Executive Summary

Introduction

The Kasomarigaon Block that is part of the oil-rich Assam-Arakan Basin is located in Golaghat District Assam. This block was leased to Oil and Natural Gas Corporation (ONGC) by Director General of Hydrocarbons for exploration and mining of hydrocarbons with effect from 2009. The Ministry of Environment and Forest has granted Environmental Clearance for exploration, development and production of oil in 2007. Exploration, development and production of hydrocarbons are already an ongoing activity in this Block. Presently, ONGC proposes to drill six development and two exploratory wells in this Block. Proposal for establishing a Group Gathering Station (GGS) in Kasomarigaon and laying of pipeline between the proposed GGS and the existing GGS at Borholla have also been presented.

SENES India has been entrusted to conduct an Environmental Impact Assessment (EIA) for the proposed activities in the Kasomarigaon Block by ONGC. The study will comprise of initial scoping, site visits, environmental monitoring and analysis of reports, baselines studies and impact assessment. The study will further help in formulating an Environmental Management Plan (EMP) to be established during the project.

Block Location & Accessibility

Kasomarigaon is 20 square kilometer in lying in the Gomariguri Block of Golaghat District, Assam. The Block is located in the South of River Brahmaputra in the Dhansiri watershed, close to Nagaland Hills. The Block is topographically represented in Survey of India’s 83 J/3 and 83 F/15 toposheets. A cluster of wells - two development wells (ISK-KSDA and ISK-KSDB) is proposed to be drilled in this block. Also, KSAB and KSAG drilled as exploratory wells are to be converted in to Development wells at their respective existing drill site Locations. Further two more exploratory cum development wells (KSAD and KSAE) are proposed to be drilled at two new locations in this block.

The proposed Block can be accessed from Golaghat by road enroute to Merapani through State Highway 34. Several roads branch out from this highway towards the Block. Furkating is the nearest railway station (approx. 30 km) that connects Mariani with Guwahati. The closest Airport is at Rowriah domestic Airport at Jorhat approximately 80 km from the Block.

Procurement of Land

The proposed activities are located at Dayang Reserve Forest where the forest lands are presently being used in an unauthorized manner for agricultural purpose. ONGC has a policy of taking land on lease and giving suitable compensation for temporary field activities like exploratory well drilling for approximately four to five months. In case hydrocarbons strike, the lease period may extend for prolonged period of activity (say more than ten years) like development well drilling, construction & operation of GGS and lying of pipeline etc the land
is taken on lease for a longer duration. In this Project, ONGC in addition to taking land on lease will also need to obtain necessary permission from the Forest Department for diversion of forest land. ONGC has already applied for the conversion of 9 hectares of Forest Land for construction of GGS. Applications for the conversion of forest land for the new exploratory cum development locations KSAD, KSAE and laying of pipeline is made. On the culmination of the activities, the land is restored to its original state and returned to their owners.

Since, all the activities in this block are proposed on Forest Land that are being used in an unauthorized manner for agricultural purpose, hence the issue of rehabilitation and resettlement is absent in this Project.

2.25 hectare of land is required for each drill site and 9 hectare land is required for construction of GGS. Approval in principal has already been obtained for diversion 2.55 Hectares of Forest land for KSAC location vide file No. 3-ASB 035/2011/SHI/2614-25 dated 22nd December 2011.

**Project Activities**

- The Project activity basically involves:
  - Construction of access roads and drill sites
  - Well drilling and testing
  - Site Closure and Well decommissioning

**Construction of Drill Site**

The construction of the drill site will involve building suitable approach road, fencing of land (barbed wires), clearing of vegetation, storage of top soil upon after gauging and scraping. Bunds and storm water drains are built along the periphery of the site to contain any discharge to adjoining lands. The drilling site primarily consists of two portions – the drill platform and the drill pad. The drill platform is the elevated concretized fenced land on which the drill pad is constructed. The drilling rig supported by the derrick is placed on the drill pad. At the center of the drill pad lays the cellar pit the center of which is drilled for hydrocarbon exploration/development or production. The other ancillary structures are HDPE lined pits for temporary storage and disposal of drill cutting, waste mud, drilling wash water and oil pit.

