Drilling of 14 wells and development of Surface Facility (EPS) and development of 5 already drilled wells by setting up Production facilities in Block CB-ONN-2000/1 in Ahmedabad District
1 SUMMARY AND CONCLUSIONS

1.1 About Gujarat State Petroleum Corporation

Gujarat State Petroleum Corporation Limited (GSPC) has been established in year 1979 as a Government of Gujarat undertaking and is involved in Exploration and Production of Oil and Gas. GSPC has grown from being an operator of small fields in Gujarat into an expansive oil and gas exploration and production company across India. Its rise in the hydrocarbon sector was helped by the Central Government's opening of the sector to private participation in the early 1990s, GSPC constructed India’s first and only Land Based Drilling Platform in the Hazira gas field in 1998, through which gas is being supplied to various industries across Gujarat.

1.2 About Block CB-ONN-2000/1

The block, CB-ONN-2000/1 covering an initial area of 1424 km² was awarded to GSPC- GAIL (50:50) consortium under NEPL II round by Government of India. Production Sharing Contract (PSC) was signed on 17th July 2001 and Petroleum Exploration License was granted on 7th January 2002. Five years exploration phase was expired on Jan 2007. After expiry of five year exploration period, extension was granted for four years 2007-2011 including two years, received ex post facto during which there was no physical activity carried out in the exploration area of 425 km². In the extended exploratory campaign, the well GSAH#5 & GSAH#5Al have been drilled and Oil Discovered.

Ring Fenced PSC of 425 sq. km exploration area has been signed on 14.06.2012. The 30 Month extension for extended exploration activities was granted vide MoPNG Letter RefNo.O-19025/15/2001-0NG-DV dated 6th August 2013. GSPC on behalf of Consortium has applied for the extension of PEL for the area 425 km² and for the period January 2011- December 2014. ML is granted for an area 14.03 km² vide letter No PML order-28, dated 15th December 2011 from Government of Gujarat.

1.3 Project Chronology till date

- As part of its EC process, M/s. GSPC had submitted relevant documents, namely Form-1 (as per the EIA Notification 2006, amended till date) along with a Pre-feasibility Report and proposed Terms of References (ToR) for carrying out environmental studies, to the Reconstituted Expert Appraisal Committee (Industry) MoEF (‘REAC, Industry’), vide letter No. GSPC/QHSE/SM/MoEF-EC/2014-41 dated 27th January 2014.
- ToR was prescribed vide its letter F. No. J-11011/45/2016-IA II (I) dated 17/01/2015.
- M/s. Kadam Environmental Consultants (a National Accreditation Board for Education and Training (NABET) Accredited Consultant Organization (ACO) and is qualified to prepare EIA reports for Project / Activity falling under 1(b) category (Onshore Oil and Gas Exploration, Development and Production only) undertook the study during the post monsoon season 2015, in accordance with the ToR issued by MoEF&CC.
- Subsequently GSPC had applied ToR amendments to MoEF&CC and received the amendment vide letters J-11011/96/2014-IA II (I) dated 08/03/2017 and J-11011/96/2014-IA II (I) dated 12/06/2017 respectively.
- Kadam Environmental Consultants had carried out additional monitoring subsequent to ToR amendments.
- Kadam Environmental Consultants presented the preliminary study findings in its draft report released for the purpose of public consultation as per the EIA Notification 2006 and compliance to the condition of issued TOR.
1.4 Proposed Project

1.4.1 Location of the Project

GSPC has planned

- Drilling of 14 wells and development of the same by setting up proposed facility and laying of 4” or 6” pipeline to connect the wells to the EPS (GSAH#5A2, GSAH#7, GSAH#5-D1, GSAH#5-D2, GSAH#5-D3, GSAH#5-D4, SE#Dev2, PK1-Dev1, PK1-Dev2, PK#Dev1, GSAH#6, GSAH#8, C-8, GSAH#3).
- Development of 5 already drilled wells by setting up of proposed development facility and laying 4” or 6” pipeline to connect the wells to EPS (PL#1, PK#2-A1, PK#2-A2, GSAH#5, GSAH#5A1).

Location details are as follow:
Taluka: Sanand, Dholka, Bavla and Daskroi
District: Ahmedabad
State: Gujarat

1.5 The Drilling Process

GSPC proposes to drill well(s) in the block CB-ONN-2000/01. The well locations have been finalized based on the results of the various geological and engineering studies carried out.

Drilling operations will be conducted round-the-clock. The time taken to drill a borehole depends on the depth of the hydrocarbon bearing formation and the geological conditions. GSPC intends to drill wells to depths up to 3000 m. This would take around 30 – 45 days time for each well.

Where a hydrocarbon formation is found, initial well tests- possibly lasting more than one month (if tested by work over rig, which is similar to a drilling rig) are conducted to establish flow rate of oil & gas and formation pressure along with other reservoir parameters. These tests may then generate oil, gas and formation water. This mode of drilling would also reduce the land used or “foot print”. On completion of testing the well would be declared oil / gas producer or dry.

In the event that economic quantities of hydrocarbons are found, the well will be completed with a well head in place at surface along with x-mass tree and casing & tubing inside the hole down to the desired reservoir depth, but all the other equipment and materials will be removed from the site.

In the event that no economic quantities of hydrocarbons are found, the site would be restored to its original form (as far as possible) and the well abandoned, following standard industry practices.

