jack-Up Rig	DD
Chapter 6 Environmental & Socio-Economic Impact Assessment,	In relation to waste generation onboard vessels and jack-up rig:	Both	Pre-D, DD

[43] Designed to produce a slurry of food particles and water that washes easily through the required 25 mm screen

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
Mitigation and Management, Section 6.2 Scoping, Table 6.1 Key "Scoped Out" Project Activities Chapter 7: Cumulative and Transboundary Impacts and Accidental Events Section 7.3.2 Release of Chemicals / Waste	• Waste onboard the jack-up rig and support/supply vessels will be segregated at source, stored and transported in fit for purpose containers. • State licensed and approved waste management facilities will be used for disposal of waste during the drilling programme. • Waste generated during the Project will be managed in accordance with the existing BP Azerbaijan Georgia Turkey (AGT) Region management plans and procedures. • Waste management plans will be established for the jack-up rig and support/supply vessels (operated in accordance with the MARPOL 73/78 Annex IV: Prevention of Pollution requirements) in accordance with the existing BP AGT Region management plans and all waste transfers will be controlled and documented.		DD Pre-D, DD, PD Pre-D, DD, PD
Chapter 8: Environmental and Social Management Section 8.3.1.3 Waste Management Plan	The Waste Management Plan (aligned to applicable national regulatory requirements, good international industry practices, existing BP AGT Region management plans and the existing Drilling Contractors' HSE MS and the associated HSSE Bridging Document) will address the anticipated waste streams, likely quantities, disposal routes and any special handling requirements. Key aspects of the Plan include the following points: • Waste will only be routed to authorised waste disposal facilities that have been approved for use by the BP AGT Region. • Non-hazardous waste generated offshore will be segregated, compacted and stored on-board the jack-up rig and vessels, and then transferred to shore to authorised waste management facilities for disposal or recycling. • Hazardous waste streams will be segregated and stored separately to prevent contact between incompatible waste streams. Hazardous waste generated offshore will be stored on board the jack-up rig and vessels in fit for purpose containers and in designated areas and transferred onshore to authorised waste facilities for treatment and disposal. • All waste generated offshore will be tracked and controlled. Waste Transfer Notes (WTNs) will be completed for every waste shipment to shore from the jack-up rig and vessels. The WTNs will detail the waste type, quantity, waste generator, consignee, consignor (if different from the generator) and, in the case of hazardous wastes, both Waste Passports and, where required, Material Safety Data Sheet (MSDS) documentation. A final visual inspection of all waste consignments will be made prior to sign-off and uplift. All parties involved in transporting wastes will retain a copy of the waste transfer documentation.	Both	Pre-D, DD

Table 8-3: Summary of Key Design Controls, Mitigation Measures, Monitoring and Reporting Requirements for Communication

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
Chapter 4 Project Description, Section 4.12 Management of Change Process	During the detailed planning and execution stages of the Project programme, there may be a need to change a design element or a process. A formal process will be implemented to manage and track any such changes, and to assess their potential consequences with respect to environmental and social impact; and in cases where a new or significantly increased impact is anticipated, to inform and consult with the MENR to ensure that any essential changes are implemented with the minimum practicable impact.	Both	Pre-D, DD, PD

