6. CONCLUSIONS AND RECOMMENDATIONS

Shell is proposing to drill one or possibly two exploration wells in the northern portion of the Orange Basin Deep Water Licence Area. At this stage an area of interest has been defined for the well locations, which is approximately 900 km^2 in extent and is located approximately 230 km offshore at it closest point with water depths ranging between 1 500 m and 2 100 m.

The first well would be drilled to a depth of between 2 700 m and 3 000 m below the seafloor, which is expected to take in the order of three months to complete. For safe operational reasons, drilling is expected to take place in a future summer window period in the second (2017 - 2018) or third (2019 – 2020) exploration right renewal period. Depending on the success of the first well, a second appraisal well may be drilled to establish the quantity and potential flow rate of the hydrocarbons. It is anticipated that the appraisal well would be drilled at least one year after completion of the first well in order to allow sufficient time for data analysis and planning.

The proposed exploration drilling programme requires authorisation in terms of both the MPRDA and NEMA. CCA, in association with NMA, has been appointed by Shell to compile an EMPr Addendum and to undertake the EIA process. Specialists have been appointed to address the key issues that required further investigation, namely (1) cuttings and oil spill modelling, (2) the impact on commercial fishing catch and effort, and (3) the impact on marine fauna. The findings of the specialist studies and other relevant information have been integrated and synthesised into this report. The two main objectives of this report are, firstly, to assess the significance of environmental impacts resulting from the proposed exploration drilling programme and to suggest ways of mitigating negative impacts and enhancing benefits, and secondly to provide I&APs with an opportunity to comment on the proposed project.

This chapter summarises the key findings of the study and presents mitigation measures that should be implemented for the proposed exploration drilling programme.

6.1 CONCLUSIONS

A summary of the assessment of potential environmental impacts associated with the proposed exploration drilling programme and No-Go Alternative is provided in Table 6.1.

6.1.1 NORMAL OPERATIONS

The majority of the impacts associated with the normal operation of the drilling unit, support vessels and aircraft / helicopter would be highly localised, of short-term duration and of low intensity, and are considered to be of **VERY LOW** significance after mitigation. Key mitigation includes ensuring that the drilling unit and all support vessels comply with MARPOL 73/78 standards; flight paths avoid sensitive areas (e.g. coastal reserves, seal colonies, bird colonies or Important Bird Areas); prior notification is provided to key stakeholders (including fishing industry and adjacent rights holders); and Radio Navigation Warnings and Notices to Mariners are released throughout the drilling period.

The only fishing sector which could potentially be impacted by the proposed exploration drilling programme is the large pelagic long-line fishery. Pelagic long-line vessels are primarily concentrated seawards of the 500 m depth contour where the continental slope is steepest, with only approximately 1.1% and 0.9% of the total national catch and effort (between 2008 and 2012) being recorded within the proposed area of interest, respectively. This, together with the short-term duration and highly localised nature of the drilling operation, would result in a potential impact on the large pelagic long-line fishery of **VERY LOW** significance with or without mitigation. There is no expected impact on other fishing sectors as there has been no catch or effort (recent or historic) recorded within the proposed area of interest.

One of the key issues associated with exploration drilling relates to the physical damage or smothering of vulnerable or sensitive benthic communities due to the location of the well and release of drill cuttings at the wellbore and drilling unit. Benthic communities in the area of interest are largely expected to be those associated with unconsolidated sediments, however, due to the high natural variability in the region, there could also potentially be vulnerable communities on rocky outcrops / reefs, which are sensitive to disturbance due to their long generation times. The total area impacted by the release of cuttings is approximately 0.09 km^2 per well (i.e. a radius of 150 m from the drill site where the thickness exceeds 1 mm), which is considered negligible in relation to the total area of the Atlantic Offshore Bioregion. The avoidance of any vulnerable or sensitive benthic communities identified during the pre-drilling ROV survey would reduce the significance of this potential impact to **LOW**.

The most significant, although unlikely, impact during normal drilling operations relates to the introduction of non-indigenous invasive marine species through vessel and equipment transfer and ballast water discharge. The improbable introduction of an invasive alien species due to vessels and equipment transfer and the discharge of ballast water could result in an impact of **high to very high** significance. However, the adherence to the IMO guidelines governing discharge of ballast waters at sea would reduce the significance of this impact to **MEDIUM**. It should be noted that this impact is not unique to the proposed project, but rather a threat common to the South African offshore environment from the numerous vessels that pass through South African coastal waters daily.