1.5.1 Workforce Arrangements

No workers camp will be required during drilling of wells. During the drilling operations, about 30 to 40 persons may be working in 8 hour shifts at site. Workers will be able to return to their homes at night and hence no camping will be required at or near the well site. Once drilling is over no person is required at site, except security cover through a contractor.

1.5.2 Power Requirements

During drilling operations, diesel engines shall be utilized as prime movers for meeting the power required to run the drilling rig, circulation system etc. A power generator shall also be installed for lighting. The capacity of the diesel engines that shall be used for operating the rig and the circulation system is expected to be of 662.5
KVA (2 Nos), which will run on High Speed Diesel. This generator shall consume approximately 200 Liters of fuel per hour, when in operation.

1.5.3 Water Requirement

The most significant requirement of water for drilling activities is for mud preparation. The other requirement would be for engine cooling, floor / equipment / string washing, sanitation, fire-fighting storage / make-up and drinking. During the drilling activity, about 40 m³ per day water will be required which will include requirements for operation and that for sanitation and drinking of the workers during drilling single well. The water shall be made available through water tanker only.

1.5.4 Waste Water Generation

The drilling operation would generate wastewater in the form of wash water due to washing of equipment, string and cuttings etc. The only other source of wastewater generated from drilling operation is sewage from sanitation facilities, around 2.5 m³/day, which shall be disposed through septic tanks/soak pits. It is expected that wastewater in the form of Drill cutting washing + Rig washing+ cooling etc shall be generated at an average rate of around 10 m³/day during the drilling operations from a single well. Waste water will be discharged in HDPE lined evaporation pit for disposal, size of the pit is generally 50mx20mx1.5m.

The wash water would contain variable quantities of mineral salts, solids, suspended and dissolved hydrocarbons, and other organic and inorganic components in very minor quantities.

1.5.5 Air Emissions

The emissions to the atmosphere from the drilling operations shall be from the diesel engines, and power generator and temporary from flaring activity (during testing).

1.5.6 Noise Generation

The source of noise generation during this phase of operations would be the operation of rig and diesel-generator sets. The expected noise generation at source, due to operation of rig is 101 dBA (Source: "Control of Noise Pollution from Diesel Generator sets", Programme Objective Series; PROBES/71/1998-99, Central Pollution Control Board). Besides, certain pumps are expected to be in operation during this phase, for mud circulation. The noise generation work however is transient and limited to the drilling period only.

1.5.7 Waste Management

224-300 MT / well of drill cuttings and 25 MT of spent drilling mud shall be generated at site per well during drilling operations. This shall be stored in well-designed HDPE line pit. It shall be tested for its hazardous constituents (Oil and Grease), If found to be hazardous, It shall be handed over to authorized TSDF. In case of Nonhazardous, it shall be disposed insitu in HDPE lined pit.

Used /waste Oil – During the drilling approx. 200 lts of spent oil shall be generated per well. This oil shall be sent to authorized recyclers.

Domestic waste of 1-2 kg/day per well shall be generated at site, which shall be segregated at source (Organic / Inorganic) and disposed accordingly.

1.5.8 Safety and Environment

Adequate safety measures such as fire-fighting equipment shall be provided at the site in accordance with the norms of OISD 189. A high-pressure influx of formation fluids (water and/or gas) into the well bore is
commonly known as a 'kick'. Well control is aimed at preventing the kick and a possible blowout. Well control can be conveniently sub-divided into two main categories, namely primary well control and secondary well control.

1.5.9 Abandonment of Operations

At the conclusion of the drilling program at each drilling site, an orderly withdrawal of all personnel and the removal of all drilling and testing equipment and non-fixed items from the drilling site will be undertaken. Broadly, there are two such scenarios:

- In case that the well is completed when economic quantities of hydrocarbons are found, the well will be left with a wellhead in place, but all other drilling equipment and materials will be removed from the site. The well site will be fenced and will be reduced to 30m X 30 m for the production phase and all non-essential area will be fully reclaimed.
- In any other case the site will be cleared and refurbished to permit recovery to as near as possible the pre-existing local environment.

1.6 Production Operation

GSPC is planning to set up EPS at any or all 14 locations plus EPS at already 5 drilled location based on commercial recovery of hydrocarbon. Brief about the process facilities and modification/amendment required is mentioned below:

1.6.1 Process Description

Process of Storage/handling of Hydrocarbon

Produced hydrocarbons from wells flows through 4" above ground pipe line up to EPS main header, where the EPS is set up at the well site itself, in other cases where the wells which are outside the EPS premises will be connected to EPS through underground 4" pipeline which will be upto EPS main header.

From EPS main header the Fluid (Oil + gas) flows into the separators for separation of Oil & Gas. Handling of Crude oil: Separated oil flows into the overhead storage tanks for measurement & storage. Oil will be loaded in Oil tankers throughloading platform and transported to ONGC-CTF for further processing.

Handling of produced associated gas: The separated Gas is piped to the Gas flow line after measurement through gas meter. The gas will be fed to bath heater and the remaining gas will go to EPS gas manifold from which the gas will be supplied to the nearby Industries through the underground pipeline belongs to the industries. During an operation upsets, the gas will be directed to flare stack for technical flaring.

In order to operate the wells for the production of oil and gas, EPS will be established.

Storage of Hydrocarbon

Once the Crude Oil and associated gas are extracted from ground either due to self-pressure or with the help of pump jack, they will be diverted to two phase separator wherein due to their density difference, the same shall be separated.

