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EIA Study on Onshore Development and Production of Oil and Gas from 28 wells and Establishment of Kasomarigaon EPS and GGS at SUAB Drill site in Forest Area in 6 PML Blocks, Golaghat and Jorhat District, Assam

February , 2020

Quality information

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Introduction

ONGC, a Public Sector Undertaking (PSU) of the Government of India, has been instrumental in exploring & developing the rich reserves of hydrocarbons including both crude oil & gas in Assam, that has contributed immensely to the State's development as well as Country's oil & gas reserve. ONGC has found high potential oil and gas reserves in the Golaghat and Jorhat districts of Assam. Extending the exploration of these reserves, ONGC proposes drilling in 28 locations in Golaghat District PML (52.12 Sq. Km.), Kasomarigaon PML additional area (56 Sq. Km), Kasomarigaon PML (20 Sq. Km), East Lakhibari PML (8.5 Sq. Km), Khoraghat Extn – I PML (83 Sq. Km) and Nambor PML (26 Sq. Km). All the PMLs are located in the forest area of Nambor and Dayang Reserve forest. ONGC has also proposed to set up a Group Gathering station at Kasomarigaon PML (Additional area), and an Early Production system at Kasomarigaon PML.

These locations will be drilled in forest area of each ML and the investment would be approximately Rs 625 crores in phase wise manner tentatively planned in next few years in these fields. Drilling & development in these locations would augment the production of hydrocarbons in the present scenario of growing demand of oil and gas in the country

The proposed project is included under activity 1(b)" Offshore and onshore oil and gas exploration, development & production)" specified in Schedule of the EIA Notification dated 14th September 2006 and subsequent amendments & categorized as "A" category project that requires an Environmental Clearance (EC) from the Ministry of Environment, Forests and Climate Change (MoEF&CC). The Terms of Reference (ToR) for the Project have been approved by MoEF&CC vide letter IA-J-11011/99/2019-IA-II(I) dated 20th April 2019.

AECOM India Pvt Ltd., a NABET-QCI accredited firm has been delegated the task of conducting an EIA study and technically assisting ONGC for obtaining environmental clearance from the MoEF&CC.

Project Description

Block location and Accessibility

The PML blocks situated in Golaghat district. The PML blocks are accessible through several roads. NH 39 passes at a distance of 15 km west from the blocks. Wokha Merapani Road or SH 34 is the main road which connects with NH 39 in Golaghat. The other SH roads like SH 32, SH 33 and SH 4 are also connected with SH 34, near Merapani.

Land Requirement

There would be drilling & development activities in 28 drilling locations in the six (6) PML areas, which has been taken on lease. The project proponent does not propose acquisition of permanent land involving residential or built-up area; hence leading to no displacement of people. Therefore, the project does not involve in resettlement and rehabilitation issues. Forest land would be used for drilling purpose, so forest clearance is applicable for the proposed project.

Pre-Drilling Activity

Before the commencement of the drilling operation, pre-drilling activities involving site selection, land lease, construction/strengthening of approach roads, Construction of drill sites, Rig mobilization and rigging up and Installation of support facilities would be carried out.

Drilling operation of Developmental wells

Drilling and Testing of well

The drilling process involves construction of a conduit between the surface and the reservoir, for the exploitation of hydrocarbons. The well will be drilled using a standard land rig or a "Mobile Land Rig" with standard water-based drilling fluid treatment system. This rig will be suitable for drilling up to the desired depth of 2200-3300 meters as planned for the project. The typical configuration of a Drilling Rig is shown in the Figure 6. Drilling is a temporary activity which will continue for about 30-60 days for each well in the block. The rigs are self-contained for all routine jobs. Once the drilling operations are completed, and if sufficient indications of hydrocarbons are noticed while drilling, the well is tested by perforation in the production casing. This normally takes 2-3 days. If the well is found to be a successful hydrocarbon bearing structure, it will be sealed off for future development.

Mud system and cuttings

Drilling of wells requires specially formulated muds that creates lubrication and cooling of the drill bit, balances subsurface formation, bring out the drill cuttings from the well bore, have thixotropic property to hold cuttings during non-operations and form thin cake to prevent liquid loss along well bore. Several additives are mixed into the mud system to give the required properties. Water based mud (WBM) will be used to the possible extent. Ingredients of WBM would be Barite, Bentonite, Carboxy Methyl Cellulose Mud Thinner / Conditioner, Resinated Lignite, Non-Weighted Spotting Fluid, Weighted Spotting Fluid, EP Lube, Drilling Detergent, Caustic Soda and Potassium Chloride.

Mud used during the operation will flush out formation cuttings from the well hole. These cuttings will be separated from the drilling mud by thoroughly washing and stored in the HDPE lined pits and after completion of the drilling activities, cuttings will be tested for hazardous nature and based on nature of the drill cuttings, final disposal pathway will be done. The total amount of cuttings produced during the entire drilling period is projected to be about 225 m^3.

Once the cuttings have been separated, the drilling fluid will be reused or processed after further treatment in a system designed to remove suspended solids that are too fine for mechanical separation in solids control package producing inlet particles called ‘flocs’. The flocs will be removed in the decanting centrifuges and the resultant sludge disposed off in High Density Polyethylene (HDPE) lined pits. The cleaned waste water will also be stored in HDPE lined pits and disposed off, after testing and any necessary treatment, to meet the regulatory requirements. The estimated amount of drilling fluid and drilling waste water generated from the whole process would be 700m3 and 15 - 20 m3/day for each well.

Well Testing

Between drilling operations for different zones, logging operations are undertaken to provide information on the potential type and quantities of hydrocarbons present in the target formations. Logging instruments (sensors) will be attached to the bottom of a wire line and lowered to the bottom of the well. They are slowly brought back, the devices reading different data as they pass each formation and recorded it on graphs, which can be interpreted by the geologist, geophysicist and drilling engineer. There are no emissions to the environment associated with wire line logging activity. The radioactive source required for well logging activity will be kept in specially designed container. Oil produced during testing activities or during development phases will be stored at the oil pit and will be transferred to the nearest Borholla GGS by oil tankers / pipeline network.

Associated Facilities

There will be other ancillary facilities like drilling mud system, ETP, Cuttings disposal, drill cementing equipment etc. and utilities to supply power (DG sets), water, fuel (HSD) to the drilling process and will be set up as a part of the project.

Well decommissioning

On completion of activities, as per the well evaluation, if commercial quantities of hydrocarbons is indicated, then the wells would either be plugged or suspended. In case the quantity of hydrocarbon is not commercially viable the wells will be permanently abandoned. In the event of a decision to suspend the well, it will be filled with a brine solution containing very small quantities of inhibitors to protect the well. The well will be sealed with cement plugs and few wellhead equipment (Blind Flange) left on the surface (Cellar). After the completion of development activities, the well will be sealed with a series of cement plugs, all the wellhead equipment will be removed leaving the surface clear of any debris and site will be restored. The embanked top soil would be overlain on the de-compacted site with certain moisture conservation measures and seeding of leguminous plant for restoration of soil nutrient level naturally.

Utilities and Resource Requirement

Water: The total quantity of fresh water required for the project during the site preparation, construction and operation phase is 1000 KLD. During the construction phase, on an average 5 KLD of water would be required for construction of drill pad and 3 KLD for domestic use. The average daily water consumption in the operation phase would be 25 m3/day of which 15m^3/day would be used for mud preparation and 10m3/d for domestic purposes (including drinking). Tankers would be deployed from nearby source through contractors. Provision of water storage would be made on-site.

Power – The power requirement during the site preparation and construction phase would be met by 4 Nos. of DG Sets (AC-SCR Type) with a diesel consumption of 6 KL/day per well location throughout the project period. The power requirement is for a small period of 8-10 months where, the intensive period lasts only for 45-60 days. It has been anticipated that four (4) nos. DG set unit would be required during the drilling and operation phase.

Labour - It is anticipated that, at any given time, there would be about 30 personnel working on site including technical staff, drilling crew, security staff etc.

Project Cost

The cost of the proposed project has been estimated would be about INR 625 Crores.

Pollution Sources

Air emissions: Point source air emissions would be generated from DG sets. Fugitive emissions would occur from vehicles involved in the drilling operations, construction activities and from windblown dust from storage and staging areas within the drill site.

Noise & Vibrations: Noise and vibration would be generated due to operation of drilling rig, DG sets and vehicles.