The proposed project would result in limited job opportunities for local companies in Cape Town / Saldanha and Kleinzee, e.g. vessel supplies, support vessels, helicopter operations, catering, cleaning, security, etc. In addition, it is anticipated that proposed drilling would have very little effect on the economy due to the very short duration (three months per well) and the relatively small amounts of additional revenue generated. Economic impacts relating to job creation and generation of direct revenues are thus considered to be of ***VERY LOW (positive)*** significance.

Table 6.1: Summary of the significance of the potential impacts associated with the proposed exploration drilling programme in the Orange Basin Deep Water Licence Area and No-Go Alternative (Note: * indicates that no mitigation is possible and / or considered necessary, thus significance rating remains).

Potential impact		Probability	Significance	
			Without mitigation	With mitigation
Normal drilling unit, support vessel and aircraft / helicopter operation:				
Pollution of the atmosphere and marine environment	Emissions to the atmosphere	Definite	VL	**VL**
	Deck drainage into the sea	Highly Probable	VL	**VL**
	Machinery space drainage into the sea	Highly Probable	VL	**VL**
	Sewage effluent into the sea	Highly Probable	VL	**VL**
	Galley waste disposal into the sea	Highly Probable	VL	**VL**
	Solid waste disposal into the sea	Improbable	Insig	**INSIG**
Disturbance of marine biota	Noise from drilling unit and support vessel operation	Probable	VL	**VL***
	Noise from aircraft / helicopter operation	Probable	L	**VL**

Potential impact		Probability	Significance	
			Without mitigation	With mitigation
Impact of well drilling on marine fauna:				
Removal or crushing of benthic macrofauna due to physical damage to the seabed and sediment disturbance	Unconsolidated sediments	Definite	VL	**VL**
	Hard grounds / reefs	Improbable	M	**VL**
Smothering of benthic macrofauna by cuttings and drilling fluid and plume turbidity	Unconsolidated sediments	Highly probable	VL - L	**VL - L**
	Hard grounds / reefs	Highly probable	M - H	**L**
Reduced physiological functioning of marine organisms due to biochemical effects	Water-based muds	Highly probable	VL	**VL**
	Synthetic-based muds	Highly probable	VL	**VL**
	Cement	Highly probable	VL	**VL**
	Increased turbidity	Probable	VL	**VL***
	Oxygen depletion	Probable	VL	**VL***
Disturbance of marine biota due to drilling noise		Probable	VL	**VL***
Faunal mortality due to attraction to drilling unit		Probable	VL	**VL**
Threat to marine biodiversity through the introduction of non-indigenous invasive marine species through vessels & equipment transfer and discharge of ballast water		Improbable	H-VH	**M**
Threat to marine biodiversity due to the physical presence of infrastructure	Removal of wellheads from the seafloor	Highly probable	VL-L (neutral)	**VL-L (neutral)***
	Abandon wellheads on the seafloor	Highly probable	L (neutral)	**L (neutral)***
Impact on other users of the sea:				
Fishing industry: temporary loss-of-access to fishing grounds and associated loss of catch	Pelagic long-line	Highly probable	VL	**VL**
	Demersal trawl	Improbable	**No impact**	
	Pelagic purse-seine			
	Demersal long-line			
	Tuna pole			
	Tradition line-fish			
	West Coast rock lobster			
	Fisheries research			
Temporary disruption to marine mining and prospecting activities		Improbable	Insig	**INSIG**
Temporary disruption to exploration and production activities		Improbable	VL	**INSIG**
Temporary disruption to marine transport routes		Improbable	VL-L	**VL**
Impact on cultural heritage material:				
Impact on historical shipwrecks		Improbable	M	**INSIG.**
Impact on socio-economic environment:				
Job creation		Probable	*VL (+ve)*	***VL (+VE)***
Generation of direct revenues		Probable	*VL (+ve)*	***VL (+VE)****
Increased traffic volumes at onshore logistics base		Probable	VL	**VL**
Cumulative impact:				
Benthic environment		Probable	L	**-**
Fishing industry		Probable	L	**-**