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
	Changes which do not significantly alter existing interactions or impacts, or which give rise to no interactions or impacts, will be summarised and periodically notified to the MENR, but will not be considered to require additional approval. This category will include items such as minor modification of chemical and drilling fluid systems, where the modification involves substitution of a chemical with equal or less environmental impact than the original.	Both	Pre-D, DD, PD
	If internal review and assessment indicates that a new or significantly increased impact may occur, the following process will be applied: • Categorization of the impact using ESIA methodology; • Assessment of the practicable mitigation measures; • Selection and incorporation of mitigation measures; and • Re-assessment of the impact with mitigation measures in place.	Both	Pre-D, DD, PD
	In practical terms, the changes that will require prior engagement and approval by the MENR are those that: • Result in a discharge to the Caspian that is not described in the Project ESIA; • Increase the quantity discharged as detailed in the Project ESIA by more than 20%;[44,45] or • Result in the discharge of a chemical not referenced in the Project ESIA and not currently approved by the MENR for use in the same application by existing BP AGT Region operations.	Both	Pre-D, DD, PD
	Once the changes (and any appropriate mitigation) have been assessed as described above, a technical note will be submitted to the MENR describing the proposal and reporting the results of the revised impact evaluation. Where appropriate, this may include the results of environmental testing and modelling (e.g. chemical toxicity testing and dispersion modelling). Following submission of the technical note, the Project team will engage in meetings and communication with the MENR in order to secure formal approval. Once approved, each item will be added to a register of change. The register will include all changes, including those non-significant changes notified in periodic summaries, and will note any specific commitments or regulatory requirements associated with those changes.	Both	Pre-D, DD, PD
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.2 Scoping, Table 6.1 Key "Scoped Out" Project Activities	Maritime businesses (including diving companies) will be consulted and informed of the Project drilling activities and the planned schedule.	Both	Pre-D, DD
	Notifications regarding the drilling programme will be issued to the relevant maritime and port authorities, as well as directly communicated with sea users where necessary, in advance of the Project drilling programme.		Pre-D
	All vessels will operate in compliance with national and international maritime regulations for avoiding collisions at sea, including the use of signals and lights.	Support Vessels	DD

[44] For the discharges detailed in the ESIA, an increase of 20% in volume would result in a 3-4% increase in the linear dimension of the mixing zone. For instance, a mixing plume 100m by 20m by 20m would increase by less than 2m in each dimension. Taking into account the actual size of the predicted mixing zones, this magnitude of increase is considered to make no material difference to the physical extent of the impacts. In practical terms, this would apply to increases of more than 20% (the value was selected to be conservative).
[45] Unless increase is deemed to have no material effect on the associated impact(s).

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.3.2.3 Impact Significance	Monitoring and reporting requirements associated with emissions to the atmosphere during jack-up rig drilling activities include: • Jack-up rig diesel usage will be recorded on a daily basis; • Environmental management system audits of drilling operations including jack-up rig drilling will be undertaken periodically; and • The following will be provided to the MENR within the Environmental Report: - Volume of fuel used by the jack-up rig (recorded daily in tonnes and reported monthly); and - Estimated volumes of emissions generated as a result of fuel used (calculated using emission factors).	Jack-Up Rig	DD, PD
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.2.3 Impact Significance	• Ongoing visual observations of Caspian seals and Caspian seal sightings will be recorded by the trained MMO or Caspian seal expert throughout conductor driving and VSP activities; • Daily logs of Caspian Seal sightings will be completed by the trained MMO/ Caspian Seal expert using the relevant Joint Nature Conservation Committee (JNCC) marine mammal observation forms; and • A final report summarising the Caspian seal observations over the duration of the Project and including all the daily log forms will be completed by the trained MMO/ Caspian Seal Expert and submitted to BP within eight weeks of completion of the activities.	Jack-Up Rig	DD
Chapter 6 Environmental & Socio-Economic Impact Assessment, Mitigation and Management, Section 6.4.4.3 Impact Significance	Black Water: • During periods when the vessel Sewage Treatment Plant (STP) is in use, sewage samples will be taken from the sewage discharge outlet and analysed monthly for relevant parameters to confirm compliance with the applicable MARPOL 73/78 Annex IV or MARPOL 73/78 Annex IV MEPC. 159 (55)4 standards; • Support vessel sewage sampling analysis results, recorded floating solids observations and estimated volumes of treated black water discharged daily (based on a generation rate of 0.1m3 per person per day) will be reported to the MENR upon completion of drilling. Grey Water • Daily visual checks undertaken when discharging from support/supply vessels to confirm no visible sheen is observable; • Daily estimated volumes of grey water discharged from support/supply vessels will be recorded monthly and reported to the MENR on an annual basis. Estimates will be based on generation rates of 0.22m3 per person per day (grey water).	Support Vessels	Pre-D, DD, PD
Chapter 7: Cumulative and Transboundary Impacts and Accidental Events Section 7.3.4.3 Reporting	Under the BP AGT Region spill reporting procedures, all accidental and non-authorised releases (liquids, gases or solids), including releases exceeding approved limits or specified conditions during all phases of the Project, will be internally reported and investigated.	Both	Pre-D, DD, PD
	Existing external notification requirements agreed with the Ministry of Ecology and Natural Resources (MENR) will be adopted for the Project which are: • For liquid releases to the environment exceeding a volume of 50 litres, notification will be made to the MENR within 24 hours after the incident verbally and within 72 hours in the written form; and • If the release to the environment is less than 50 litres, then information about the release will be included into the BP AGT Region Report on Unplanned Releases and sent to the MENR on a monthly basis.	Both	Pre-D, DD, PD