Crude Oil shall be transferred to the temporary storage tanks and later transported to ONGC-CTF for further processing.
Oil shall be maintained in liquid form by providing heat through bath heaters.

A part of produced associated gas will be used in the bath heaters to heat the fluid for maintaining the fluidity, whereas the remaining gas will be supplied to local buyers through underground flow line which shall be laid by buyers from EPS gas manifold up to their plant / Industry.

Excess gas, if any shall be flared through Vertical flare stack (technical flaring).

**Workforce Management**

Being a small facility, the average number of people per shift at EPS will be max up to 6 -10Nos, who in turn will go back to their residence in town/ village after work. For all the wells to be connected to nearby EPS, there shall be only security personnel deployed at each well sites.

**Power Requirements**

Power shall be sourced from local GEB at each proposed EPS.

Motive: 100 HP & Light: 25 KVA.

For emergency supply, DG set of 125 KVA will be provided at site.

The requirement of power source shall be limited to EPS site only, however at later stage, artificial lift (Sucker Rod Pump - SRP) may be required at wells to enhance the production, at that time electricity shall be sourced through local power grid to run SRP at wells.

**Water Requirement**

2.2 KLPD water will be required for industrial and domestic purpose at each EPS which will be sourced through bore well at site of from nearby water bore (private) or Panchayat Water supply

**Wastewater Generation**

Produced Water at each EPS: 15 m³/day will be generated which would be collected in waste water pit and thereafter would be sent through approved water tankers to an authorized CETP

For strict adherence and compliance of regulatory norms for proper disposal and treatment of produced effluent water, GSPC shall have two number of 100 scm RCC tank with siphoning system within EPS. This system shall ensure effluent water free of oil particles. Subsequently after collecting Oil free water, following disposal/treatment plan shall be executed:

If the quality of water is within the Onshore Discharge standards, as per EPA 1986 (72(A) Oil Drilling and Gas Extraction Industry), it will be utilized for green belt development or may be facilitated for natural evaporation.

In case, if it exceeds the Onshore Discharge standards, as per EPA 1986 (72 (A) Oil Drilling and Gas Extraction Industry), following arrangements have been planned:

It will be dispatched to CETP Kalol, Industries Association CETP (Common Effluent Treatment Plant) which is approved by Gujarat Pollution Control Board .GSPC is the registered member of CETP Kalol for handling/treatment of 20 m³ per day effluent water or similar kind of arrangements will be made.
Air Emissions

In accordance with the Oil Mines Regulations Rules 1984, a flare stack of 9 m height shall be provided at each
EPS at a distance of min 30 m from well. Gas produced shall either be re used internally or supplied to nearby
industries and flaring shall be restricted to technical flaring only.

Fugitive emissions may result from handling and storage of hydrocarbons (crude & diesel) which are very
minor. At the time of transportation dust will be generated. This emission will be temporary; however impact
assessment of the same is covered in chapter 4. Air quality modelling was done in order to evaluate PM10, PM
2.5, SOx and NOx incremental concentrations due to proposed project. These results are based on considering
the main stacks

Noise Generation

The source of noise generation during this phase of operations would be the operation of SRP (if any) and
diesel-generator sets. The expected noise generation at source, due to operation is expected to be ~85-90 dBA
(Source: “Control of Noise Pollution from Diesel Generator sets”, Programme Objective Series;
PROBES/71/1998-99, Central Pollution Control Board). Besides, fire pumps are expected to be in operation,
only in case of emergency or during fire drills.

Solid and Hazardous Waste Management

Solid and Hazardous waste generation shall be restricted to EPS site only.

Generation of Waste Oil/ Used oil is in very negligible quantity and shall be used for internal purpose for Oiling
/ greasing machine parts whereas oily cotton waste will be sent to approved TSDF site. Oily sludge generated
will be sent to authorized recyclers. Hazardous Waste storage shall be properly designated and concreted.
Domestic Solid waste generated at site will be segregated at source (Organic / inorganic) & disposed
accordingly.

Quantity of Solid and Hazardous waste generated at each EPS are enlisted below:-

- Solid Waste: 2 kg/Day
- Used Oil: 10 Lit/year
- Oily cotton waste: 360 kg/year

Safety and Environment

Adequate fire-fighting equipment shall be provided at the site in accordance with the norms of OISD 189. OMR
– 1984, (amended till date) guidelines shall be followed for safe operation at Production site. Personal
Protective Equipment shall be provided to employees working at site.

1.7 Description of the Environment

Baseline environmental studies were carried out during post monsoon season 2015 and additional monitoring
were carried out after ToR Amendments.

1.7.1 Study Area

The study area is defined as area within a radius of 10 km covering block.
1.7.2 Landuse of the Study Area

A recent satellite image for the study area was collected using Google Earth Pro-version 7.1.5.1557. The image was interpreted through manual supervised classification based on National Remote Sensing Agency (NRSA) classifications. Ground truthing was done in the month of July 2015 to confirm and edit the interpreted landuse / land cover classes.

For Study Area the main landuse / landcover class in the area is Agricultural Land, with a ~69.97% component of the total landuse. Vegetation Cover comes next with ~13.82% followed by Built up land / habitation, Waste Land, Water bodies and others.

1.7.3 Climatology

The climate of this region is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season from March to middle of June. The period from middle of June to September is the southwest monsoon season. October and November constitute the post-monsoon or retreating monsoon season.