Potential impact			Probability	Significance	
				Without mitigation	With mitigation
Accidental release of oil:					
Toxic effects related to small instantaneous spills	Marine fauna		Improbable	M	**L**
	Fishing		Improbable	VL	**VL**
Toxic effects related to large blow-outs	Marine fauna		Improbable	VH	**H**
	Fishing	Pelagic purse-seine	Improbable	H	**H**
		Demersal trawl, demersal long-line, traditional line-fish and West Coast rock lobster	Improbable	M	**M**
		Pelagic long-line and tuna pole	Improbable	L	**L**
No-Go Alternative:					
Lost opportunity to further explore on the West Coast and to maximise the use of South Africa's potential own oil and gas reserves			Improbable	M	**-**

VH=Very High	H=High	M=Medium	L=Low	VL=Very low	Insig = insignificant	N/A = Not applicable

6.1.2 ACCIDENTAL OIL SPILL (UPSET CONDITION)

This is considered to be an abnormal operation and relates to the unlikely event of an uncontrolled release of oil during drilling operations. In order to assess the potential impact related to an oil spill, a modelling study was undertaken to establish the extent, trajectory and fate of oil due to a small accidental spill and a large well blow-out. The modelling study concluded that the significance of this impact depends on a number of factors including, but not limited to, the severity of the release / spill, weather conditions and time of year.

A minor accidental spill of hydrocarbons, chemicals or drilling mud would be relatively short-lived on the water surface (< 2 days) and there would be no probability of the oil reaching the shoreline. The impact of a small operational spill on marine fauna and fishing at the well site or near the coast is considered to be of **LOW** and **VERY LOW** significance after mitigation, respectively.

The most significant environmental threat from offshore drilling operations is the risk of a major spill of crude oil occurring either from a blow-out or loss of well control. Oil spilled in the marine environment would have an immediate detrimental effect on water quality. Based on the results of the oil spill modelling study, oil is predicted to reach the shore under the following scenarios, assuming no mitigation measures are put in place:

- 5-day blow-out scenario: During winter there is a <10% probability of shoreline oiling at various point between Oranjemund and Cape Town under the slow weathering scenario.
- 20-day blow-out scenario:
  - During winter there is a <10% probability of shoreline oiling between Lüderitz to Oranjemund under the medium weathering scenario; and
  - During winter and summer there is a <10% probability of shoreline oiling along the central and southern Benguela coastline off South Africa and Namibia under the slow weathering scenario.

In the unlikely event of a large oil spill, the impact on marine fauna is considered to be of **HIGH** significance with mitigation, while the impact on fishing is considered to range from **LOW** (for the pelagic long-line and tuna pole sectors) to **MEDIUM** (for the demersal trawl, demersal long-line (hake and shark), traditional line-fish and West Coast rock lobster sectors) to **HIGH** (for the small pelagic purse-seine sector) with and without mitigation. In order to mitigate this unlikely impact it is recommended that a project-specific oil spill response plan be prepared and be put in place for the duration of the drilling operation.

It should also be noted that OSRL operates advanced well intervention and capping equipment from Saldanha Bay for deployment in the event of a subsea well control incident. This would significantly reduce the spill period and thus the likelihood of oil reaching the shore in the event of a blow-out. Shell is a member of OSRL, which gives them ready access to this equipment.

6.1.3 COMPARATIVE ASSESSMENT OF PROJECTS ALTERNATIVES

6.1.3.1 Drill site alternatives

Shell is proposing to drill the exploration wells in the northern portion of the licence area. This area of interest is based on an understanding of the geological information for the area from an analysis of the existing seismic data. Thus the drilling area is more or less fixed by the location of the area of geological interest. Although the final well location within the area of interest would be based on a number of factors, including further analysis of the seismic data, the geological target and seafloor obstacles, this EIA assesses the potential impacts associated with drilling anywhere within the area of interest.

The potential impact on the marine benthic environment and significance thereof is ultimately dependent on whether any vulnerable or sensitive benthic communities occur within the vicinity of the selected drill site. Similarly, the potential impact on cultural heritage material (e.g. historical shipwrecks) is dependent on whether any wrecks are located nearby. Thus in order to minimise the significance of these potential impacts, it is recommended that the final well position be adjusted to avoid any significant topographic features, vulnerable habitats / species or wrecks.

6.1.3.2 Drill schedule alternatives

The specific timing of drilling is highly dependent on physical factors such as sea state conditions and weather conditions. Thus for safe operational reasons, Shell is proposing to drill in a future summer window period from November to April.