Liquid wastes: There would be generation of 15-20 m^3 per day of drilling & wash water and about 2.5 m3 per day of domestic waste water from per well.

Drill cuttings & waste drilling mud: Approximately 225 m^3/well of drill cuttings and 700 m^3/well of waste drilling mud would be generated.

Existing Baseline Environment of the Project Area

Baseline information about the Block was collated by review of other published literature, site surveys, stakeholder interactions and primary monitoring carried out during the period of October 2019 to January 2020 by a NABL Accredited Agency.

Sub-surface Geology
The Block is situated in Jorhat and Golaghat district. Geological set-up of both the district is represented by hilly tract and alluvial flood plain of River Brahmaputra. foot hill region is marked by the older terrace deposit. Two terrace surfaces have been identified as the Harmuti and Joyhing surfaces that represent high- and low-level terraces. These terrace deposits are characterised by undulating surface comprising boulders, pebbles of quartzitic and gneissic rocks with fine sand, silt and clay. The alluvial flood plain consists of younger and older alluvial deposits. It represents various sub-features, viz., palaeochannel, swampy/marshy land, river terraces, flood plains, point bars, channel bar and river channel.

Hydrology

The Golaghat district is underlain by Quaternary formation followed by Archaean group of rocks. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the south eastern parts, the thickness reverses considerably. Hydro-geologically, the district is proved to be very potential. Ground water occurs under water table to confined conditions

Drainage pattern of Jorhat district is characterized by river Brahmaputra, and its tributaries like south Dhansiri, Bhogdoi and Kakodonga drain the district. The tributaries originate in Naga-Patkai range and flow northward to join the Brahmaputra River, almost at right angles which give rise to subparallel type of drainage.

Hydrogeology and Groundwater Quality

The Golaghat district is underlain by Quaternary formation followed by Archaean group of rocks. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the south eastern parts, the thickness reverses considerably. Hydro-geologically, the district is proved to be very potential. Ground water occurs under water table to confined conditions.

Ground water in Jorhat district mainly present in under water table to semi-confined conditions in the near surface conditions and in the deeper horizon, under semi-confined to confined conditions. Depth to water level in the water table zone varies from 0.41 to 3.07 m bgl in the pre-monsoon period and 0.56 to 3.41 m bgl during post-monsoon period.

Total of 8 ground water samples have been collected and analysed for parameters as per IS: 10500:2012 standards. Concentrations of various heavy metals like mercury, arsenic, lead, barium, cadmium and selenium were found below detectable limits at all the sampling locations. Presence of Faecal Coliforms has not been observed in any of the water sampled.

Climate and Meteorology

The climate of Golaghat and Jorhat District is humid sub-tropical, dominated by the subtropical monsoon which is normally active from April to October with occasional winter showers. At times approach of monsoon is also marked by cyclones in April and May. The plains get flooded. Autumn and winter are dry seasons. The temperature varies from 3°C to 37°C and 04°C to 37°C (October to December) in Golaghat and Jorhat Districts respectively. The yearly rainfall for Golaghat district varied from minimum 1232 mm to maximum 1871 mm with an average rainfall of 1450 mm. The yearly rainfall for Jorhat district varied from minimum 1380 mm to maximum 2112 mm with an average rainfall of 1755 mm

Ambient Air Quality

Ambient air quality was monitored at 8 locations (for a period of 3 months – October 2019 to January 2020). The PM10 values of all monitored locations were below were NAAQS value, the values observed would be in the range of 69.72 – 71.44 µg/m^3. The PM2.5, SO_2, NOx values were in the range of 29.17 -32.77 µg/m3, 8.40- 9 µg/m3, and 13.77 –

15.21 µg/m^3 respectively and are well within the National Air Quality Standards (NAAQS). Other parameters namely CO, ozone, ammonia are within NAQS limits. Concentration of other parameters i.e., Arsenic, Lead, HC as methane and Non-methane, Benzo(a)Pyrene (BaP) and VOC were observed to be below detectable limit at all locations

Ambient Noise Levels

Noise levels were monitored at 8 locations within the study area. The locations for the noise levels are selected on the basis of sensitive receptors such as health centre, educational centres, market place etc. The day time and night time noise levels were found would be within the permissible standards of 55 and 45 dB respectively during day and night time for rural areas.

Ground water Quality

The colour of the samples was found <1 hazen units and with unobjectionable odour. The pH of water samples ranged from 7.3 to 7.5. Turbidity of all the samples found between 0.25 – 0.86, which is under the permissible limit of 5 NTU. The TDS in the water samples varied from 66 mg/l to 285 mg/l, which is incompliance with desirable limit of 500 mg/l. The concentrations of heavy metals such as Iron, Nickel, Copper, Zinc, Arsenic, chromium, lead was below their corresponding permissible limit. Bacteriological parameters namely E. Coli, Faecal and total coliform were not detected in any of the groundwater samples collected for testing.

Surface water Quality

The pH value ranged between 7.4 to 7.8 and DO concentrations between 7.35 to 7.64, which is higher than the safe criteria of 5 mg/l. The TDS concentrations of all the samples ranged between 80 to 260 mg/l. The BOD and COD ranged between 1.2. to 2.2 mg/l and 9.22 to 12.29 mg/l respectively. The load of total coliform was measured as 17 MPN/100 ml and 109 MPN/100 ml at all the sampling locations. Concentration of Metals like lead (<0.001 mg/l), mercury (<0.001 mg/l), cadmium (<0.001 mg/l), Hexavalent chromium (<0.02 mg/l) were found to be below detection limits for the surface water samples.

Soil Quality

The soil sample collected from 6 locations in general indicates slightly acidic to neutral to moderately alkaline nature. The textures of the collected soil samples were found to be sandy loam type to loamy fine sand. The EC values for the soils monitored at the study area range between 105 and 488 µs/cm. The nutrient content of the soil looks satisfactory as per monitored data. Heavy metals such as copper, lead, Nickel and zinc were detectable whereas the concentration of lead and mercury in the soil sample was below detection level in the soil of the study area. However, the monitored values were below the soil remediation intervention values specified in Dutch Soil Remediation Circular. Sodium Absorption Ratio (SAR) - Sodium absorption ratio for the samples varied between 2.34 – 3.11.

Ecology

Quadrat based survey was carried out across the Block and it was observed that major portion of the study area comprises of moderate vegetation. Total 53 species of trees, 34 species of shrubs, 24 species of herbs, 25 species of climbers and 21 species of cultivated crop were recorded. 12 species of mammals, 50 species of birds, 6 species of reptiles and five species of amphibians were observed in the study area during primary survey.

Socio- Economic Conditions

Villages are distributed between Jorhat and Golaghat District. The average sex ratio in identified villages is observed to be 970 females per 1000 males (Census 2011). According to the Census 2011, SC population, on an average account for 2.55%, with the maximum percentage being observed for Rupkolia (84.08%) in Golaghat district. ST population on an average is 10.81 % and the Bijoupur Baghdhora (97.66 %) shows the highest observed ST population. The villages in the close proximity and within the seven (6) PML areas shows an average literacy rate of 79.33 % which is slightly higher than the state average. Consultation with several group of stake holders, reveal the socio-economic issues like insufficient health care facility nearby, physical infrastructure like road condition and sanitation facilities.

Impact Assessment and Mitigation Measures

Impact on Land use

ONGC would have to take the land for short/long term lease from local panchayat/land owners. In short /long term lease, land will be converted from agricultural land to industrial land. After the completion of the lease period the land will be reinstated. Additionally, necessary measures will be adopted by ONGC through provision of adequate compensation against loss of standing crops. Once the drilling activities are completed, the rig would be dismantled, and the drilled oil will be conveyed through underground pipeline. The procurement of land on lease can lead to moderate impact mainly due to expectations on compensation package. There may be impact on the surrounding land use due to disturbance in the micro drainage pattern of the project area due to construction and drilling activities.

Mitigation Measures

- Levelling and grading operations will be undertaken with minimal disturbance to the existing contour, thereby maintaining the general slope of site;
- The excavated material from the drill site should be stored (temporarily /permanently) in uncultivated/vacant land and away from any drainage channel.
- Provide adequate compensation to landowners against loss of standing crops in accordance to regulatory requirements viz. Petroleum & Mineral Pipelines (PMP) Act, Land Acquisition Act, 1894 (amended in 1984) and Scheduled Tribes and Other Traditional Forest Dwellers Right, 2006.