Reference	Summary of Key Measures Outlined in ESIA Report	Applicable to Jack-Up Rig and/or Support Vessels	Execution Stage
	It will be the responsibility of the contractors to report to BP any spills that occur from vessels used for Project related activities. BP will then proceed through their notification process to the MENR to report any unplanned releases.	Both	Pre-D, DD, PD

9 Residual Impacts and Conclusions

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9.1 Introduction

This Chapter of the Environmental and Socio-economic Impact Assessment (ESIA) summarises the residual impacts and conclusions of the Project.

9.2 Residual Impacts

Table 9.1 outlines the residual environmental impacts for the activities associated with the Project. As outlined in Chapter 6, social impacts anticipated as a result of the Project are anticipated to be negligible.

Table 9-1 Summary of Residual Environmental Impacts for the SWAP Exploration Drilling Project

	Event/Activity	Magnitude				Sensitivity		Overall Score		
		Extent /Scale	Frequency	Duration	Intensity	Human	Ecological	Event Magnitude	Receptor Sensitivity	Impact Significance
Atmosphere	Emissions from jack-up rig power generation	1	2	3	1	2	2	Medium	Low	Minor Negative
	Emissions from support vessel engines	1	2	2	1	2	2	Medium	Low	Minor Negative
Marine Environment	Generation of underwater sound from jack-up rig positioning	1	1	3	1	-	2	Medium	Low	Minor Negative
	Generation of underwater sound from conductor driving	2	1	2	2	-	2	Medium	Low	Minor Negative
	Generation of underwater sound from drilling	1	2	3	1	-	2	Medium	Low	Minor Negative
	Generation of underwater sound from use of support vessels	1	3	3	1	-	2	Medium	Low	Minor Negative
	Generation of underwater sound from VSP airgun operations	1	2	3	1	-	2	Medium	Low	Minor Negative
	Jack-up rig cooling water intake and discharge to sea	1	1	3	1	-	2	Medium	Low	Minor Negative
	Support vessel treated black water discharge	1	1	2	1	-	2	Medium	Low	Minor Negative
	Support vessel grey water discharge	1	1	2	1	-	2	Medium	Low	Minor Negative
	Drainage water discharge	1	1	1	1	-	2	Low	Low	Negligible
	Support vessel galley waste discharge	1	1	1	1	-	2	Low	Low	Negligible
	Seabed disturbance due to positioning of the jack-up rig	1	1	2	1	-	2	Medium	Low	Minor Negative

Emissions to the atmosphere associated with jack-up rig power generation and support vessel engines will occur at the NKX01 location. Air quality dispersion modelling results demonstrated that, during routine drilling activities at the NKX01 well location, the predicted short term concentrations of nitrogen dioxide (NO_2) at the nearest onshore receptors are expected to be well below the applicable short-term limit value of 200µg/m^3. Emissions from vessels are expected to disperse rapidly and are not expected to result in measurable increases in NO_2 concentrations at onshore locations. As such the impact of atmospheric emissions due to jack-up rig power generation and support vessel activities to onshore communities was considered to be of minor negative significance.