It is evident from these results of the oil spill modelling that drilling during winter would significantly increase the probability of shoreline oiling in the event of an unlikely blow-out. Thus it is recommended that drilling is confined to summer, as proposed.

6.1.3.3 Drilling unit alternatives

All potential impacts associated with the normal operation of both drilling unit options (either a semi-submersible drilling vessel or drill ship) are assessed to be of similar significance. These include:

- Emissions to the atmosphere;
- Discharge of waste to sea;
- Fauna attraction to drilling unit;
- Introduction of non-indigenous invasive species through vessel transfer; and
- 500 m safety zone around the drilling unit.

There are no additional impacts or differences in impact significance relating to the choice of drilling unit used during the exploration drilling programme.

6.1.3.4 Drilling method and material alternatives

Two drilling methods may be employed on a drilling unit, namely rotary or downhole motor drilling. The potential impact associated with the noise related to both drilling methods is assessed to be of similar significance. Thus there are no additional impacts or differences in impact significance relating to the choice of drilling method used during the exploration well drilling programme.

Two types of drilling fluid would be used during drilling, namely WBM and SBM. During the initial riserless drilling stage WBM would be used. However, during the risered drilling stage, a low toxicity SBM would be used, when WBMs cannot provide the necessary characteristics. Although the potential impact related to biochemical effects from the discharge of drill cuttings and muds is assessed to be of similar significance for both WBF and SBM usage, the intensity of the impact is considered to be higher for SBM. It is thus recommended that the use of WBF is maximised at all times, using risered SBMs only when necessary.

6.1.3.5 Well completion alternatives

During well abandonment the wellheads would either remain on or be removed from the seafloor. At the proposed drilling depths, the preferred option would be to leave the wellhead on the seafloor.

The proposed abandonment of the wellhead on the seafloor would have no impact on the demersal trawl sector, which currently operates along the 1 000 m depth contour inshore of the area of interest. There is, however, a concern that the permanent abandonment of the wellhead on the seafloor could have a potential future impact on the fishery. In historically trawled areas, predominantly on the shelf in waters shallower than 500 m water depth, the trawling industry has objected to and requested the removal of abandoned wellheads and other structures associated with oil and gas development. Although the expansion of trawling into waters deeper than 1 000 m water depth is uncertain, it is unlikely that trawling effort would move into the proposed area of interest, which has water depths ranging between 1 500 m and 2 100 m (noting that the technology exists to trawl to these depths but that such activity would require approval from the national fisheries management authority).

It is anticipated that the proposed abandonment of the wellhead on the seafloor would have no long-term impact on the demersal trawl sector.

6.1.3.6 Onshore logistic base alternatives

An onshore logistics base would be located in either the Cape Town or Saldanha Bay harbour precincts. The location within the harbour precinct would ultimately be based on discussions with the relevant Ports Authority, availability of service providers and space availability to accommodate the proposed onshore logistics facilities. The overall positive impact related to the limited job opportunities and direct revenues would remain the same for both possible onshore logistic base alternatives.

Similarly, the potential traffic impact associated with operational activities at either the Cape Town or Saldanha Bay harbours is assessed to be of similar significance.

There are not considered to be any noticeable differences in impact significance associated with the location of the onshore logistic base in either Cape Town or Saldanha Bay.

6.1.3.7 No-go alternative

The no-go alternative is the option of not undertaking the proposed exploration drilling operation. If exploration drilling does not proceed, the residual impacts (i.e. impacts after implementation of mitigation measures) of the proposed activities would not occur. Without exploration drilling, information about the subsurface geology and potential for the presence of oil and gas would not be collected. Thus further exploration and production activities would less likely to be carried out. The halt of oil and gas exploration and production would result in a decrease in commercial interest in South Africa's oil and gas sector, and the loss of potential economic benefits including government revenues, taxes, and employment.

The implications of not going ahead with the proposed exploration in the Orange Basin Deep Water Licence Area relate to the lost opportunity to further explore for oil and gas reserves on the West Coast and maximise the use of South Africa's own hydrocarbon reserves should they exist. This potential impact of the No-Go Alternative is considered to be of **MEDIUM** significance.

6.1.4 RECOMMENDATION / OPINION OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

The key principles of sustainability, including ecological integrity, economic efficiency, and equity and social justice, are integrated below as part of the supporting rationale for recommending an opinion on whether the proposed project should be approved.