Impact on Topography & Drainage

Potential impact on drainage is primarily anticipated in the form of disruption of natural drainage pattern during site preparation, approach road construction, pipeline construction and well site restoration. These activities may lead to alteration of onsite micro-drainage pattern leading to potential problems of obstruction of natural flow of water. This problem is likely to be further aggravated during the monsoons.

Mitigation Measures

- Levelling and grading operations will be undertaken with minimal disturbance to the existing contour, thereby maintaining the general slope of site;
- Provision of drainage system will be made for surface run-off
- Disruption/alteration of micro-watershed drainage pattern will be minimized to the extent possible.
- Loss of micro-watershed drainage, if any, is to be compensated through provision of alternate drainage

Impact on Air Quality

Impact

There would be impact on the ambient air quality from generation of flue gas containing Sox and NOx from stacks of DG sets & flare stacks and fugitive dusts from construction activities, vehicular movements, material stockyard, etc. he project already embeds control measures like water sprinkling at regular activities, design of DG sets as per statutory requirement and covered storage of materials.

Mitigation Measures

- Location of construction materials will be away from nearby worker's camps;
- Proper handling of materials to ensure minimal emission of dust.

To minimise emission from the vehicles, equipment and machinery the following measures would be adopted:

- Movement of construction vehicles will be minimised, and minimum speed will be enforced along the access and approach roads;
- Black-topping of roads to prevent fugitive emission
- All diesel-powered equipment will be regularly maintained, and idling time reduced to minimise emissions;
- Low sulphur diesel will be used in diesel powered equipment and best management practices would be adhered to;
- Vehicle / equipment air emissions will be controlled by good practice procedures.

Impact on Noise Quality

Potential impact on ambient noise level is anticipated from vehicular movement, operation of construction machinery, access road strengthening during well site preparation and operation of drilling rig, DG sets, pumps and ancillary equipment during drilling operation and early production.

Mitigation Measures

- Providing a green buffer at the fence line of the well pad site facing the sensitive receptors to further attenuate the noise propagation beyond the well pad boundary
- The DG set would be kept in an acoustic enclosure.
- 100 meters buffer area from the boundary of the well pad would be maintained to prevent uncalled disturbances due to noise generations on the sensitive area such as school buildings, primary health center, etc particularly during operation phase.
- Periodical monitoring of noise level within 500 mts buffer area around well pad.
- Undertaking preventive maintenance of vehicles and machine to reduce noise levels

Impact on surface water quality

Site clearance and stripping of top soil during construction/preparation phase will result in an increase in soil erosion potential leading to an increased sediment load in the surface run-off during monsoon. Also, surface run off from drilling waste (cuttings and drilling mud), hazardous waste (waste oil, used oil etc) and chemical storage areas may lead to the pollution of receiving water bodies viz. natural drainage channels. There would also be impact if wastewater generated during construction phase is released without adequate treatment.

Mitigation Measures

- Proper treatment of all wastewater and produced water discharges will be made to ensure that they comply with criteria set by the regulatory body (MoEF&CC and SPCB).
- Waste mud to be stored in the HDPE lined pit
- Drainage and sediment control systems at the well site will be efficiently designed
- Construction activities viz. stripping, excavation etc during monsoon season will be restricted to the extent possible.
- An oil-water separator will be provided at the storm water drainage outlet, to prevent discharge of contaminated run-off.
- All chemical and fuel storage areas, process areas will have dykes/bunds around it to prevent escape of contaminated surface run-off into the storm-water drainage system.

Impact on ground water quality

Groundwater extraction has not been envisaged for the proposed exploration & development project.

However, there would be impact on the groundwater resource due to the drilling activity as there may be contamination in the shallow aquifer, if present near the drill site. Cementing and casing would be done within few hours of drilling.

Possibility of contamination of subsurface and unconfined aquifers may happen if the casing and cementing of the well is not carried out properly leading to infiltration or seeping of drilling chemicals or mud into porous aquifer region. The same is also valid for disposal of drilling waste and mud in an open/unpaved pit. However, the toxicity test of the drill cuttings of nearby wells of Assam Arakan-Assam Basin has shown the absence of any hazardous chemicals.

Mitigation Measures

Wastewater would be temporarily stored in impervious pits.

Impact on soil quality

Potential impact on soil quality is envisaged in the form of increase in soil erosion and loss of soil fertility resulting from site clearance and top soil stripping during well site preparation. The impact from accidental spillage resulting from storage and handling of mud chemicals is also envisaged.

Mitigation Measures

- The top soil will be stored properly; in mound form upto a height of 2m and a slope angle of 30˚
- A jute mat will be over layered on the mound to contain the erosion of top soil.
- A garland drain will be constructed around the mound to contain the runoff of top soil.
- Adopt best practices e.g. use pumps and dispensing nozzle for transfer of fuel, use drip trays etc.
- Restricted project activities during monsoon.
- Carrying out adequate restoration of soil.

Impact on Roads and Traffic

There would be impact on Roads & traffic due to increased traffic load due to movement of machinery & manpower.

Mitigation Measures

- Speed limits would be maintained by vehicles involved in transportation of raw material and drilling rig.
- Road safety awareness programs/campaign would be organized in coordination with concerned authorities
- Entry of vehicles into the drilling site area is prohibited except for material movement.
- Adequate parking would be provided outside the drilling location.

Impact on Terrestrial Ecological environment

The Potential Impacts on the existing floral and faunal diversity may arise due to Vegetation Clearance, Illimitation from Site and Generation of noise.

Mitigation Measures

- The working area would always be kept minimum.
- For felling of trees prior approval from concerned department would be obtained;
- Appropriate shading of lights would be ensured to prevent unwanted scattering.
- Plantation of local trees would be undertaken;
- Fencing would be done on the camp site to avoid any unfortunate encounter with faunal species.

Impact on Aquatic Ecological environment

Potential impact on aquatic floral and faunal diversity is envisaged particularly during Site preparation phase and operation phase. During Monsoon, due to the surface run off from drilling waste (cuttings and drilling mud), hazardous waste (waste oil, used oil etc) and chemical storage areas may lead to the pollution of receiving water bodies and rivers unless precautionary measures are adopted.

Mitigation

- Proper treatment of all wastewater and produced water and any water discharge from well site would comply with CPCB Discharge Standards for Oil and Gas Industries
- Waste mud would be stored in the HDPE lined pit
- Drainage and sediment control systems at the well site would be efficiently designed
- All chemical and fuel storage areas, process areas would have proper bunds so that contaminated run-off cannot escape into the storm-water drainage system.

Impact on Socio economic environment

Influx of population is anticipated in all stages of the project cycle particularly during exploratory drilling. Interaction between workers with villagers of nearby areas might give rise to various issues like conflict of workers with the local population, nuisance caused by workers due to improper sanitation facilities, etc.

Mitigation

- The shortest distance as far as available/feasible would be considered for access road, with additional care to avoid division of land parcels into agriculturally unviable fractions;
- The village road identified for accessing proposed project footprints, would be strengthened and widened as per requirement

- Appropriate awareness program on grievance redressal mechanism, would be designed and implemented for local community around proposed project footprints;

Occupational Health & Safety Risks

The health and safety risks associated with drilling operations may include well kick or blow out, crane failure, fire Hazards and radiation hazard from well logging tool handling and storage.

Mitigation Measures

- Blowout preventers would be provided;
- Flare pit would be placed at a safe distance from the well head and fuel storage areas;
- Fire-fighting measures would be provided.
- Periodic onsite surveillance would be conducted so that the workers use the designated PPEs all the time;
- Periodic Health surveillance would be conducted of all working personnel
- Regular health and safety training would be provided to workers.
- Exposure of workers operating near high noise generating sources would be reduced to the extent possible;

Impact on Community Health & Safety

Community health and safety of inhabitants residing close to the drilling site is likely to get affected from frequent heavy vehicular movement along village access roads and due to noise from drilling rig operations. The increase in traffic load due to project activities would have implications on their safety too, as well as create congestion, potential delays and inconvenience for pedestrians.

Mitigation Measures

- Drilling activities would be under proper fencing
- Proper hoardings in English and local language would be displayed during construction and operation phase to prevent people from encroaching the fenced area or to make them aware of the danger associated with the project activities.
- Traffic management plan would be developed and implemented at site.
- Proper Onsite & offsite management plan along with Disaster Management Plan (DMP) would be in place to deal with emergencies and contain the impact to minimum extent.