Meteorological data shows that mean average wind speed during study period are 2.6 m/s.

During study period wind blows mostly from N direction.

Mean average temperature recorded during study period was 26.5°C with mean maximum temperature of 47.2°C and mean minimum of 20.6°C.

The mean average relative humidity recorded was 47.6% with mean maximum humidity of 58.8% and mean minimum of 34.8%.

1.7.4 Ambient Air

Post monsoon 2015

Ambient air quality monitoring was carried out during post monsoon season 2015. The ambient air quality monitoring stations were set up at 16 different locations.

The average concentration of PM10 recorded at 16 locations ranged from 55 µg/m³ (Lana village) to 70 µg/m³ (Ingoli Village). All these values are exceeds the specified limit of PM10 given by CPCB (100 µg/m³).

The average concentration of SO2 recorded at 16 locations ranged from <8 to 8.1 µg/m³ (Daran Village). All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of NOX recorded at 16 locations ranged from 15.0 µg/m³ (Badarkha Village) to 21.6 µg/m³ (Ranmalgadh Village). All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of HCrecorded at 16 locations ranged from 1143 µg/m³ (Daran Village) to 1242 µg/m³ (Lekhmba Village).

The average concentration of NMHC recorded at 16 locations was below 10 µg/m³.

The average concentration of VOC recorded at 8 locations is all below 1 ppm.

Winter Season 2016-17

The average concentration of PM10 recorded at 2 locations ranged from 97.5 µg/m³ (Shela) to 100.5 µg/m³ (Ghuma).
The average concentration of SO2 recorded at 2 locations ranged from 12.0 (Ghuma) to 13.1 µg/m³ (Shela Village). All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of NOX recorded at 2 locations ranged from 20.3 µg/m³ (Shela) to 21.0 µg/m³ (Ghuma). All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of HC recorded at 2 locations ranged from 1052 µg/m³ (Ghuma) to 1062 µg/m³ (Shela).

**Summer Season 2017**

The average concentration of PM10 recorded ranged from 68 µg/m³ to 78 µg/m³.

The average concentration of SO2 recorded ranged from 9.0 to 10 µg/m³. All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of NOX recorded ranged from 19.6 µg/m³ to 20.3 µg/m³. All these values are within the specified limit of CPCB (80 µg/m³).

The average concentration of HC recorded ranged from 1053 µg/m³ (Ghuma) to 1136 µg/m³ (Shela).

### 1.7.5 Noise

Noise levels were recorded at 17 different locations within the study area.

Noise level during daytime was observed to be in range of 52.3 dBA to 55.2 dBA, which is within the limit of CPCB standard.

Noise level during Nighttime was observed to be in range of 42.7 dBA to 47.5 dBA, which exceed the limit of CPCB standard. One of the reasons may be due to vehicular movement at night time and close proximity of locations near to road.

### 1.7.6 Soil

Soil samples were collected from 8 different locations within the study area.

Assessment soil physical properties revealed that porosity ranged from 51 to 60 % and WHC (water holding capacity) varied from 31 to 57 %, while soil permeability ranged from 2.7 to 25.2 mm/hr. High WHC and low permeability is on account of loam to clay loam texture of soils.

The soil EC (electrical conductivity) varied from 0.173 to 1.067 dS/m, indicating low to moderately high salinity level of soils. The ESP (exchangeable sodium percentage) was also varied from 0.36 to 3.38, however it was within the prescribed limit of < 5. The high EC could be on account using underground saline water.

The pH of soil was near neutral in almost all soils, which varied from 6.33 to 6.68. Although soils showed built up of Sodium the soil pH was near neutral may be on account of predominance of sulphate salts.

The water soluble cations values showed predominance of sodium followed by Ca, Mg and K.

### 1.7.7 Surface Water Quality

The analysis results of surface water samples (4 Nos) were compared with Inland Surface Water (CPCB) Standards. It is observed from the analysis report of surface water samples that:
Based on the analyzed parameters, it can be concluded that above surface water is not fit for drinking purposes unless it is treated and disinfected.

1.7.8 Ground Water Quality

Ground water samples were collected from 8 different locations within the study area and analysed for parameters mentioned in the Indian Standard IS 10500:2012.

TDS is ranging from 1100 to 2000 and it is found to be less in Muriya i.e. 328 which indicates pearched condition or presence of surface water body or tank in near vicinity.

The presence of Nitrate in varying proportion in lower aquifer could be indicative of likely leakage from upper aquifer.

Fluoride is within permissible limits except in Sarajana village (> 1.5 ppm)

1.7.9 Biological Environment

As per topo sheet study there is no Forest, Protected Forest, Wild Life Sanctuary, Biosphere Reserve, Tiger / Elephant Reserve and Corridor falls in the project study area. However, some village water bodies and Sabarmati River is present in the buffer zone of the study area.

Core Zone (Project site premises) encompasses sporadic plantation, herbs, shrubs and grass species. While, Buffer Zone, around 1 km. of the well location mainly dominated with agriculture fields and scrub vegetation.

Overall 12 bird species reported from the well site were common. There are no mammals were reported from the well site during survey. Also, site guard people were asked about presence of mammals and reptiles within site premises.

Overall 69 floral species including 17 tree species, 19 shrubs, 26 herbs and 7 species of climbers were reported from 1 km radius of study area. This zone mainly encompasses agriculture area. Prosopis cineraria (Khejri) found very common on agriculture hedges and dominant species among trees.