- Ecological integrity

  The disturbance of benthic communities is considered negligible in relation to the available area of similar habitat on and off the edge of the continental shelf in the Atlantic Offshore Bioregion, which is classified as Least Threatened. In addition, this localised impact is short-term with recovery expected within two to five years, assuming as recommended the avoidance of rock outcrops / reefs.

  The more significant impacts relating to large oil spills and the introduction of non-indigenous invasive marine species are both considered to be highly unlikely. These risks are no different to any other past or future exploration drilling operation undertaken of the coast of South Africa. As indicated above, the unlikely introduction of invasive marine species is not unique to the proposed project, but rather a threat common to the South African offshore environment from the numerous vessels that pass through South African coastal waters daily.

  In summary, the proposed project would result in the loss of some ecological integrity in the study area, but it is considered to be small, localised and short-term under normal operating conditions.

- Economic efficiency

  The 500 m safety zone around the drilling unit would essentially exclude other vessels from a very small area off the West Coast. The only economic activity operational in the area is that of the large pelagic long-line fishing sector, the impact on which is assessed to be highly localised of short-term duration (three months), after which the area would be opened up again to fishing.

  Although the economic benefits (job creation and generation of direct revenues) associated with this stage of exploration in the Orange Basin Licence Area are considered to be only of ***VERY LOW (positive)*** significance, an oil discovery could result in significant future benefits to South Africa.

The proposed project is also considered to be economically efficient, as no other party/ies would be significantly impacted, while establishing the extent of indigenous oil / gas reserves.

- Equity and social justice
  Due to the offshore location of the licence area, the proposed project would not unfairly discriminate, directly or indirectly, against any one party nor result in an unequal distribution of negative impacts.

It is the opinion of CCA in terms of the sustainability criteria described above, the nature and extent of the proposed well drilling programme (under normal operating conditions) and the findings of the specialist studies, that the generally **VERY LOW** to **LOW** significance associated with normal operations should support a positive decision being made by DEA in this regard.

6.2 RECOMMENDATIONS

6.2.1 COMPLIANCE WITH ENVIRONMENTAL MANAGEMENT PROGRAMME AND MARPOL 73/78 STANDARDS

- All phases of the proposed project must comply with the Environmental Management Programme presented in Chapter 7.
- The drilling unit and all vessels must ensure compliance with MARPOL 73/78 standards.

6.2.2 NOTIFICATION AND COMMUNICATION WITH KEY STAKEHOLDERS

- Prior to the commencement of drilling activities the following key stakeholders should be consulted and informed of the proposed drilling programme (including navigational co-ordinates of well location, timing and duration of proposed activities) and the likely implications thereof (specifically the 500 m exclusion zone and the movements of support vessels):
  > Fishing industry / associations: South African Tuna Long-line Association, South African Deep-sea Trawling Industry Association, South African Tuna Association and Fresh Tuna Exporters Association; and
  > Other key stakeholders: DAFF, DEA, PASA, Transnet National Ports Authority (ports of Cape Town and Saldanha Bay), SAMSA, South African Navy Hydrographic office and adjacent prospecting / exploration right holders.

  These stakeholders should again be notified at the completion of drilling when the drilling unit and support vessels are off location.
- Shell must request, in writing, the South African Navy Hydrographic office to release Radio Navigation Warnings and Notices to Mariners throughout the drilling period. The Notice to Mariners should give notice of (1) the co-ordinates of the well location, (2) an indication of the proposed drilling timeframes, (3) an indication of the 500 m safety zone around the drilling unit, and (4) provide details on the movements of support vessels servicing the drilling operation. These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible;
- Any fishing vessel targets at a radar range of 24 nm from the drilling unit should be called via radio and informed of the safety requirements around the drilling unit;
- The drilling unit vessel should be accompanied by a support vessel equipped with appropriate radar and communications be kept on 24-hour standby near the drilling unit in order to ensure that other vessels adhere to the safety zone;
- Any dispute arising with adjacent prospecting / exploration right holders should be referred to the Department of Mineral Resources or PASA for resolution; and

- Any wells suspended or abandoned on the seafloor must be surveyed and accurately charted with the South African Navy Hydrographic office.