**Drilling and Testing**

The drilling of the wells is expected to be up to a depth of 2500. Standard Land Rig or Mobile Land Rig with standard water based drilling fluid treatment system is used for drilling. ONGC is committed to use water based drilling mud for the wells. The exploratory and development wells will be drilled for 2-3 month only. Drill cuttings generated will be collected and separated using a solid control system and temporarily stored on-site in HDPE
lined pits. Drilling and wash wastewater generated will also be stored at an onsite HDPE lined pit. The water will be adequately treated in a mobile ETP to ensure conformance to the CPCB onshore oil and gas extraction industry effluent standards before disposal.

**Site closure and decommissioning**

The drill sites will be properly reclaimed and rehabilitated if indication of potential hydrocarbon is absent or commercially the reserve is not profitable. This process will involve decommissioning of rigs and all machineries; disposal of drilling waste as per CPCB guidelines, disposal of fill materials, top soil restoration.

**Construction of GGS and Pipeline Laying**

The construction of the GGS will also involve the fencing (concrete walls) of land, clearing of vegetation and storage of top soil upon after gauging and scraping. Storm water drains are built along the periphery of the site to contain any sudden discharge to adjoining lands. The land is concretized and will include the following components:

- Separator - Separation of liquid (oil and water) and gas will take place
- Liquid storage facility
- Pumping of liquid (oil and water) to Borholla GGS through a eight feet, twenty five kilometer pipeline
- Flare system
- Power generation system
- Associate Utility

The twenty five kilometer long pipeline will carry oil and water from the proposed Kasomarigaon GGS to existing Borholla GGS. The laying of pipeline will involve similar land preparation as fencing (fluorescent ribbons), vegetation clearing and storage of top soil. Sections of pipe will be lowered after trenching and boring to suitable depth. The trench will be first backfilled by excavated soil barring stones or rocks after lowering the pipeline. The laying of pipeline will progress in a manner where each section of the pipeline will be laid individually, covered with soil and then the trenching for the next section will begin in continuum.

**Project Utilities and Resource Requirements**

**Power**

The power requirement for each exploratory and development wells will be met through the operation of AC-SCR DG set of 750KW. One DG set will be operable during site construction, two operable and one standby during drilling operation and one for lighting and other power requirements. It is estimated that 6KLD of diesel will be required during drilling phase alone. Reserve Fuel will be stored as per Petroleum Rules 2002.
Water

Water demand during peak construction period is estimated to be 5KLD for construction and 3 KLD for workers at each well site. During the drilling operation, water requirement at site to meet the industrial requirements is 20 KLD. Total water requirement at each well site during drilling activities is estimated to be 1200 KL, considering a total of 60 days of drilling operation (including testing & contingency period). The water requirement at the drilling sites during construction and drilling phase will be met through procurement of surface/ground water from approved local sources/suppliers and partly through re-cycling of treated water from ETP.

Manpower

Thirty personnel will be employed at the drill site at each shift of 12 hours. Provisions for drinking water and water for other purposes, sewage disposal will be provided at drill site and campsite. Kitchen facility will be provided at the campsite.

Pollution Sources and Characterization

Noise

Construction equipment and drilling activities generate noise ranging from 79-103dBA. However, noise pollution mitigation measures are in place.

Air Emissions

DG set and flaring activities are the major sources of air pollution. Based on ISC3, maximum concentrations of 80.532 μg/m3 Particulate Matter, 34.71 μg/m3 NOx, 4.143 μg/m3 of SOx will travel to a distance of 2024.85 from a 750KW DG set with a stack ht of 9m. Maximum concentration of 34.78 μg/m3 of NOx will be emitted from intermittent Flaring activities.