Environment Management and Monitoring Plan

A comprehensive environmental monitoring plan has been developed for the project. Monitoring of ambient air quality, noise levels, soil and groundwater quality, etc. would be carried out by MoEF&CC/NABL/ASPCB recognized laboratories for pre and post drilling operations to assess the effectiveness of the environment management plan and adopt appropriate corrective measures if it found that those are not functioning properly.

HSE Policy

ONGC is committed to protect the environment as well as health & safety of every individual involved in its operation, and he sustainability of the environment in which it operates. ONGS already has a appropriate environmental management system in line with ISO 14001.

ONGC has implemented Integrated HSE management system (QHSE) based on ISO 14001, ISO 9001 and OSHAS 18001 in their existing installation.

ONGC would continue to conduct its activities in a professional and effective manner and comply with the legislative requirements and when found non-complaint, would promote creative measures and internal standards for safeguarding of Health, Safety & Environment to a possible extent, for all who may directly or indirectly be affected by any of the activities.

Corporate Environment Responsibility (CER)

The company would comply with the Office Memorandum of Government of India dated 1st May 2018.

EMP Budget

The capital cost & recurring expenses for implementation of EMP measures per well capital cost is about INR 15,00,000 and the recurring cost is INR 12, 00, 000 for Pollution Control Measures.

1. Introduction

1.1 Background

Oil and Natural Gas Corporation Limited (ONGC), a Maharatna company under Government of India being the leader in Exploration and Production (E&P) activities in India. ONGC has contributed 72% to India's total production of crude oil and 48% of natural gas for past few decades and established more than 7 billion tonnes of in-place hydrocarbon reserves in the country. In fact, six out of seven producing basins in India have been discovered by ONGC.

Assam is one of the most vibrant states of North east region, in terms of availability of natural resources, as hydrocarbon reserve. For this reason, many investors have set up their production and manufacturing units over the decades. The Assam & Assam Arakan Basin with major tectonic elements has rich deposits of these hydro carbons including both Crude oil and gas. The basin has been explored for more than 60 years now and ONGC has been instrumental in exploring these oil reserves.

ONGC has found high potential oil and gas reserves in the Golaghat and Jorhat districts of Assam. Extending the exploration of these reserves, ONGC proposes a number of 28 onshore wells for exploration and development drilling in some Petroleum Mining Lease (PMLs) in Golaghat District PML (52.12 Sq. Km.), Kasomarigaon PML additional area (56 Sq. Km), Kasomarigaon PML (20 Sq. Km), East Lakhibari PML (8.5 Sq. Km), Khoraghat Extn – I PML (83 Sq. Km) and Nambor PML (26 Sq. Km). All the PMLs are located in the forest area of Nambor and Dayang Reserve forest. ONGC has also proposed to set up a Group Gathering station at Kasomarigaon PML (Additional area), and an Early Production system at Kasomarigaon PML. The estimated project cost is 625 Crore.

1.2 Status of the Project

ONGC has submitted Form-1 of the EIA Notification, along with a draft Terms of Reference (ToR) for EIA study to MoEF&CC. MoEF&CC has issued approved ToR vide letter No. IA-J-11011/99/2019-IA-II(I) dated 20th April 2019. The primary data collection including baseline monitoring was conducted during the post monsoon (14th October 2019 to 15th January 2020) of 2019 - 2020, as per the requirements of the ToR.

AECOM India Private Limited has been entrusted by ONGC to undertake an Environmental Impact Assessment (EIA) for the proposed project. Additionally, as a part of ONGC's Corporate HSE Policy, an EIA study will play an important role in formulating appropriate environmental management response for the proposed development drilling project. In this perspective AECOM has strived to fulfill the project objectives delineated in the section below.

1.3 Objective of the EIA study

The objective of the EIA study for the present project is as follows:

- To establish the prevailing environmental and socio-economic condition of the PML Blocks and its surroundings along with the needs for environmental approvals to carry out exploration and development for extraction of hydrocarbons;

- To assess environmental and socioeconomic impacts arising out of the proposed activities;
- To recommend appropriate preventive and mitigation measures to eliminate or minimize pollution, environmental and social disturbances during the life-cycle of the project, ensuring compliance with environmental laws and regulation as applicable;
- To identify and propose alternative actions in terms of good practices that may help in abating environmental or socio-economic impacts due to the project;

1.4 Scope of the Study

The basic scope for this study involves conducting an EIA study to understand the environmental and social impacts of the Project and recommend suitable preventive/mitigative actions through the Environmental Management Plan (EMP). The scope for the study finalized in ToR has been summarized below:

- Initiate site visits for collection of primary and secondary information on environmental and social setting;
- Formulate environmental monitoring plan and supervision of the onsite monitoring program as per plan;
- Gathering of secondary information on baseline environmental and social settings from different veritable sources like Forest Department, Census Office, Panchayat office, etc;
- Conduct primary environmental monitoring and public consultation during socio economic survey.
- Asses environmental and social impacts.
- Formulate EMP.

1.5 Structure of the EIA report

The EIA reports and associated document and results of the study conducted by AECOM. The subsequent sections of the report present description of project activities, environmental and social baseline scenario, impact and risk assessment that might rise during the life cycle of the project. Consequently, the environmental management plan along with the mitigation measures has been put forth to combat the adverse impacts on the environment. The content of the report is structured, as tabulated in table 1:

Table 1. Structure of the EIA report

Sl. No.	Section	Brief Description
	Executive Summary	Executive Summary of EIA report.
1.	Introduction	This section covers project background; regulatory requirement and overview of the project.
2.	Project Description	Presents a Description of the Existing and proposed project.

Sl. No.	Section	Brief Description
3.	Environmental Baseline Study	Baseline Environment Status: The methodology for assessing various baseline environmental components in the study area has been identified in this chapter. The various parameters of present environmental status are identified under different aspects, which include location and regional setting of the area, physical aspects such as land use, land cover and soil quality. Hydrological aspect consists of area drainage, surface water and ground water quality. Meteorological aspect contains all the climatic factors and ambient air quality existing in the study area. Ecological environment describes the flora and fauna of the region. Human aspect includes the demographical features, socio-economic environment and infrastructure facilities of the study area.
4.	Impact Assessment and Mitigation Measures	Includes impact identification through scoping, assessment of impact, mitigation measures and evaluation of significance of residual impacts.
5.	Alternative Analysis	This section includes alternatives analysis with respect to site and technology
6.	Environmental Monitoring Program	The environmental monitoring to be scheduled during construction and operation phase is provided
7.	Additional studies	A summary of the additional studies/activities conducted as per the requirements of the ToR is given in this chapter. The additional studies conducted are Risk Assessment and Disaster Management Plan. On-site disaster management describing the on-site and off-site emergencies commands and controls have also described in this chapter. Stakeholder assessment as per primary consultation and Public hearing related issues.
8.	Project Benefits	The benefits that will be accrued from the project in the locality in particular and society in general as well as development will be identified and described in this chapter.
9.	Environmental Management Plan	This section covers introduction and elements of EMP i.e. planning, implementation, checking and management review.
10.	Summary and Conclusion	Presents the overall findings of the EIA study and includes overall justification for implementation of the project and provides explanation of how, adverse effects have been mitigated.

Sl. No.	Section	Brief Description
11.	Disclosure of Consultants	Provides brief information about AECOM and professionals who were engaged for completion of this study.

1.6 Limitations

This EIA study is based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available data and information.

This report has been developed based on the project related information provided by ONGC with the assumption that the information gathered is representative for the proposed drilling of 28 onshore exploratory and development wells and installation of GGS and EPS in Kasomarigaon PML (Additional area) and Kasomarigaon PML. If information to the contrary is discovered, the findings in this EIA may need to be modified accordingly. The impact assessment for the Project is based on the project configuration as described in Section 2 on Project Description.