Underwater sound is anticipated to arise from both continuous and impulsive sources during the Project:

- Continuous sound sources including vessels during jack-up rig positioning, drilling of the well and supply vessel movements; and

Impulsive sound source including driving of the well conductor section and vertical seismic profiling (VSP) using airguns (with VSP comprising shallow VSP activities and potentially conventional VSP activities in the event the well is successful).

These activities have the potential to impact sensitive receptors within the marine environment; specifically, fish and the International Union for the Conservation of Nature (IUCN) endangered Caspian Seal. Seals are known to be present around the proposed Project location throughout the year with greatest numbers during the spring and autumn migrations, with spring being the period of greatest sensitivity. During this period (usually April and May) they are typically migrating south to feed from overwintering in the Northern Caspian and the islands of the Absheron Archipelago are an important haul out location, with large numbers typically gathering here or passing through. Outside of these periods, seals do not use the area exclusively and have been observed as individuals and in small numbers only.

To assess potential underwater sound impacts, for the continuous sound sources, propagation of underwater sound was calculated using a simplified geometric spreading model to estimate distances at which impacts may occur to fish and Caspian seals. Given the different characteristics and potential for greater risk to receptors from impulsive sound in the marine environment, a detailed sound propagation model was used to estimate these distances from conductor driving and the VSP airgun operations.

The geometric sound calculations completed for the continuous sources showed that, during the positioning of the jack-up rig, with respect to seals:

- Permanent threshold shift (PTS) may occur in seals if they remain within a distance of 12m from the tugs positioning the rig for a period of 1 hour.
- Temporary threshold shift (TTS) may occur if the seals remain within approximately 265m of the tug operations for a similar period; and
- Moderate behavioural reactions in seals, such as changes in swimming direction and speed, may occur at distances beyond approximately 610m. At distances beyond 2.8km the likelihood of any observable responses to sound is expected to be low.

With regard to jack-up rig positioning and impacts to fish:

- TTS may occur in high sensitivity fish if they remain within approximately 130m of vessels for a period of 12 hours; and
- Recoverable injury may occur if they remain in close proximity (within 10m) to the operations for a period of 48 hours

In relation to vessel movements during the drilling programme, it was calculated that with regard to seals:

- PTS may occur in seals if they remain within a distance of approximately 60m from supply vessel movements or 10m of standby/crew vessels for a period of 1 hour;
- TTS may occur if the seals remain within 1.3km from cargo vessel movements or 23m of standby/crew vessels for a similar period; and
- Behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 5km from the supply vessels in particular. At distances beyond 13km the likelihood of any observable responses to sound is low.

With regard to vessel movements during the drilling programme and impacts to fish:

- TTS may occur if they remain within approximately 630m of vessels for a period of 12 hours.
- Recoverable injury was estimated to potentially occur to high sensitivity fish if they remain in close proximity (within 29m) to the cargo vessels for a period of 48 hours; although the likelihood is that they will move away from a disturbing sound source.

In comparison to the other continuous sound sources, sound emissions from drilling are relatively low with results showing PTS and TTS for both Caspian Seal and fish species occurring at less than 10m in distance from the source. It is understood that due to existing activity within the area (e.g. vessel movements), seals have been shown to be habituated to the sound generated by vessel movements and their typical behavioural response is to sense the sound from a distance and adjust their course away accordingly. In addition most seals undertaking foraging dives in the vicinity of a vessel will be

able to rapidly return to the surface or move away from the vessel. Seals are likely to be foraging where high abundance of fish will be found and fish are also expected to likely move away from the sound source, thus reducing the potential for seals to be present in the close vicinity of the vessel to feed. As such for the drilling and vessel related activities no significant impacts are anticipated from underwater sound.