Liquid Waste

9KLD of Drilling and Wash Wastewater will be generated during peak drilling period.

Solid and Hazardous Waste

The major solid waste generated during peak drilling period will be 212-225m3of mud cuttings.

Baseline Environmental Status

The study of the baseline environmental status helps in assessing the existing environmental conditions and identifying the critical environmental attributes. The study of the physical, biological and socio-economic environment of the Block and an area within a radius of 10
km from the cluster of wells comprises of the baseline environment. Primary and secondary data were collected for conducting the study.

**Physical Environment**

**Climate and Meteorology**

The study area is experiences a humid and warm sub-tropical climate throughout the year except for a cold winter in December till February. Hourly micro-meteorological data collected during the pre-monsoon reveals that the pre-dominant wind direction is South-East with an average speed of 0.81m/s.

**Air Quality**

The ambient air quality representing Particulate Matter 2.5 and 10 μm, Sulfur Dioxide (SO2), Nitrogen Dioxide (NO2) was monitored at eight different locations for 24 hours twice a week during May-June, 2013. Volatile Organic Carbons (VOCs), Methane (CH4), non-methane hydrocarbons (NMHCs) were monitored once a week for the same period. All the parameters were found to be below the National Ambient Air Quality Standards (NAAQS), 2009. The average 24 hourly PM10 at the monitoring locations ranged between 55.29-79.14μg/m3 (NAAQS-100 μg/m3). The average 24 hourly NO2 at the monitoring locations ranged between 21.07-24.71 μg/m3 (NAAQS-80 μg/m3). The average 24 hourly SO2 at the monitoring locations were found to below 4μg/m3 (NAAQS-80 μg/m3). Mean values for methane and non-methane hydrocarbon ranged between 1.8-3.35 ppm and 0.34-0.78 ppm, respectively. Mean values of VOC varied between 1.45-3.4 ppm.

**Noise Quality**

The noise quality was monitored for 24 hours at eight locations in and around the site. The ambient noise quality at day and night was below the Noise Limits set for the residential area as per Noise Pollution (Control and Regulations), 2000. The maximum daytime noise level was detected at 46dBA and the maximum nighttime noise level was detected at 37dBA.

**Physiography**

The Kasomarigaon Block lies in the Brahmputra Valley, drained by rivers and rivulets of River Dhansiri. The Block comprises of alluvial deposits of the rivers that flows down from Naga Patkoi range. A continuous belt of piedmont and foothills is extending all along the southern margin of the study area. Topographically this belt represents an undulating surface with intermittent protrusions of foothills of the Naga-Patkoi Range.
Hydrogeology

The unconsolidated formations of the sandstone, shale, limestone including conglomerate of the Coenozoic, Mesozoic and Upper Paleozoic era in the Brahmaputra Basin are significant ground water reservoirs. The depth at which the ground water occurs varies from 2 to 5m. Near the hill stations the depth of the water could go further down to 5 to 7m.

Groundwater Quality

Groundwater was collected and analysed as per IS: 10500 from five locations in the study area. All the parameters analysed was under the acceptable and permissible limit of IS: 10500 except turbidity and iron that was found to be high in all the samples. Heavy metals were absent except for Arsenic that ranged from 0.028 to 0.588mg/l in all the sampled groundwater. High total coliform count was detected in only one sample of groundwater.

Watershed and Drainage

The Block lies in the watershed of Dhansiri. River Dhansiri doesnot flow through the Block and Doyang is the principle river that drains the Block apart from Ghiladhari, Jia Kacha Jan, Sesapani, Mera Jan, Kakodanga, etc.

Surface Water Quality

Surface water was sampled upstream and downstream of Dayang, Ghiladhari and Jia Kacha Jan Rivers. After analysis the quality of the water was found suitable for Class A except at Daya river downstream where the BOD, COD is high and may be classified as Class D as per CPCB’s Designated Best Use for water quality criteria.