Overall 8 species of mammals, 7 species of reptiles and 27 species of birds were reported through direct and indirect evidences from the buffer zone 1 km radius of the project area.

Common peafowl (Schedule-I faunal species) observed in the study are other than that there is no threatened species of flora or fauna were reported from the core zone as well as buffer zone of the study area.

1.7.10 Socio economic Profile

The study area falls in Ahmedabad District, there are about 242 villages in the study area having household of about 133530 with population of 655311.

The study area has a predominant Hindu population.

Literacy rate in the study area for male is about 58.31% and for female 41.69%.

The major crops in the study area are paddy and wheat. Cotton is also grown extensively in the study area. The villagers mainly go to the Ahmedabad and Dholka market to sell their agricultural products.
1.8 Anticipated Environmental Impact Identification, Prediction and Mitigation

1.8.1 Ambient Air

Drilling

A number of sources are there to cause potential impacts on air quality, which are as follows:

- Emissions from DG sets used as part of the drilling rig;
- Flaring of gases primarily during the testing phase will contribute to additional air pollution;
- Fugitive emissions during site preparation and closure phases;
- Emissions from vehicular movement;

Impacts of emissions from DG sets on the GLC at various distances were predicted using the dispersion modeling guidelines given by the Central Pollution Control Board, New Delhi and the AERMOD of the United States Environment Protection Agency (USEPA) based on type of fuel (HSD), Fuel consumption rate and operating conditions.

The maximum 24 hourly GLC’s are observed to be 0.17µg/m³, 25.54 µg/m³ and 0.17 µg/m³ for SO2, NOx and particulate matter respectively. These GLC’s are expected to occur at a distance of 100 m from the source towards the south direction.

The predicted impact level due to the operation of DG set is within the limit prescribed in National Ambient Air Quality Standards.

The mitigation measures for air quality impacts are:

- The exhaust of the DG set will be at sufficient height to allow dispersion of the pollutants and DG sets will be properly maintained so that emissions will be under statutory limits;
- Location of the flare stack will be decided in accordance with the Oil Mines Regulation Rules, 1984 (Chapter 9, Section 96 – Protection against Pollution of Environment), a flare stack of minimum 9 m height will be provided at the site (during testing) taking into consideration nearest habitations, campsite location and prevailing wind direction;
- Water spraying will be done on the access roads to control re-entrained dust during dry season (if required);
- The engines and exhaust systems of all vehicles and equipment used in this project will be maintained as such, that exhaust emissions are low and do not breach statutory limits set for the concerned vehicle/equipment type;
- Blow out preventer of sufficient capacity will be installed at well head during drilling operation
- Ensuring the availability of valid Pollution Under Control Certificates (PUCC) for all vehicles used on site.

Production

A number of sources are there to cause potential impacts on air quality, which are as follows:

- Emissions from DG sets (Which will run during power failure only);
- Flaring of associated gas
- Fugitive emissions during site preparation, pipeline laying etc;
- Emissions from vehicular movement;

The mitigation measures for air quality impacts are:

- Flaring of gas will be restricted to technical flaring only
Water spraying to be done on the access roads to control re-entrained dust during dry season (if required);
The engines and exhaust systems of all vehicles and equipment used will be maintained as such, that exhaust emissions are low and do not breach statutory limits set for the concerned vehicle/equipment type;
D.G set & fire engine shall be properly maintained;
Ensuring the availability of valid Pollution Under Control Certificates (PUCC) for all vehicles used on site

1.8.2 Noise Environment

Drilling
The proposed drilling operations and related activities will lead to emission of noise that may have significant impact on the surrounding communities in terms of increase in noise levels and associated disturbances, but it shall be transient in nature.

Following activities would result in increase in noise level

- Noise from rig and associated machinery
- Noise from vehicular movement
- Noise from DG sets

Mitigation measures for noise will include the following:

Temporary sound reflective barriers to be kept surrounding the drilling site of the project
The minimum height of the barriers should be 2.5 m and with 15 dB shadow zone transmission loss rating
Sufficient engineering control during installation of equipments and machineries (like mufflers in DG sets) is to be ensured to reduce noise levels at source;
Proper and timely maintenance of machineries and preventive maintenance of vehicles is to be adopted to reduce noise levels;
Personnel Protective Equipments (PPE) like ear plugs/muffs is to be given to all the workers at site and it will be ensured that the same are wore by everybody during their shift;

Production
The proposed project and related activities shall lead to emission of noise that may have insignificant impact on the surrounding communities in terms of increase in noise levels and associated disturbances

Following activities would result in increase in noise level

- Noise from Production Operation
- Noise from vehicular Traffic / movement
- Noise from DG set / fire engine

Mitigation measures for noise will include the following:

- Sufficient engineering control during installation of equipment’s and machineries (like mufflers in DG sets) is to be ensured to reduce noise levels at source;
- Proper and timely maintenance of machineries and preventive maintenance of vehicles is to be adopted to reduce noise levels;
• All noise generating operations, (except anything directly related to Production operations) to be restricted to daytime only to the extent possible;
• Personal Protective Equipment’s (PPE) like ear plugs/muffs is to be provided to all the workers at site and it shall be ensured that the same are worn by everyone during their shift.

1.8.3 Surface Water / Ground water

Drilling

Quantity
Drilling operations require the use of water for domestic requirements as well as for operations, but the use will be of temporary nature and limited to a few days (30 - 45 days) for each well (40 m³ per day per well). Water will be sourced from through tanker water supply. Hence these impacts are not significant.