During the driving of the conductor, the detailed modelling results showed the following:

- PTS may occur in seals if they remain within a distance of less than 1m from the operations for a period of 1 hour and TTS may occur if the seals remain within 2m of the operations for a similar period.
- Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 70m from the conductor driving operations.
- TTS may occur in fish if they remain within 4m for a period of 1 hour. Injury (recoverable or mortal) may only occur if they remain in close proximity (<1m) to the operations for a period of 1 hour.

During the VSP operations, provided that receptors are not located directly beneath the VSP source or within the main directivity of the source the modelling estimated:

- PTS may occur in seals if they remain within a distance of 5m from the operations for a period of 1 hour.
- TTS may occur if the seals remain within 30m of the operations for a similar period.
- Disturbance and behavioural reactions in seals such as changes in swimming direction and speed may occur at distances up to 8.5km from the VSP activities.
- TSS may occur in fish within 40m of the VSP source for a period of 1 hour with low level disturbance possibly occurring beyond 8.5km.
- Beyond this distance moderate behavioural reactions in seals, such as changes in swimming direction and speed, may occur from the VSP operations.

With regard to both conductor driving and VSP operations, the Project base case is to undertake these activities outside of the seal spring and autumn migration periods and to use soft start/ramp up procedures and visual monitoring prior to the start of the activities, delaying if a seal is observed within the defined Mitigation Buffer Zone will allow time for marine mammals and fish to move away from the activity. This will be completed in accordance with Joint Nature Conservation Committee (JNCC) Guidance assuming a pre-watch survey of 20 minutes within a defined 500m Mitigation Buffer Zone by a trained Marine Mammal Observer (MMO) or seal expert. Further mitigation embedded within the project design for contingency purposes comprises the following:

- In the event a delay occurs in the drilling programme, causing the shallow VSP activity to be delayed to commencing no earlier than mid-March:
    - Develop a Caspian Seal Observation Protocol in liaison with a local seal expert, which will include the following:
        - Monitor available information relating to timing of the ice melt in the Northern Caspian (typically during March) and compare to previous years (particularly 2011 and 2014).
        - Gather available seal observations from the Northern Caspian to give an indication of when seal migration is expected to commence in Azerbaijani waters
        - Gather available seal observations from the Northern Azerbaijani waters (e.g. from fishermen located in the vicinity of Yalama and Mukhtahir) (approximately 100km north of the well location) to determine when the seals migration has reached Azerbaijani waters and provide feedback to the rig operator.
        - Based on timing provided by the local seal expert using the information and observations collected, establish an observation point approximately 10km north of the well location and record seal observations such as to confirm the commencement of the spring migration at this location.

  - Once spring migration has been confirmed at the observation point, the local seal expert will inform the jack-up rig operator to either immediately cease VSP activities in progress or prohibit commencing VSP activities.
  - In the event VSP activities are not complete before the seal spring migration is complete, the local seal expert will continue to monitor the presence of the seals through the spring in the vicinity of the Absheron Peninsula. The VSP survey activities will be permitted to re-commence subject to existing controls once the seal expert has confirmed the spring migration has finished.
  - In the event the well is successful and the need for conventional VSP is identified further information will be provided to the MENR on the characteristics of the survey, timing, potential impacts and additional mitigation measures where required.

- Should it become necessary to plan conductor driving activities to occur within the spring or autumn Caspian seal migration periods due to a delay in drilling programme then the ramp up procedures will include a pre-watch survey for 2 days within a defined 800m Mitigation Buffer Zone by a trained Marine Mammal Observer (MMO) or seal expert prior to activities commencing.
- If ramp up or soft start procedures are not considered feasible for conductor driving or VSP activities, an Acoustic Deterrent Device (ADD) (specifically set for the hearing range of pinniped seals) should be obtained and implemented in accordance with project specific procedures.

Based on the predicted event magnitude, receptor characteristics, observed sensitivities and embedded controls, the impact from underwater sound was assessed as being of minor negative significance.