Land Use

The land cover data analysis of the study area shows that the 40% of the area is under cultivation and about 29% under settlements. Further about 29% of the study area is forest area and the entire stretch of the forest cover is beyond the Block boundaries situated in Nagaland. Rivers and waterbodies comprise of about 1.34% of the total study area.

Soil Quality

Primarily two types of soil – Inceptisol (Old alluvial) and Entisols (Recent Alluviums) can be seen in Golaghat District. The primary analyses of the soil sampled from agricultural field at 5 locations in the study area shows that the soils are acidic in nature, either sandy loam or clayey and absence of heavy metal content.

Natural Hazards

The study area lies in Zone V of the Bureau of Indian Standard (BIS) 2000 which might encounter earthquakes of maximum intensity. The last significant earthquake was felt in
1950 with the epicenter in Indo-China border region. The other recurrent natural hazard is flooding of Brahmaputra along with its tributaries and its distributaries. Floods are also common in the few parts of the Kasomarigaon Block. Public consultation revealed that flash flood is a common phenomenon in the Ghiladhari River.

**Biological Environment**

The Kasomarigaon Block lies in the Dayang Reserve Forest Area. The reserve forest has totally lost its tree cover due to extensive deforestation. Presently the whole area is under cultivation and not a single tree will be felled from the proposed activities. However, Golaghat district is rich in biodiversity and has a number of ecologically sensitive areas like wildlife sanctuaries, National Parks and Elephant Reserves. None of these ecological habitats lie within the study area and hence will not be impacted by the Project.

**Socioeconomic Environment**

Golaghat District in Assam has 1125 villages under eight administrative Blocks. As per 2011 Census, the total population of the district is 1,058,674 with a % decadal growth rate of 11.88. The sex ratio of male/Female is 961 and the population density is 305.

**Socioeconomic profile**

The focus of the study areas is twenty three villages in Golaghat District. It was seen from the Census Data of 2001, Chawdang Pothar Village has the highest population (2801 persons). The overall demography shows that the 22.7% and 21.7% of the population of the study area villages belongs to Scheduled Caste and Scheduled Tribe, respectively. The highest literacy rate (74.31) was observed in Athgaon and the least was found in Dighalpani Kadamguri (34.17%). The total working population varies from 28.14% (Dighalpani Kadamguri Village) to 77.85% (Athgaon Village). Mono-cropping is practiced in the study area where 81.65% of the population depends on agriculture.

**Socioeconomic Infrastructure**

The socioeconomic infrastructures of the Golaghat district as per 2011 District Handbook have been outlined here. There is 1 Civil Hospital, 1 sub-divisional hospital, 38 Primary health Centers, 1 first Referral Units, 5 Community Health Center and 144 sub centers. There are 864 Primary, 194 Middle and 173 Secondary and 23 Senior Secondary Schools. Drinking water facility exists in the premises of 46.1% of households. Power supply is present in 36.6% of households.

- On consultation with the local people, the following facts were revealed
  - Primary schools are present in almost all the villages in the study area
  - Majority of the people are farmers and paddy is the major crop
  - Electrical connection is present in all the villages
Environmental Impact Assessment

The potential impact arising due to the construction and operation of the Drilling wells, GGS and Pipeline on the environment have been identified, characterized and evaluated. The major impacts envisaged due to the realization of the Project is given below:

- **Air Quality:** The movement of vehicles, handling and storage construction materials, DG set operation and flaring are the major activities that will impact the air quality in and around the well sites through fugitive and point dust emissions. NOx is the second major pollutant that will be emitted from the operation of DG sets and flaring.
- **Noise Quality:** Operation of construction machineries, movement of heavy vehicles, operation of drilling rig, DG set operation are the activities that will primarily impact the noise quality of the surrounding environment.
- **Topography & Drainage:** Possibility of water logging due to surface run-off from elevated drill platforms or GGS site or activities like approach road construction or pipeline laying over drainage, etc may impact the topography and drainage of the surroundings.
- **Water Quality and Hydrogeology:** The surface runoff from the drill sites composed of drilling waste fluids or storm water mixed with oil and grease might contaminate rivers like Giladhari and Jia Kacha Jan if allowed to flow into them. The unquantifiable flow of formation water due to drilling through aquifer zone might impact the local water table if not cemented and cased as early as possible.
- **Biological Environment:** The proposed sites are devoid of vegetation hence there is no impact on local flora. Migratory routes or corridors of animals are not present in this Block. Sensitive wildlife locations are also absent. Hence, there is minimum impact on biological environment except on soil inhabiting organisms especially microorganisms that inhabit the aerated layer of soil.
- **Socio-Economic Environment:** Loss of livelihood is envisaged as the proposed exploratory wells, GGS and 64% of pipeline is located in land that is cultivated by the inhabitants. Disruption of infrastructure is also envisaged due to heavy vehicular movement.

The beneficial impacts due to the Project are

- The local people are interested in working for ONGC hence employment opportunity will increase.
- Improvement in basic infrastructure for facilitation of the Project that will eventually reap benefits for the local dwellers.
Quantitative Risk Assessment

The quantitative risk assessment has been done to provide a systematic analysis of the major risks associated with onshore exploratory/development drilling activities in Kasomarigaon Block. Oil spills, loss of well control/blow-out and process leaks constitute the major potential hazards of onshore drilling. Based on Frequency Analysis Method, it has been estimated that the likelihood of a blowout is Occasional/Rare at a rate of $6 \times 10^{-2}$.

Even on blowout, the probability of ignition is approximately 0.00375% i.e. negligible. The consequence analysis of Blowout assessed by using ALOHA shows settlements like Uttar Naghari Gaon, Chaodang Pothar Toranichuk and Merapani FS, Hindupur might be impacted by pool fire and natural gas release.

Pipeline failure could lead to potential hazard due to ignition of leaks that might result into a jet fire or immediate ignition of rupture that might lead to Fireball and Crater fire. The frequency analysis of past 41 years has revealed that the failure has declined from 0.87 per 1000 km.yr in 1970 to 0.35 per 1000 km.yr in 2010.

Environmental Management Plan

Site-specific Environment Management Plans (EMP) has been developed to prevent and mitigate significant adverse impacts and accentuate beneficial impacts will be implemented by ONGC for the proposed project. The key mitigation measures specific for each management plan have been discussed in the Table below:

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<th>Sl. No</th>
<th>Environment Management Plan</th>
<th>Key Mitigation Measures</th>
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</table>
| 1     | **Pollution Prevention and Abatement Plan**                      | 1. The top soil generated from site clearance activities will be stored in designated area and stabilized to prevent fugitive dust emissions. It will be used for greenbelt development in GGS and will be laid on the buried pipelines.  
2. Preventive maintenance of DG sets to be undertaken as per manufacturers schedule to ensure compliance with Sl No 95 GSR 371(E) dated 17.5.2002.  
3. All vehicles, equipment and machinery used for construction will be subjected to preventive maintenance as per manufacturer norms.  
4. Flaring will be undertaken in accordance with the CPCB Guidelines S No. 72 B. for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry.  
5. High combustion efficiency, smokeless flare/burner will be used.  
6. Installation of acoustic enclosures and mufflers on engine |
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<th>Waste Management Plan</th>
<th>Wild Life Management Plan</th>
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<td><strong>2</strong></td>
<td>1. Use of low toxicity chemicals for the preparation of drilling fluid.</td>
<td>1. The drill site will be properly fenced (chain-linked) to avoid straying of any outsider as well as wildlife;</td>
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<td>2. Management of drill cuttings, waste drilling mud, waste oil and domestic waste will be made in accordance with S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005</td>
<td>2. No temporary electric supply connection line from the grid will be laid for the proposed project activity. All electric requirements will be supplied from the internal DG sets.</td>
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<td>3. The hazardous waste (waste and used oil) will be managed in accordance with Hazardous Waste (Management, Handling &amp; Trans boundary Movement) Rules, 2008.</td>
<td>3. Noise Levels at the drill site will be controlled through selection of low noise generating equipment and installation of sufficient engineering controls viz. mufflers, silencers etc.</td>
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<td>4. The hazardous waste so stored (not more than 3 months) to be periodically sent to ASPCB registered used and/or waste oil recyclers/ facilities.</td>
<td>4. Movement of heavy vehicles will be restricted at night time.</td>
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<td>5. Proper manifest as per HWMH Rules, 2008 to be maintained during storage.</td>
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1. Project vehicular movement involved in sourcing and transportation of borrow material will be restricted to defined access routes. Precautions will be taken to avoid damage to the public access routes including highways during vehicular movement. Clear signs, flagmen & signal will be set up at major traffic junctions and near sensitive receptors viz. primary schools in discussion with Gram Panchayat and local villagers.