Quality
Wastewater discharged from the drilling/other operations shall be collected in HDPE lined pit for evaporation. Domestic waste water will be disposed off in soak pit.

Following mitigation measures will be implemented for water pollution control:

- Proper treatment of discharged wastewater will be made by disposing waste water in an impervious HDPE lined pit for evaporation;
- The domestic waste water will be discharged into the soak pits;
- All chemical and fuel storage areas will have proper bunds so that contaminated run-off cannot meet the storm-water drainage system;
- GSPC will ensure proper spill control at site
- GSPC will use best engineering technique during drilling operation and also during the cementing job and installation of casing so that drilling mud does not contaminate the ground water

Production

Quantity
2.2 KLPD water will be required for industrial and domestic purpose at each EPS which will be sourced through bore well at site of from nearby water bore (private) or Panchayat Water supply.

Quality
During Production Operations, Waste water generated in the form of produced water shall be restricted to EPS site only. Produced Water generated shall be temporary stored in well-designed concrete pit (~200 m³) and thenafter would be send through approved tankers to CETP

Following mitigation measures will be implemented for water pollution control:

- Domestic waste water shall be discharged into the soak pits;
- All chemical and fuel storage areas shall have proper bunds so that contaminated run-off cannot meet the storm-water drainage system;
- Produced water generated at site will be dispatched to CETP Kalol, Industries Association CETP (Common Effluent Treatment Plant) which is approved by Gujarat Pollution Control Board .GSPC is the registered member of CETP Kalol for handling/treatment of 20 m3 per day effluent water
- Company shall strive continually on Reduce, Recycle, and Reuse principle.
1.8.4  Land

Drilling

Impact on land environment, due to site preparation shall be loss of vegetation or change in land use from agriculture land use/ other land use to industrial land use for a parcel of land of 110 m X 110 m. The drilling activities will require leasing of land for which voluntary land acquisition will be carried out, based on mutually agreed terms and conditions.

In case of discovery of commercial quantity of hydrocarbon an area of 30 m X 30m shall be retained and rest shall be restored to its original condition. In other case full area shall be restored and returned to the owner.

Mitigation measures

- Necessary efforts will be made during selection of drill site to minimize disruption of current land use to the extent possible;
- Necessary restoration efforts will be made during decommissioning and site closure to restore the site back to its original condition to the extent possible;
- Proper restoration of site will be carried out to bring the physical terrain, soils and vegetation, as closely possible, to their original condition;
- On completion of works (in phases), all temporary structures, surplus materials and wastes will be completely removed till 1m below the surface;
- Temporary new approach roads can be constructed and existing roads can be improved, if required, for smooth and hassle free movement of personnel as well as materials and machineries;
- Optimization of land requirement through proper site layout design will be a basic criteria at the design phase.

Production

During production, the land shall already be acquired by M/s GSPC at the time of drilling, no additional requirement of land shall be there, and hence there shall be negligible impact on land. All Well site areas are also continued on lease basis. For laying of flow lines from wells to nearby EPS, required land shall be leased from the farmer/ landowners by paying adequate compensation.

Mitigation measures

Necessary efforts will be made during selection of routes for connection of flow line / pipeline routes to EPS to minimize disruption of current land use to the extent possible;

On completion of works (installation of additional Tanks, Separators etc) at EPS site, surplus materials and wastes will be completely removed;

Optimization of land requirement through proper site layout design will be a basic criteria at the design phase;

It is our belief that land use and land cover related impacts are manageable and should not impede the objective of sustainable development.
1.8.5  **Soil**

**Drilling**

During site preparation the topsoil will be removed from the drilling site and the approach road, which contains most of the nutrients and organisms that give soil productivity. This will in turn result in minor changes of topsoil structure.

Soil quality may be affected by setting up of rig and associated machinery and will continue till the site is restored to its original condition.

Contamination of soil can result from the project activities if certain operations like storage of chemicals and fuels, cement and mud preparation, spent oil and lubricants are not managed efficiently.

Improper storage of drilling waste and return/unused drilling mud at the on-site waste disposal facility can also result in contamination of the soil.

**Mitigation measures**

- Store, preserve and protect topsoil separately to use it during restoration period;
- Carry out adequate restoration of soil at the drilling site, to the extent possible using the soil stored from piling and excavation activities;
- Dispose drilling mud and drill cutting temporarily in an impervious HDPE lined pit for evaporation carefully so that there is no spillage.
- The drilling rig system to be employed for drilling will be equipped for the separation of drill cuttings and solid materials from the drilling fluid. The drill cuttings, cut by the drill bit, will be removed from the fluid by the shale shakers (vibrating screens) and centrifuges and transferred to the cuttings containment area and will be disposed off in accordance with MoEF&CC Notification dated 30th August 2005 - G.S.R 546 (E);
- Management of spilling of contaminants such as oil from equipments, cement, drilling mud, and etc. on the soil;
- Proper arrangement of soak pits provided at the drilling site for disposal of water per well;

**Production**

During production, the land shall already be acquired by M/s GSPC at the time of drilling, no additional requirement of land shall be there. During laying of flow lines from wells to EPS, construction of above ground structure i.e. Storage tanks, Separators etc there shall be excavation activity, which may impact the top layer soil.