With regard to discharges, with exception of deck drainage and cooling water (comprising lifted seawater, used for indirect cooling onboard the rig prior to being discharged), there are no planned discharges to the marine environment from the jack-up rig for the duration of the Project. All black water, grey water and galley waste generated on the rig will be contained and shipped to shore for disposal.

Modelling of the cooling water to be discharged from the rig showed that the temperature difference between the discharge plume and ambient conditions will return to zero well within 100m of the discharge location with an increase of 0.5-1°C occurring within the first few metres of the discharge point for both summer and winter conditions. The modelling results also indicated that cooling water discharge plume remains within the main water column i.e. does not reach the sea surface nor seabed. The assessment demonstrated that Minor Negative impacts to seals, fish, zooplankton and phytoplankton are predicted from cooling water discharge. Therefore, no additional mitigation beyond existing control measures is deemed to be necessary.

Discharges to sea from vessels used through the drilling programme (comprising treated black water, grey water, galley waste and deck drainage) are all small in volume and do not contain components of high environmental concern. These discharges, which are monitored in accordance with existing procedures to ensure applicable project standards are met, will be rapidly diluted and are all assessed as having a minor impact upon biological receptors in the water column.

No discharges of drilling muds or cuttings to sea are planned as a result of the NKX01 exploration drilling activities. This complies with the requirements of the PSA for the Contract Area.

Seabed disturbance from the positioning of the jack-up rig is expected to be short term and localised, occupying an area less than 500m^2 for the duration of the drilling programme (approximately 3 to 4 months). The benthic environment in the Project location is considered to be relatively tolerant to disturbance with evidence showing that invertebrates, which are generally short-lived, reproduce rapidly and re-establish following disturbance. No rare, unique or endangered species have been recorded in the area. The physical disturbance is therefore considered minimal and no significant impacts are anticipated.

For all environmental impacts assessed it has been concluded that impacts are minimised as far as practicable and necessary through the implementation of the existing control measures and no additional mitigation is required.

9.3 Cumulative, Transboundary Impacts and Accidental Events

Potential cumulative and transboundary impacts were assessed taking into account potential for inter project impacts as well as other potentially significant projects where the associated impacts may overlap geographically or temporally with SWAP Exploration Drilling Project impacts.

The potential Project impacts are expected to be both of a short duration and occurring within a few hundred metres to several kilometres of the NKX01 well location. Due to the localised nature of the Project's impacts and the absence of other development projects in the area, no cumulative or synergistic impacts are expected.

Greenhouse gases (GHG) have the potential to give rise to transboundary impacts. The estimated GHG emissions associated with the Project represent approximately 0.6% of the annual operational GHG emissions from BP's upstream activities in Azerbaijan based on GHG emissions data from 2018. The contribution from the Project to Azerbaijan's national GHG emissions is considered to be insignificant.

To support the assessment of unplanned events, modelling of potential hydrocarbon spill scenarios using Stiftelsen for Industriell og Teknisk Forskning (SINTEF)'s Oil Spill Contingency and Response (OSCAR) modelling software was undertaken to predict the behaviour of the spilled hydrocarbon in the marine environment and to estimate where and how much spilled hydrocarbon may come ashore. It must be noted that modelling has not taken into account any spill response mitigation measures meaning that the results should only be interpreted as indication of theoretical spill consequences without implementation of the oil pollution prevention strategy. In reality, spill mitigation measures such as chemical dispersant application, containment, recovery and shoreline protection measures would be implemented to reduce adverse effects to marine and coastal resources.

The key accidental event scenarios modelled and assessed included:

- Scenario 1: Supply vessel inventory loss of 600m^3 of diesel; and
- Scenario 2: A surface blowout of crude oil (810019 m^3) over 81 days duration.