2. Movement of vehicles during night time will be restricted. Speed limits will be maintained by vehicles involved in transportation of raw material and drilling rig.

3. A Traffic Management Plan will be formulated and implemented by the contractor to control construction and operational phase traffic.

4. Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.

5. Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with concerned authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.

### Occupational Health & Safety Management Plan

1. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the site Engineer.

2. Contractor workers involved in the handling of construction materials viz. borrow material, cement etc. will be provided with proper PPEs viz. safety boots, nose masks etc.

3. No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day. Provision of ear plugs, ear muffs etc. and rotation of workers operating near high noise generating areas.

4. All chemicals and hazardous materials storage container will be properly labeled and marked according to national and internationally recognized requirements and standards. Materials Safety Data Sheets (MSDS) or equivalent data/information in an easily understood language must be readily available to exposed workers and first-aid personnel.

5. The workplace must be equipped with fire detectors, alarm systems and fire-fighting equipments. Fire-fighting Equipments shall be periodically inspected and maintained to keep good working condition.

6. Adequate sanitation facilities will be provided onsite for the operational workforce both during construction and operational phase of the project.

7. Training programs will be organized for the operational
### Management of Social issues and concerns

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<td>6</td>
<td>Workforce regarding proper usage of PPEs, handling and storage of fuels and chemicals etc.</td>
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<td>1. People from adjoining areas especially given job preference through local contractors according to the skill sets possessed.</td>
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<td>2. Prior to the commencement of the proposed activity, a consultation program will be conducted by ONGC with the target groups and local authorities. The primary objective of such consultation will be to share with the concerned villagers/stakeholders the objective of the proposed project associated impacts and their mitigation.</td>
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<td>3. ONGC will give more emphasis and priority on periphery development, development of health facilities and provision for drinking water facility as per Corporate Social Responsibility (CSR) Plan.</td>
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<td>4. During the drilling phase and for the rest of the project activities proper safety measures will be undertaken both for transportation as well as the other operations.</td>
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<td>5. The drill site would be fenced and gates would be constructed so that the children are refrained from straying into the site.</td>
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### Emergency Response Plan

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<td>7</td>
<td>Drilling rig and related equipments to be used for development drilling will be conformed to international standards specified for such equipment.</td>
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<td>2. Blow-out preventers and related well control equipment shall be installed, operated, maintained and tested generally in accordance with internationally recognized standards.</td>
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<td>3. Appropriate gas and leak detection system will be made available at each of the drilling location.</td>
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<td>4. Adequate fire-fighting equipment shall be provided at each drilling site.</td>
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<td>5. The EMP has been designed with a flexibility so that it can be monitored and adapted to future changes in project design, scope, or the environment and be seamlessly integrated and implemented by ONGC.</td>
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### Project Cost

Based on ONGCs previous experience of drilling in the area, cost for drilling for of 8 wells (including well site construction and site decommissioning), will be approximately INR 200 crores. Estimated project cost for construction of GGS facility and pipeline laying is 125 crores. The EMP considered for the wells is INR 44.82 lakhs.