1.7 TOR

The approved TOR is presented in Appendix 1-1. The compliance to TOR in the EIA report is tabulated below:

Table 2. ToR Compliance

Sl. No	Condition	Reference Section
1.	Executive summary of the project	ONGC proposes drilling of 28 development wells and setting up of early/quick production and group gathering station in forest block PML, located in Golaghat District of Assam. Refer to Executive Summary.
2.	Project description, project objectives and project benefits	Refer to Chapter 2, Section 2.1 and 2.2 **Project Description** The proposed project involves drilling of 28 development wells and setting up of Early Production Units (EPUs)/ Quick Production Units (QPUs) and Group gathering station for produced well fluid processing and production in Golaghat district of Assam. **Project Objectives** ➢ To develop and produce hydrocarbons safely. ➢ To augment National Production of oil and gas

Sl. No	Condition	Reference Section
		Project Benefits ➢ Provision of royalty to Assam Government and more access to Govt. of India ➢ Provision of direct and indirect employment opportunity to local people ➢ Increase in business opportunity for the local people ➢ Energy security for the country
3.	Cost of project and period of completion	Refer to Chapter 2., section 2.15 **Cost of Project and period of completion** The estimated project cost is Rs. 625 Crore and expected to complete within 10 – 12 years.
4.	Site details within 1 km of the each proposed well, any habitation, any other installation/activity, flora and fauna, approachability to site, other activities including agriculture/land, satellite imagery for 10 km area.	Settlement is present within 1 km radius of the all well locations. A detailed well profiling study has been done for each proposed well in the block, and all the habitation, any other installation or activity is documented within 2.5 km radius of the well location. Refer Appendix.
	All the geological details would be mentioned in the Topo sheet of 1:40000 scale, superimposing the well locations and other structures of the projects.	Refer to Chapter 2, Figure 2. The entire study area is covered by SoI Toposheet no G46K/3, G46J/15 and G46J/16. The hydrocarbon Blocks lie between 26°02'45.28"N to 26°22'31.36"N Latitude and 93°50'52.58"E to 94°08'12.55"E longitude. The study area represents flat to moderately undulating terrain with ground elevation ranging between 110 – 135 metre above MSL from north to south. The Block location map is superimposed on Toposheet and Satellite imagery.
5.	Details of sensitive areas such as National Park, Wildlife sanctuary and any other eco-sensitive area along with map indicating distance	Dayang Reserve forest and Nambar wildlife sanctuary is within the block, total 29.126 Ha of forest land is involved in this project. Refer Chapter 2, Section 2.5, figure 5.
6.	Approval for the forest land from the State/Central Govt.	Dayang and Nambar reserve forest is within the block, total 29.126 Ha land is needed, and the Forest clearance is in stage 1.

Sl. No	Condition	Reference Section
	under Forest (Conservation) Act, 1980, if applicable.	
7.	Recommendation of SCZMA/CRZ clearance as per CRZ Notification dated 6th January 2011 (if applicable).	The proposed project is located in Golaghat and Jorhat district of Assam, no shoreline is present in Assam and hence, no SCZMA/CRZ clearance is required as per CRZ Notification, dated 6th January 2011
8.	Distance from nearby critically/severely polluted area as per Notification, if applicable. Status of moratorium imposed on the area.	No critically polluted area is present (as per CPCB), within 15 km of the project area.
9.	Does proposal involve rehabilitation and resettlement? If yes, details thereof.	No rehabilitation and resettlement would be required, as the proposed well locations would not encounter with any settlement structure.
10.	Environmental considerations in the selection of the drilling locations for which environmental clearance is being sought. Present any analysis suggested for minimizing the foot print giving details of drilling and development options considered.	Analysis of alternatives has been done for project site, technologies used and use of mud for drilling purpose. Refer Chapter 5- Analysis of Alternatives
11.	Baseline data collection for air, water and soil for one season leaving the monsoon season in an area of 10 km radius with centre of Oil Field as its centre covering the area of all proposed drilling wells.	A detailed baseline monitoring analysis has been done for air, surface and ground water and soil in pre monsoon, within 10 km radius about the centre of Oil Field, covering the area of all 28 proposed drilling wells sites. The monitoring programme continued from October 2019, to May 2020. Refer Chapter 3, section 3.9, under ambient air quality section. Soil quality is covered within section 3.13. Ground water quality is covered in 3.11 and surface water is covered within 3.12.
12.	Climatology and Meteorology including	A micro meteorological station was installed in Sarupathar. Climate was dry with low temperature

Sl. No	Condition	Reference Section
	wind speed, wind direction, temperature rainfall relative humidity, etc.	throughout the season. Meteorological profile of this region characterised by low temperature with a heavy amount of rainfall. Temperature of this region varies from, 8.7°C to 28°C, with an average of 18.9°C Refer Chapter 3, section 3.9-Climate and Meteorology.
13.	Details of Ambient Air Quality monitoring at 8 locations for PM2.5, PM10, SO2, NOx, CO, VOCs, Methane and non-methane HC.	Air quality monitoring was carried out at 8 monitoring stations, within the block boundary. Average PM 10 value ranged between 71.88 – 73.77 µg/m^3, PM 2.5 ranged between 29.77 – 38.35 µg/m^3, NO_2 ranged between 14.91 – 16.57 µg/m^3 and SO_2 ranged between 7.73 – 8.40 µg/m^3. VoCs (except at one location), Methane and Non-methane HC were undetected for all monitoring locations. Most parameters analysed were observed to be within the NAAQS limit. Refer Chapter 3, Section 3.9, under heading Ambient air quality. (Table 17).
14.	Soil sample analysis (physical and chemical properties) at the areas located at 5 locations.	Sampling for soil quality analysis was carried out at 6 locations. Soil was characterised to be old alluvial, with slightly acidic in reaction. Soil texture was observed to be loam to clay loam. pH of the soil samples ranged from 5.7 to 8. Nitrogen contents in the soil samples ranged between 51,660 – 106110 kg/Ha, phosphorus content in the soil samples ranged between 152.69 – 380.43 kg/ha and potassium contents ranges between 1344 – 1749 kg/ha. Refer Chapter 3, Section 3.13, (Table 24)
15.	Ground and surface water quality in the vicinity of the proposed wells site.	**Ground water** was collected from 8 locations. TDS, hardness was found to be within permissible drinking water standard. The pH of water samples ranged from 7.3 to 7.5. Turbidity of all the collected samples varied from 0.25 to 0.86 NTU. The TDS in the groundwater samples varied from 66 mg/l to 285 mg/l. Pesticides content was undetected in the samples. Toxic substances were observed to be below detectable limits for most samples. **Surface water** was collected from 9 location including river and pond water. The pH value ranged

Sl. No	Condition	Reference Section
		between 7.4 to 7.8 in all monitoring locations and characterized as mild basic to neutral. The concentration of BOD for the water samples was found to be 1.2. to 2.2 in all the collected samples. The concentration of COD for the water samples 9.22 to 12.29 mg/l in the collected surface water samples. The water samples were found to be suitable for "B" class of water, i.e. Outdoor bathing. The analysed values also reveal that all the samples complied to the CPCB Class D i.e. Propagation of Wild life and Fisheries. Refer 3.12 Ground Water Quality and 3.13 Surface Water Quality. Table 20 and Table 22.
16.	Measurement of Noise levels within 1 km radius of the proposed wells.	Noise levels were monitored at 8 locations. Day time equivalent noise level ranged between 51.3 – 53.7 dB(A). The daytime and night-time ambient noise quality within the CPCB Standards for most monitored locations. Refer Chapter 3, Section 3.10, table 19.
17.	Vegetation and land use; flora/fauna in the block area with details of endangered species, if any.	Refer Chapter 3, Section 3.15.
18.	Incremental GLC as a result of DG set operation, flaring etc.	Resultant concentration at a distance of 2 - 5 km for PM 10 was accounted as 79.35 µg/m^3, SO_2 was 10.52 µg/m^3 and NO_2 was 28.50 µg/m^3. A detailed model representation by AERMOD is provided in Chapter 4, Section 4.2, under potential impact and mitigation measures on air quality, Figure no. 41, 42 and 43.
19.	Potential environmental impact envisaged during various stages of project activities such as site activation, development, operation/ maintenance and decommissioning.	Environmental impact assessment was done for every environmental receptor which could get affected due to the project activities at various phases. Refer Chapter 4.