The modelling indicated that following the release of 600m^3 of diesel, initially the majority of the diesel was predicted to be present on the sea surface. Over the first two days around 20% of the volume was predicted to evaporate with an increasing percentage anticipated to reach the shore over the release period. Dispersion and dissolution into the upper water column is expected to take place very close to the release point. The diesel is predicted to travel less than 50km from the point of release in both summer and winter conditions before it drops below the lowest recognised visible thickness under ideal viewing conditions of 0.04 micrometres (µm). During winter conditions, diesel is predicted to reach the shoreline within approximately 6 hours with up to 275 tonnes predicted to be on the shoreline, although the 50th percentile value[46] is 12.9 tonnes. A spill of diesel from a vessel located at the Project location will have a limited impact to the marine environment as the majority of spilled diesel evaporates, disperses or biodegrades relatively quickly. The probability of the spilled diesel reaching the coastline is low and is unlikely to directly impact designated areas with the exception of the Absheron National Park (5-30% probability of diesel reaching shore), however the concentration of diesel will quickly reduce below harmful levels.

Modelling for the blowout event was based on a worst case estimate that the release would continue for an estimated 81 days, which is the estimated time that would be required to mobilise a drilling rig and to drill a relief well. During this time, it was estimated that approximately 810,019m^3 of crude oil would be released. The modelling indicated that the majority of the oil would initially be present on the sea surface following the release, while 7% would evaporate almost immediately, 26% would biodegrade, 20% would remain in the water column, 38% would deposit in sediments, approximately 3% would reach the shoreline and a relatively high 6% would remain on the sea surface. The crude oil on the sea surface was predicted to travel around 400-500km before it drops below the lowest recognised visible thickness under ideal viewing conditions. Although the precise movement of the surface oil is dependent on the exact metocean conditions at the time, the analysis of over 100 different

[46] Means that in 50% of scenarios modelled, this value or less would result.

sets of metocean data suggest that the most likely locations to receive oil on shore are Azerbaijan, Russia and northern Iran.

The modelling predicts that a blowout under winter conditions could result is a worst case of up to 64684 tonnes of oil reaching the coastline and that this would mainly impact three coastal areas: southern Azerbaijan, northern Iran and the Absheron Peninsula. The modelling under summer conditions also predicts oil reaching the Russian coast. The eastern coastline of the Caspian Sea is unaffected. A mixture of areas of very light (<0.1mm), light (0.1-1mm), moderate (1-10mm) and heavy (>10mm) oil deposition are predicted in these areas.

In the event of a blowout, species in the immediate vicinity of the spill that cannot actively avoid the oil such as plankton, benthic invertebrates, birds and seals are likely to suffer the greatest impacts. Highly mobile species such as fish are anticipated to largely avoid the spilled oil areas. The modelling of the blowout predicts that a number of Important Bird Areas (IBAs) and Key Biodiversity Areas (KBAs), and associated bird species may be exposed to elevated hydrocarbon concentrations as a result of surface or dispersed / dissolved oil beaching on the shoreline. Given the persistence and volume of oil predicted to beach in some IBAs and KBAs the potential impact on IBAs and KBAs (and the birds present there) could be potentially significant, especially if the release occurs during the bird nesting period (April to July). The blowout scenario may also affect small scale fishing grounds along the coast, and commercial fishing.

The AGT Region Offshore Facilities Oil Spill Contingency Plan (OSCP) provides guidance and actions to be taken during a hydrocarbon spill incident associated with all Azeri Chirag Gunashli (ACG) and Shah Deniz (SD) offshore operations, which include mobile offshore drilling units, platforms, subsea pipelines and marine vessels. It is valid for spills that may occur during the commissioning, operation, and decommissioning of the systems. This plan will be updated to include activities within the SWAP Contract Area.

9.4 Environmental and Social Management

BP will have overall responsibility for managing the Project activities and will be monitoring and verifying the implementation of environmental and socio-economic mitigation measures detailed in this ESIA.