6.2.3 FINAL WELL LOCATION AND EQUIPMENT

- Pre-drilling site surveys (using a ROV) should be undertaken in the vicinity of the proposed well locations to confirm the presence of any significant topographic features (e.g. rocky outcrops), vulnerable habitats (e.g. hard grounds) and / or species (e.g. cold-water corals and sponges), and cultural heritage material (e.g. shipwrecks) in the area. Final well location should be adjusted to avoid any identified vulnerable seabed communities bearing in mind the extent of smothering effects (as per the cuttings dispersal modelling) and cultural heritage material; and
- Unless thoroughly cleaned, no infrastructure (e.g. wellheads, BOPs and guide bases) should be deployed that has been used in other regions.

6.2.4 EMISSIONS AND DISCHARGES

6.2.4.1 General

- A Shipboard Oil Pollution Emergency Plan (SOPEP) must be prepared for the drilling unit and all other vessels and be in place at all times during operation;
- All diesel motors and generators should receive adequate maintenance to minimise soot and unburnt diesel released to the atmosphere;
- Leak detection and repair programmes should be implemented for valves, flanges, fittings, seals, etc.;
- Spill management training and awareness should be provided to crew members regarding the need for thorough cleaning-up of any spillages immediately after they occur in order to minimise the volume of contaminants washing off decks;
- Deck drainage should be routed to a separate drainage system (oily water catchment system) for treatment to ensure compliance with MARPOL (15 ppm);
- All process areas should be bunded to ensure drainage water flows into the closed drainage system;
- Drip trays should be used to collect run-off from equipment that is not contained within a bunded area and the contents routed to the closed drainage system;
- Low-toxicity biodegradable detergents should be used in cleaning of all deck spillage;
- All hydraulic systems should be adequately maintained and hydraulic hoses should be frequently inspected;
- Initiate a waste minimisation system on board all vessels;
- On-board solid waste storage is to be secure; and
- The disposal of waste (solid and hazardous) onshore must be in accordance with the appropriate laws and ordinances.

6.2.4.2 Drilling fluids, cuttings and cement

- Maximise the use of WBM at all times, using risered SBMs only when necessary;
- Ensure only low-toxicity and partially biodegradable drilling fluid and cement additives are used;
- If the extent of cuttings dispersion overlaps with any vulnerable seabed communities identified in the vicinity of the proposed well location using the existing 3D seismic data and / or ROV (as recommended in Section 6.2.3 above), innovative technologies and operational procedures for drilling solids discharges should be considered (e.g. the use of weighted mud when drilling tophole sections to limit the extent of dispersion);

- Ensure regular maintenance of the onboard solids control package;
- The dispersion of the discharged cuttings should be aided by placing the cuttings chute at least 5 m below the sea surface;
- All recovered SBM should be stored on-board and taken to shore for treatment and reuse; and
- Avoid excess cement usage by using a ROV to monitor discharges to the seafloor around the drill casing.

6.2.4.3 Ballast water

- A ballast water management plan must be prepared for the drilling unit;
- De- and re-ballasting of vessels must be undertaken only under strict adherence to IMO guidelines governing discharge of ballast waters at sea. De- and re-ballasting at sea currently provides the best available measure to reduce the risk of transfer of harmful aquatic organisms, but is subject to ship-safety limits. The IMO states that vessels using ballast water exchange should, whenever possible, conduct such exchange at least 200 nm from the nearest land and in water of at least 200 m depth. Where this is not feasible, the exchange should be as far from the nearest land as possible, and in all cases a minimum of 50 nm from the nearest land and preferably in water at least 200 m in depth; and
- Other precautionary guidelines recommended by the IMO include:
  - > During the loading of ballast, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms, through adequate filtration procedures;
  - > Where practicable, routine cleaning of the ballast tank to remove sediments should be carried out in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's ballast water management plan; and
  - > Avoidance of unnecessary discharge of ballast water.

6.2.4.4 Flaring

- A high-efficiency burner should be used for flaring (as proposed) in order to minimise emissions and hydrocarbon ‘drop-out’ during well testing;
- Only the minimum volume of hydrocarbons required for the test should be flowed, without compromising safety, and well test durations should be reduced to the extent practical;
- Flare combustion efficiency should be maximised by controlling and optimising flare fuel/air/stream flow rates;
- The risk of pilot blow-out should be minimised by ensuring sufficient exit velocity and providing wind guards;
- Where appropriate, a high integrity instrument pressure protection system should be used to reduce over pressure events;
- Liquid carry over and entrainment in the flare stream should be minimised with a suitable liquid separation system;
- Flame lift off and / or flame lick should be minimised; and
- Odour and visible smoke emissions (no visible black smoke) should be monitored and controlled.