Sl. No	Condition	Reference Section
20.	Actual source of water and 'Permission' for the drawl of water from the Competent Authority. Detailed water balance, wastewater generation and discharge.	Total water consumption was recorded as 25 m^3/ day/well, drawn from nearby water source with permission from the competent authority. Refer Chapter 2, Section 2.9, water table diagram is mentioned in figure 10.
21.	Noise abatement measures and measures to minimize disturbance due to light and visual intrusions	Noise abatement measure would be taken during the operational and construction phase to mitigate the noise pollution. For the propose of the project, following mitigation measure would be undertaken: • Installation of adequate engineering control on equipment and machinery (like mufflers & noise enclosures for DG sets and mud pumps) to reduce noise levels at source, carrying out proper maintenance. • Providing Personnel Protective Equipment (PPEs) like ear plugs/muffs to workers at site. • Undertaking periodic maintenance of vehicles to reduce noise levels Refer Chapter 4, Section 4.2 under the heading impact on noise quality.
22.	Details on wastewater generation, treatment and utilization /discharge for produced water/ formation water, cooling waters, other wastewaters, etc. during all project phases.	Drilling wash waste water would be adequately treated in ETP and domestic waste water would be treated in mobile STP. Treated water would be used for dust suppression and green belt. Refer to Chapter 2, section 2.12, under the heading of liquid waste.
23.	Details on solid waste management for drill cuttings, drilling mud and oil sludge, produced sand, radioactive materials, other hazardous materials, etc. including its disposal	Drill cuttings would be stored in HDPE lined collection pit and domestic waste would be stored in composed pit. Chapter 2 Section 2.12, under the heading of Solid and hazardous waste; table 13.

Sl. No	Condition	Reference Section
	options during all project phases.	
24.	Disposal of spent oil and lube.	Spent oil would be disposed as per Hazardous waste rules, 2016. Refer to Chapter 2, Section 2.12, table 13.
25.	Storage of chemicals and diesel at site. Hazardous material usage, storage and accounting	Diesel would be stored in separate storage area, within the project site, and hazardous material would be generated from the generated, disposed via CPCB approved vendors. Refer to Chapter 2, section 2.9-Utilities & Resource Requirements
26.	Commitment for the use of water-based mud (WBM) only	ONGC would use WBM only, as their standard practice. Refer to Chapter 5, section 5.5- Use of Water Based Mud
27.	Oil spill emergency plans for recovery/ reclamation	A detailed spill emergency plan is proposed for recovery and reclamation in Refer Chapter 9, table 67
28.	H_2S emissions control	preventive measures would be adapted like avoidance and extinguished of all naked flame, stopping the source of leakage etc. Details of preventive measure was given in chapter 7, section 7.2, Disaster Management Plan.
29.	Produced oil/gas handling, processing and storage/transportation	Early Production Units (EPUs) and GGS would be installed for the processing of produced well fluid. Refer Chapter 2.
30.	Details of control of air, water and noise pollution during production phase	Details of control of air, water and noise pollution during production phase were discussed in chapter 4.
31.	Measures to protect ground water and shallow aquifers from contamination	All water stored in drill site, would be kept covered I leak proof tank. Refer to Chapter 4. Impacts on ground water quality.
32.	Whether any burn pits being utilised for well test operations	In case of ground flaring, all the sites would equipped with flaring pit with proper combustion system. Refer to Chapter 2, section 2.5-Well Drilling
33.	Risk assessment and disaster management	A detail Risk assessment for every possible scenario like well fluid release, structural failure, loss of

Sl. No	Condition	Reference Section
	plan for independent reviews of well-designed construction etc. for prevention of blow out. Blowout preventer installation.	containment of fuel and disaster management plan for natural hazard is discussed in chapter 7
34.	Environmental management plan.	A detailed EMP was proposed for every environmental receptor which would be get affected during operational and construction phase. Refer to Chapter 9.
35.	Total capital and recurring cost for environmental control measures	Total capital and recurring cost of EMP is 15,00,000 lakh and 12,00,000 lakh respectively as per the 1st May 2018 OM of Government of India w.r.t. CER. Refer to Chapter 9, table 69
36.	Emergency preparedness plan.	A detailed emergency preparedness plan was discussed as onsite and offsite emergency response plan in chapter 7.
37.	Decommissioning and restoration plans	After completion of the drilling activity, partial de-mobilisation of the drilling rig and associated infrastructure will be initiated if ONGC does not strike oil after drilling at the required depth. As discussed earlier, well testing may be carried out immediately after the drilling is completed or about 3 months depending on initial evaluation timing. The complete de-mobilisation of the facilities at site will happen after well-testing has been completed. This will involve the dismantling of the rig, all associated equipment and the residential camp, and transporting it out of the project area. It is expected that demobilization phase will last about 10-15 days and will involve the trucking away of materials, equipment and other materials from site to bring it back to original condition. It is estimated that about 60 truckloads will be transported out of site during this period. Refer chapter 2, well decommissioning.
38.	Documentary proof of membership of common disposal facilities, if any	No disposal facilities are available near the project site. Project proponent will dispose waste material as per CPCB guidelines.
39.	Details of environmental and safety related documentation within the	Details of environmental and safety related documentation was discussed in chapter 6 and 9.

Sl. No	Condition	Reference Section
	company including documentation and proposed occupational health and safety Surveillance Safety Programme for all personnel at site. This shall also include monitoring programme for the environmental	
40.	A copy of Corporate Environment Policy of the company as per the Ministry's O.M. No. J-11013/ 41/2006-IA. II(I) dated 26thApril, 2011 available on the Ministry's website	CER activities to be taken up in consultation with and permission from the District Collector and also in line with the corporate environmental policy of ONGC.
41.	Any litigation pending against the project and or any direction/order passed by any court of law against the project. If so, details thereof	NA

Source: ToR issued By MOEF&CC dated 14 Apr 2019 as presented in Appendix 1-1

2. Project Description

2.1 Overview of the project

The present PML blocks, located in forest area comprises 6 PML blocks in Sarupathar and Golaghat Tehsils of Golaghat District. Some portion of Nambor and Dayang reserve forests are present within the 6 PML areas. A total of 29.126 ha of forest land is involved with the present project.

Dayalpur Field

The newly established Dayalpur structure, renamed after the exploratory success of the discovery well Suphyam-3 (renamed as Dayalpur-1) is a structural closure bounded by a set of parallel NE-SW trending normal faults. The structure is situated in close proximity to the Naga Schuppen belt (at its west) and have undergone episodic events of compression during the Neogene time. Dayalpur field consists of two PML blocks, Golaghat District PML and Kasomarigaon PML (additional area) respectively. Dayalpur field is the youngest and most promising field of Jorhat Asset. Presently 18 development wells along with one GGS have been proposed in this field to accelerate the oil and gas production in this area. The well locations are mainly falling in Dayalpur, Sonalipathar and Dineshpur village of Golaghat district. Out of the 18 well locations, 6 locations fall in Golaghat district PML and the remaining 12 locations fall within the boundary of Kasomarigoan ML (additional area). Total area of the two PMLs are 52.12 and 56 sq. km respectively. The estimated production of the field would consist of crude oil production of 497m3/day and 1.015 LSCMD of natural gas. The proposed GSS would be established with a capacity of 545m^3/day and 1.1 LSCMD of natural gas.

Kasomarigaon PML

The Kasomarigaon area (20 sq. km) is located in the South Assam Shelf of the Assam Arakan Basin. Hydrocarbons showing at different stratigraphic levels were reported in the first well on the Kasomarigaon prospect in the year 1985; commercial success could not be achieved. The area has been revisited with addition of 3D seismic data and a well KSAB was released with an objective of Barail and Bokabil formations. Presently ONGC is planning to drill two developmental well locations at KSDC and KSDD, along with an early production system. Only two developmental well locations of the fields are coming under Dayang Reserve forest. The two wells KSDD and KSDC are considered in GAGD (Gas Assisted Gravity Drainage) scheme and drilling of these locations are required to avail maximum benefits from the said scheme. The estimated crude oil production of this block would be 197m^3/day and natural gas of 3.017 LSCMD.

East Lakhibari PML

East Lakhibari PML is located at Golaghat tehsil of Golaghat district and regarded as one of the consistent oil producing field of Jorhat Asset. The PML comprises of area about 8.5 sq. km. Presently One location has been planned to be drilled near an existing site of ELAA. The estimated peak crude oil production would be 35m3/day and 3500 SCMD of natural gas.

Khoraghat EXT-1 PML

Khoraghat field is in Sarupathar tehsil of Golaghat district, the field comprises of area of about 83 sq.km. Presently a developmental location is planned to be drilled, which is situated near Khoraghat GGS. The estimated crude oil production for this PML would be 300m3/day and 2 LSCMD of natural gas.