Contamination of soil can result from the project activities if certain operations like storage of chemicals, fuels, crude oil and hazardous waste like (Used/waste oil/oily cotton waste) etc are not managed or carried out efficiently.

**Mitigation measures**

- During pipeline/flow lines laying stage, preserve and protect topsoil separately to use it during backfilling.
- Management of spillage of contaminants such as oil from equipment's, etc. on the soil;
- Chemicals / HSD to be stored at concrete paved designated area, with roofs
- Proper arrangement of soak pits to be provided at the production site for disposal of domestic waste water;
- Hazardous waste generated at site shall be segregated at source based on the categories and stored on concrete paved designated area with roofs.
1.8.6 Socio Economic

Drilling

- The proposed drilling project will have positive impact on socio economic status of the area due to
- Generation of indirect employment in the region due to the requirement of workers in trail making, supply of raw material, auxiliary and ancillary works, which would marginally improve the economic status of the people.
- Result in an increase in local skill levels through exposure to activities.
- As the existing loose / soft surface roads, trails shall be upgraded to facilitate the movement of the heavy equipment required, the project in turn would lead to improvement in transport facilities.

Production

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- Generation of indirect employment in the region due to the requirement of workers, supply of raw material, auxiliary and ancillary works, which would marginally improve the economic status of the people.
- Result in an increase in local skill levels through exposure to activities.
- As the existing loose / soft surface roads, trails shall be upgraded to facilitate the movement of the heavy equipment required, the project in turn would lead to improvement in transport facilities.
- CSR activities shall be carried out by GSPC, under the directive of Government of Gujarat which shall help in improvement of facilities in the area.

1.8.7 Flora and Fauna

Drilling

Possible Biological Impacts of proposed Project

- Impact on terrestrial fauna due to noise
- Project infrastructure and well development will disturb agriculture land of site
- Drilling fluids, spillage, leakage and well treatment may produce chemical spillage which will disrupt agriculture of nearby farm
- Drilling activity may increase deposition of dust and dust settling on the vegetation may alter or limit plants’ abilities to photosynthesize and/or reproduce
- Loss/ damage of floral diversity and disturbance to faunal diversity
- Habitat fragmentation
- Disturbance to normal faunal movements in surrounding habitats
- Contamination of habitat

Mitigation Measures

- Acoustic enclosure shall be provided to D.G. set to reduce the noise intensity during the drilling operation
- GSPC will use water sprinkler so that the deposition of dust on nearby vegetation is reduced
- Development of plantation of native species to substitute the access cutting, site preparation will provide habitat, food and breeding areas to birds, small animals and insects
- Since, the activity is temporary wastewater discharged from the drilling operations shall be collected in HDPE lined collection pit and would be disposed of as per the prescribed norms
- GSPC will develop and implement a spill management plan in case of spill.
Use existing facilities (e.g. Access Roads) to the extent possible to minimize the amount of new disturbance.

Avoid use of unnecessary lighting at night to avoid attracting avifauna.

Reclamation of project site and surrounding area

**Production**

Possible Biological Impact of proposed project

Impact on terrestrial fauna due to noise

- Project infrastructure and well development will disturb agriculture land of site.
- Spillage, leakage and well treatment may produce chemical spillage which will disrupt agriculture of nearby farm.
- Production activity (tanker movement) may increase deposition of dust and dust settling on the vegetation which may alter or limit plants' abilities to photosynthesize and/or reproduce.

Mitigation Measures

- Flaring (if required) shall be restricted to technical flaring and shall be done as per OMR 1984 standard to minimize effect on avifauna.
- Acoustic enclosure shall be provided to D.G. set to reduce the noise intensity.
- Development of plantation of native species to substitute the access cutting, site preparation, which shall provide habitat, food and breeding areas to birds, small animals and insects.
- Use existing facilities (e.g. Access Roads) to the extent possible to minimize the amount of new disturbance.
- Avoid use of unnecessary lighting at night to avoid attracting avifauna.

1.8.8 **Occupational Health and risk to surrounding community**

**Drilling**

- Site preparation, drilling and post drilling activities involve many occupational health hazards to the workers at site.
- Noise generated during drilling operation may affect the workers and staff members.
- Handling of chemicals, fuel, may cause health hazard if not handled properly.
- Uncontrolled flow of hydrocarbon or other fluids during blow out may cause serious health injuries including fatality of workers as well as surrounding communities.

Mitigation measures

- GSPC shall arrange medical checkups in two stages which include clinical examination and laboratory test if required.
- During site preparation proper care would be taken by GSPC, proper PPE will be provided to site workers and staff members.
- Site preparation work will be carried out during day time only.
- Acoustic enclosures will be provided to DG sets and other noise generating equipment.
- GSPC will develop and implement a spill management plan to prevent risk of spill which may cause health problem.
- Blow out preventer of sufficient capacity will be used to mitigate risk of blow out.
Production

- Production activities involve many occupational health hazards to the workers at site and surrounding community.
- Noise generated during operational activity may affect the workers and staff members.
- Handling of chemicals, fuel, may cause health hazard if not handled properly.
- Uncontrolled flow of hydrocarbon or other fluids during blow out may cause serious health injuries including fatality of workers as well as damage to surrounding communities.