The Project specific environmental and social management plans will be developed by BP before the Project commences. The plans, procedures and reporting requirements for the Jack-Up Rig and those relevant to drilling activities will be aligned to the existing BP and Operator's Health Safety and Environmental (HSE) Management System (MS), the Health Safety, Security and Environment (HSSE) Bridging Document and the BP Environmental Operating Procedure and associated Environmental Monitoring & Reporting Forms.

The plans will cover the following topics:

- Environmental Management;
- Pollution Prevention Management;
- Waste Management; and
- Communication Management.

The plans will identify key criteria (e.g. waste volumes, discharge parameters, marine mammal observations, communication frequency, etc.) that will be used to measure environmental and social performance.

BP will verify that mitigation measures and commitments set out in this ESIA are implemented. This will be achieved through periodical environmental checks and reviews, the results of which will be documented within "Site Inspection Reports". An action-tracking system will be maintained to monitor close-out actions and the effectiveness of actions taken in response to findings.

9.5 Conclusions

The assessment of activities associated with the Project exploration drilling demonstrated that with implementation of existing design control and mitigation measures the residual environmental and

socio-economic impacts will be of negligible or minor negative significance and no additional mitigation measures will be required.

APPENDIX 4A

Cement Chemicals

Estimated Usage of Well Cement Chemicals

Additive	Hazard Category[2]	Equipment Commissioning Mix Trial		20" Casing		13-3/8" Casing		13 1/2 Open hole (OH) Plugs x 2 (plugback)		End of Well Possible Disposal	
		Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *
Cement Class G D907	E	13.00	13.00	102.00	46.82	90.00	32.13	50.00	50.00	50.00	50.00
Antifoam Agent D206	Gold	0.10	0.10	0.60	0.26	0.44	0.15	0.50	0.50		
Silicate Additive D75	E										
Weighting Agent Hematite D076	E										
Accelerator D077	E			0.60	0.31						
SALTBOND II Dispersant D080A	Not currently listed in UK OCNS Lists of Notified and Ranked Products (former B)										
Low Temperature Retarder D081A	E										
Cemnet D095 LCM	E			0.40	0.18	0.34	0.12	*0.10*	*0.10*		
Liquid Extender B038	E			4.06	1.86	4.05	1.45	*1.50*	*1.50*		
Dispersant D145A	Gold										
Mid Temperature Retarder D177	Not currently listed in UK OCNS Lists of Notified and Ranked Products			1.25	0.57	1.40	0.61	0.50	0.50		
Low Temp Dispersant D230	Gold			0.60	0.28	0.49	0.18	0.20	0.20		
Accelerator D186 Low Temperature Set	Gold										
Solid Extender D188	E										
Fluid Loss Agent D193	Gold										
AccuSET D197	Gold										
Losseal D097	Gold			0.40		0.34	0.20	0.10	0.10		
GASBLOK* LT D500	Gold			3.39	1.55	5.50	2.04	1.20	1.20		
D600G GASBLOK*Gas-Migration Control Additive	Gold										
Mid-Temp Retarder-L D801	E										

Additive	Hazard Category[2]	Equipment Commissioning Mix Trial		20" Casing		13-3/8" Casing		13 1/2 Open hole (OH) Plugs x 2 (plugback)		End of Well Possible Disposal	
		Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *	Estimated Use per Hole (tonnes)	Worst Case For Disposal (tonnes) *
MUDPUSH* II Spacer D182	Gold			0.44	0.45	0.44	0.45	0.54	0.54		
Ezeflo* F103 Surfactant	Gold			1.30	1.33	1.31	1.34	1.62	1.62		
Mutual Solvent U67	Not currently listed in UK OCNS Lists of Notified and Ranked Products			1.30	1.33	1.31	1.34	1.62	1.62		
D231 Solvent	Gold			1.30	1.33	1.31	1.34	1.62	1.62		
D232 Surfactant	Gold			1.30	1.33	1.31	1.34	1.62	1.62		
D259 Spacer additive fiber	Gold			0.34	0.15	0.34	0.15				

APPENDIX 6A

Marine Discharge and Oil Spill Modelling Report