Nambor PML

Nambor PML is located within Sarupathar tehsil of Golaghat district. It comprises of an area about 26 sq. km. It is an an important hydrocarbon-producing field of South Assam shelf was discovered in the year 1999 and came into commercial production since March, 1999. Nambor Field is characterized by the presence of multi-layered hydrocarbon reservoirs belonging to Lower Bokabil Formation. For development of the field, six Development locations are currently available for drilling. The Nambor PML is expected to provide a crude oil production of 150m3/day and 1 LSCMD of natural gas.

Presently twenty eight highly prospective development locations DPDA, DPDB, DPDC, DPDE, DPDF, DPDG, DPDD, DPDH, DPDI, DPDJ, DPDK, DPDL, DPDM, DPDN, DPDO, DPDP, DPDQ, DPDR, KSDC, KSDD KHDE, ELDA, NRDE, NRDG, NRDH, NRDJ, NRDK & NRDL are planned to drill in next five years to augment oil and gas production in the existing pools of the Dayalpur and Kasomarigaon field. During the year 2019-2024, the above-mentioned locations are planned to be taken up for drilling which falls in Golaght Distt PML, Kasomarigaon PML, Kasomarigaon PML (additional area), Khoraghat Extn-I PML, East Lakhibari PML and Nambor PML area.

2.2 Objectives and Benefits of proposed drilling activity

Objectives

- To drill and evaluate hydrocarbons' prospects safely.
- To construct facilities for hydrocarbon processing and transportation.
- Benefits of the proposed drilling activity

ONGC expects to augment the production of hydrocarbons in the present scenario of growing demand of oil and gas in the country. The neighboring village dwellers will benefit by direct or indirect means that will supplement their livelihood. The proposed project will also result in the improvement of existing infrastructure.

2.3 Site location and description

Dayalpur Field:

Golaghat Disrict PML: Golaghat District PML lies in Sarupathar tehsil of Golaghat district, and it is situated towards southern direction from the river Brahmaputra and close to Naga hills. Sarupathar is the only town present at 10 km west from the block. Assam Nagaland interstate border is lies within 10 km east from the block.

Kasomarigaon PML (additional area): Kasomarigaon PML (additional area) located in Golaghat tehsil of the district Golaghat, towards southern direction from the river Brahmaputra and close to Naga hills. Merapani s the only town present at a distance of 12 km north from the block. Assam Nagaland interstate border lies within 10 km from the block area. Apart from development wells a GGS has also been proposed in the block.

Kasomarigaon PML: Kasomarigaon PML lies in Golaghat tehsil of the district Golaghat. Merapani town is 6.73 km north from the block. Apart from two development wells an EPS has also been proposed in the block. Assam Nagaland interstate boundary is present within 10 km east from the block.

East Lakhibari PML: East Lakhibari PML is situated in Golaghat tehsil of the district Golaghat and very near to the Merapani town. Assam Nagaland interstate boundary is present within 10 km east from the block.

Khoraghat EXT-1 PML: Khoraghat EXT-1 PML is located in Sarupathar tehsil of the district Golaghat. Nearest town is Sarupathar, which is 8 km NW from the block. This block is present very near to the Assam Nagaland interstate border.

Nambor PML: Nambor PML is the adjoining PML with Khoraghat EXT-1 PML and located in Sarupathar tehsil of the district Golaghat. Nearest town is Sarupathar, which is almost 11 km north from the block boundary. Assam Nagaland interstate border is approximately 7 km east from the block.

The geographic location of the entire PML is included within overlaid on the Survey of India's Topo- Sheet No. G46J16.

Regional setting of the blocks is present in Figure 1.