Mitigation measures

- GSPC shall take utmost care during site preparation either by themselves providing PPE to site workers and staff member or ensuring it through contractors.
- Acoustic enclosures will be provided to DG sets and other noise generating equipment.
- GSPC will develop and implement a spill management plan to prevent risk of spill which may cause health problem.
- All operational activities shall be carried out in confirmation with applicable OISD and OMR standards/regulations/guidelines.
- Regular internal / external HSE inspection shall be carried out.
- Community awareness with regards to Operation activities and Risk and Hazards associated with the same shall be carried out.

1.8.9 Additional Studies

Hazard Identification and Consequence Assessment

Hazards are identified for release of HSD and crude oil from storage tank at drill site and EPS respectively. Consequence analysis of all possible containment scenarios was carried out using DNV Technica Software (PHAST 7.1)

Result of Consequence Assessment

Heat radiation of 4 kw/m² crosses the boundary premises in both the scenario i.e. 25 mm eq diameter leak and catastrophic rupture of HSD storage tank at drill site and crude storage tank at all EPS, which may cause pain if duration is longer than 20 sec.

Heat radiation of 12.5 kw/m² crosses the boundary premises all the catastrophic rupture scenario HSD storage tank at drill site and crude storage tank at all EPS, which may cause 1% lethality in one minute or First degree burns in 10 sec.

However, GSPC shall take utmost safety precautions to prevent any such kind of incidents.

Disaster Management Plan

The DMP describes the role and responsibilities of various authorities under the emergency organization. First objective of a DMP is to save human life and then comes minimizing damage to property. Specifically, the DMP contains the following:

- Major emergencies likely to happen
- Prevention plan of an impending emergency by control of incidents;
- Internal emergency reporting and communication system;
- Offsite plan components;
It is recommended that the DMP be integrated into the actual operations prior to commencement of project work. Mock drills should be conducted at periodic intervals to check the efficacy of the DMP. GSPC shall develop Organizational DMP/ERP and integrate it with district and national level Disaster Management Plans.

1.8.10 Project Benefits
The project benefits are summarized as follows:

- New oil/gas finds in the block will lead to reduction in India’s dependence on imported crude oil and thereby result in considerable savings in foreign exchange.
- There will be a beneficial effect of a flourishing production unit that will directly and indirectly boost the living standards of the people, save foreign exchange and with increase in industrial activities, create more jobs in the local economy.
- The activities would result in an increase in local skill levels through exposure to drilling technology.
- In the event of discovery of commercial quantity of hydrocarbon reserves, more long-term employment opportunities shall be created. Besides, the hydrocarbons brought to the surface shall help in contributing the ongoing efforts of the government to meet the national demand of petroleum resources.
- Development of ancillary activities resulting into indirect jobs and skills of local manpower. There shall be Increase in technical knowledge of the local people. Apart from the above, GSPC (Govt. of Gujarat undertaking company), various CSR and community development activities, under directives of Govt. of Gujarat shall be carried out in the region where the hydrocarbon will be produced.

1.8.11 Environmental Management Plan (EMP)
The EMP provides a delivery mechanism to address potential adverse impacts, to instruct contractors and to introduce standards of good practice to be adopted for all project works. For each stage of the programme, the EMP lists all the requirements to ensure effective mitigation of significant biophysical and socio-economic impacts identified in the EIA. The EMP covers the following:

Role of GSPC and its contractors;

- A comprehensive listing of the mitigation measures (actions) will be prepared and implemented
- The parameters that will be monitored to ensure effective implementation of the action;
- The timing for implementation of the action to ensure that the objectives of mitigation are fully met.

1.8.12 Expenditure on Environmental Matters

Drilling
The one-time expenditure for environmental management and mitigation is estimated to be approx. Rs.21, 84,000

Production
The one-time expenditure and recurring cost for environmental management and mitigation is estimated to be approx. Rs.8, 95,000/-

1.8.13 Environmental Mitigation
GSPC shall be carrying out the operations in a way to avoid or minimize the impacts to the environment and local communities wherever practicable & desirable. Where residual impacts remain, which may have moderate
or significant impact on the environment; adequate mitigation measures shall be implemented. Some of the major mitigation measures are as below

**Drilling**

- Disposal of drill cuttings and drilling mud as per G.S.R. 546 (E) point no C: “Guidelines for Disposal of Solid Waste, Drill Cutting and Drilling Fluids for Offshore and Onshore Drilling Operation”;
- Acoustic insulation / enclosure of Diesel Generating Sets;
- Controlling air emission from Diesel Generating Sets to limiting values as per NAAQS, 2009; by ensuring regular preventive maintenance.
- Post-project restoration of site
- GSPC to implement the principle of Reduce, Recycle and Reuse

**Production**

- Produced water generated at site will be dispatched to CETP Kalol, Industries Association CETP (Common Effluent Treatment Plant) which is approved by Gujarat Pollution Control Board (GSPC is the registered member of CETP Kalol for handling/treatment of 20 m3 per day effluent water)
- Acoustic enclosures of Diesel Generating Sets;
- Controlling air emission from Diesel Generating Sets to limiting values as per NAAQS, 2009; by ensuring regular preventive maintenance.
- Post-project restoration of site.
- GSPC to implement the principle of Reduce, Recycle and Reuse

**1.8.14 Environmental Monitoring**

The following will be monitored on a regular basis during Production operation to ensure a high level of environmental performance and also to comply with statutory / legal conditions:

- During Drilling Environment Monitoring.
- Post project sampling.
- The general effectiveness of pollution control measures shall also be monitored.

Post Environment Clearance Environment Monitoring at Production facility (as stipulated by MoEF&CC/SPCB)