6.2.5 VESSEL SEAWORTHINESS AND SAFETY

- The drilling unit and support vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. American Bureau of Shipping, Det Norske Veritas, Lloyds Register, etc.). The certification, as well as existing safety standards, requires that safety precautions would be taken to minimise the possibility of an offshore accident;
- Collision prevention equipment should include radar, multi-frequency radio, foghorns, etc. Additional precautions include: the support vessels, the enforcement of the 500 m safety zone around the drilling unit, cautionary notices to mariners and access to current weather service information;
- The drilling unit and support vessels must be fully illuminated during twilight and night; and
- Report any emergencies to SAMSA.

6.2.6 VESSEL LIGHTING

- Non-essential lighting should be minimised on all platforms to reduce nocturnal attraction. However, such measure should not undermine work safety aspects or concerns.
- A monitoring programme of faunal attraction should be implemented where any seabird injuries and mortalities are logged.

6.2.7 AIRCRAFT AND HELICOPTER OPERATIONS

- All flight paths must be pre-planned to ensure that no flying occurs over coastal reserves (MacDougall's Bay), seal colonies (Buchu Twins, Kleinzee and Strandfontein Point), bird colonies (Bird Island at Lambert's Bay) or Important Bird Areas (Orange River Mouth wetlands, Olifants River Estuary, Velorenvlei, Lower Berg River wetlands and the West Coast National Park and Saldanha Bay Islands);
- Extensive low altitude coastal flights (<2 500 ft and within 1 nm of the shore) should be avoided, particularly during the winter/spring (June to November inclusive) whale migration period and during the November to January seal breeding season. The flight path between the onshore logistics base in Kleinzee and drilling unit should be perpendicular to the coast. As no seasonal patterns of abundance are known for odontocetes occupying the proposed exploration area, a precautionary approach to avoiding impacts throughout the year is recommended;
- Aircrafts may not, without a permit or an exemption, approach to within 300 m of whales in terms of the Marine Living Resources Act, 1998. As this may be both impractical and impossible, it is recommended that an application for an exemption permit is made to DEA;
- The contractor should comply fully with aviation and authority guidelines and rules; and
- All pilots must be briefed on ecological risks associated with flying at a low level along the coast or above marine mammals.

6.2.8 CULTURAL HERITAGE MATERIAL

- If any cultural heritage material is found during activities SAHRA should be notified immediately. If any material older than sixty years is to be disturbed a permit would be required from SAHRA.

6.2.9 JOB CREATION

- The use of local companies for support services should be promoted as far as possible. In addition, local skills should be developed where possible.

6.2.10 ACCIDENTAL RELEASE OF OIL

6.2.10.1 Small instantaneous spills

- A SOPEP must be prepared for the drilling unit and all other vessels and be in place at all times during operation;
- Oil pollution emergency procedures for small spills must be integrated with the drilling units emergency procedures for all incidents covered in the Emergency Procedures Manual;
- A tiered response plan must be prepared;
- Arrangements must be put in place for rapid deployment of Tier 1 response at the spill site (e.g. from support vessel);
- Personnel must be trained in emergency procedures;
- Training and exercise programmes must be established to ensure that the response activity can be effectively executed; and
- Onboard spill equipment and spill containment materials must be in place, maintained and positioned in clearly identified locations.

6.2.10.2 Large blow-outs

Mitigation for large blow-outs falls into two categories, namely (1) prevention and (2) response:

1. Subsea Blow-out Prevention includes, *inter alia*:
    - Safety and technical training;
    - Subsea BOP stack;
    - Pipe rams;
    - Drilling fluids;
    - Casing and cement;
    - Leak detection systems; and
    - Integrity testing of well casing and cementing activities.
2. Oil Spill Response includes, *inter alia*:
    - OSRP and WCCP;
    - Safety and technical training;
    - Mechanical recovery (e.g. booms, skimming devices and / or absorbent material);
    - Dispersants; and
    - Shoreline protection (including preventing the oil from reaching the shoreline), clean-up and rehabilitation of wildlife.