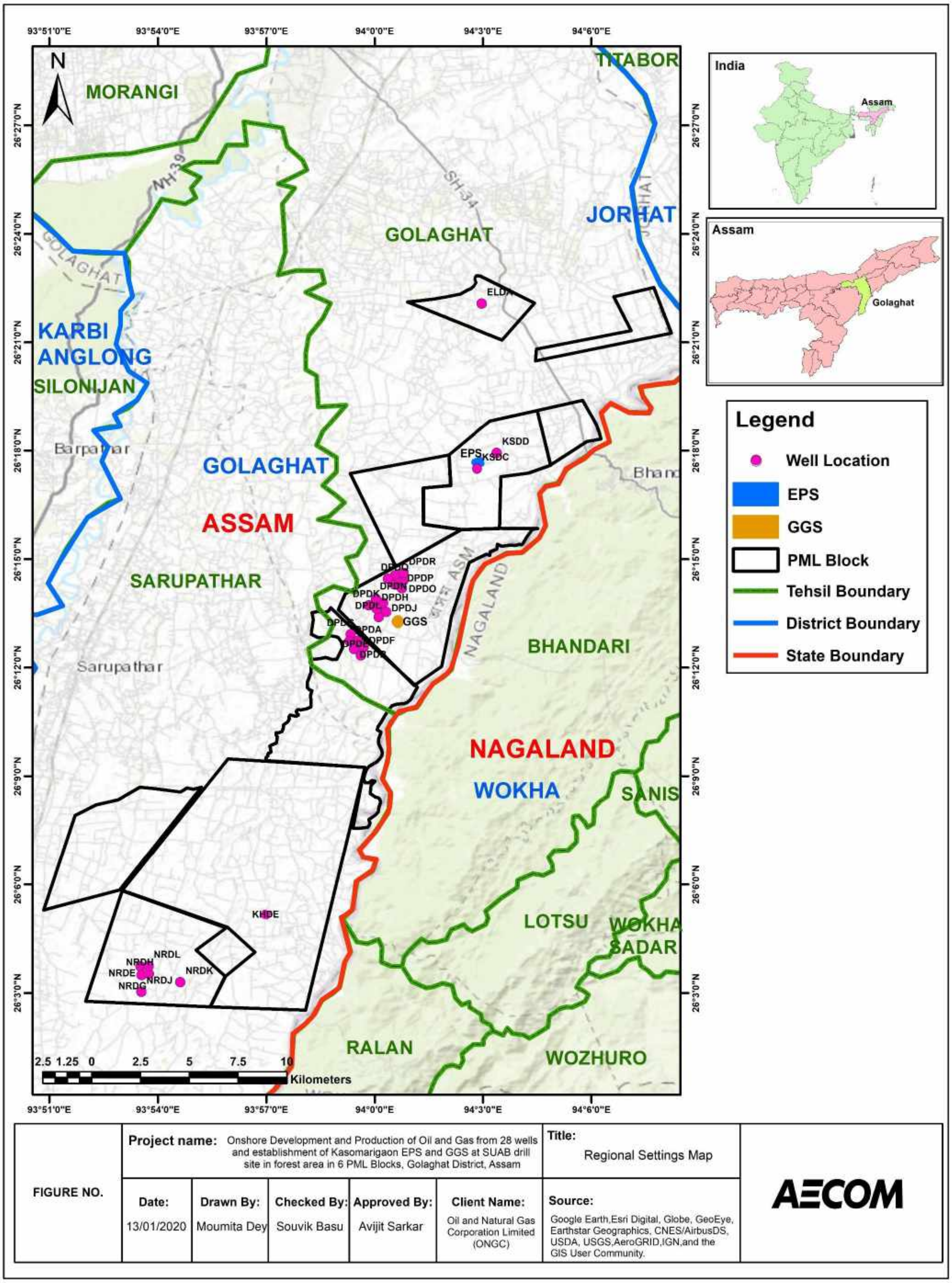


Figure 1. Regional settings of PML blocks

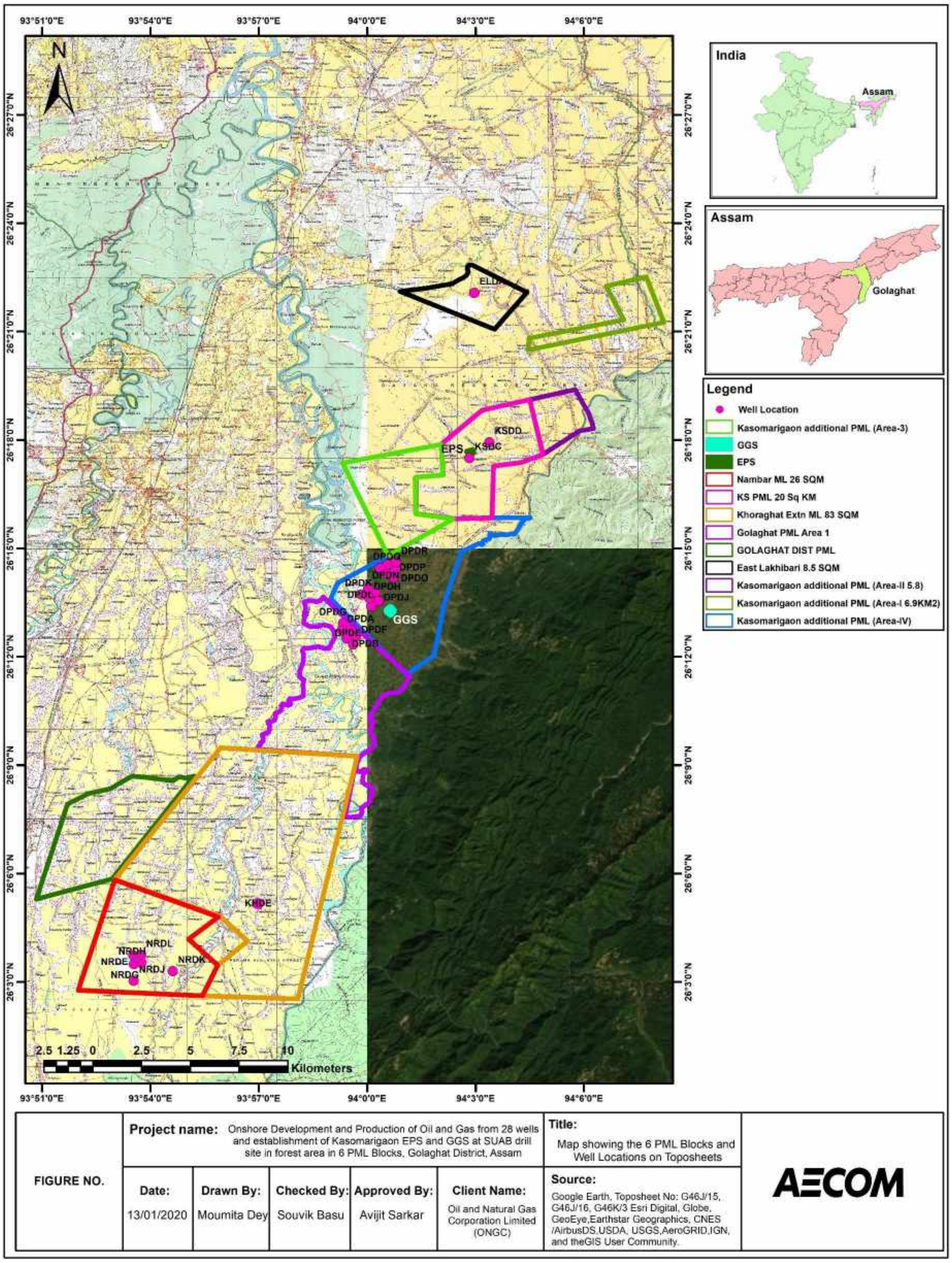


Figure 2. PMLs on survey of India Topo sheet

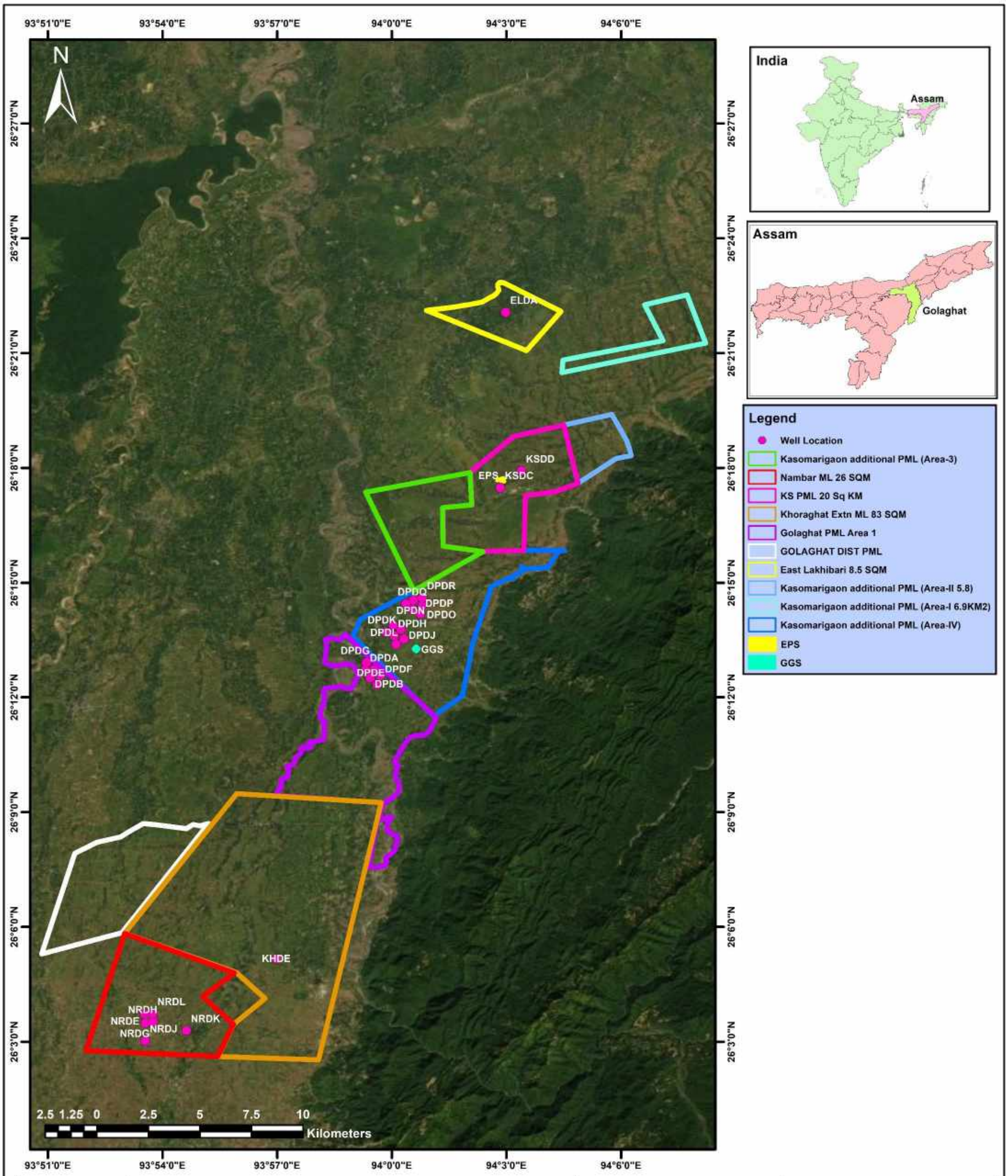


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					**Title:** Map showing the 6 PML Blocks and Well Locations on Satellite Imagery	AECOM
	Date: 13/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth,Esri Digital, Globe, GeoEye, Earthstar Geographics, CNES/AirbusDS, USDA, USGS,AeroGRID,IGN,and the GIS User Community.	

Figure 3. PMLs on Google satellite Imagery

Salient Features:

The water consumption, generation of drill cuttings and drilling fluid is determined by depth and type of well as presented in Table 3.

Table 3. Salient features of a typical development well

Well type	Depth of well	Water Consumption	Drill cutting	Drilling Fluid
Developmental	2200-3300 m	1000 m^3	225m^3	700m^3

Source: ONGC

2.4 Accessibility

- **Roads**: The PML blocks are accessible through several roads. NH 39 passes at a distance of 15 km west from the blocks. Wokha Merapani Road or SH 34 is the main road which connects with NH 39 in Golaghat. The other SH roads like SH 32, SH 33 and SH 4 are also connected with SH 34, near Merapani.
- **Railways:** Furkating is the nearest railway station approximately 30 km from the Block. It is a junction station that connects Mariani with Furkating and Guwahati with Dibrugarh. One can reach the station via public transport like TATA Magic that goes to Merapani.
- **Airport:** The nearest airport is Jorhat/Rowriah domestic airport that is approximately 80km away from the Block. To reach the Block, private cars, auto and magic have to be hired.

Accessibility map of the PML blocks are given in figure 4.

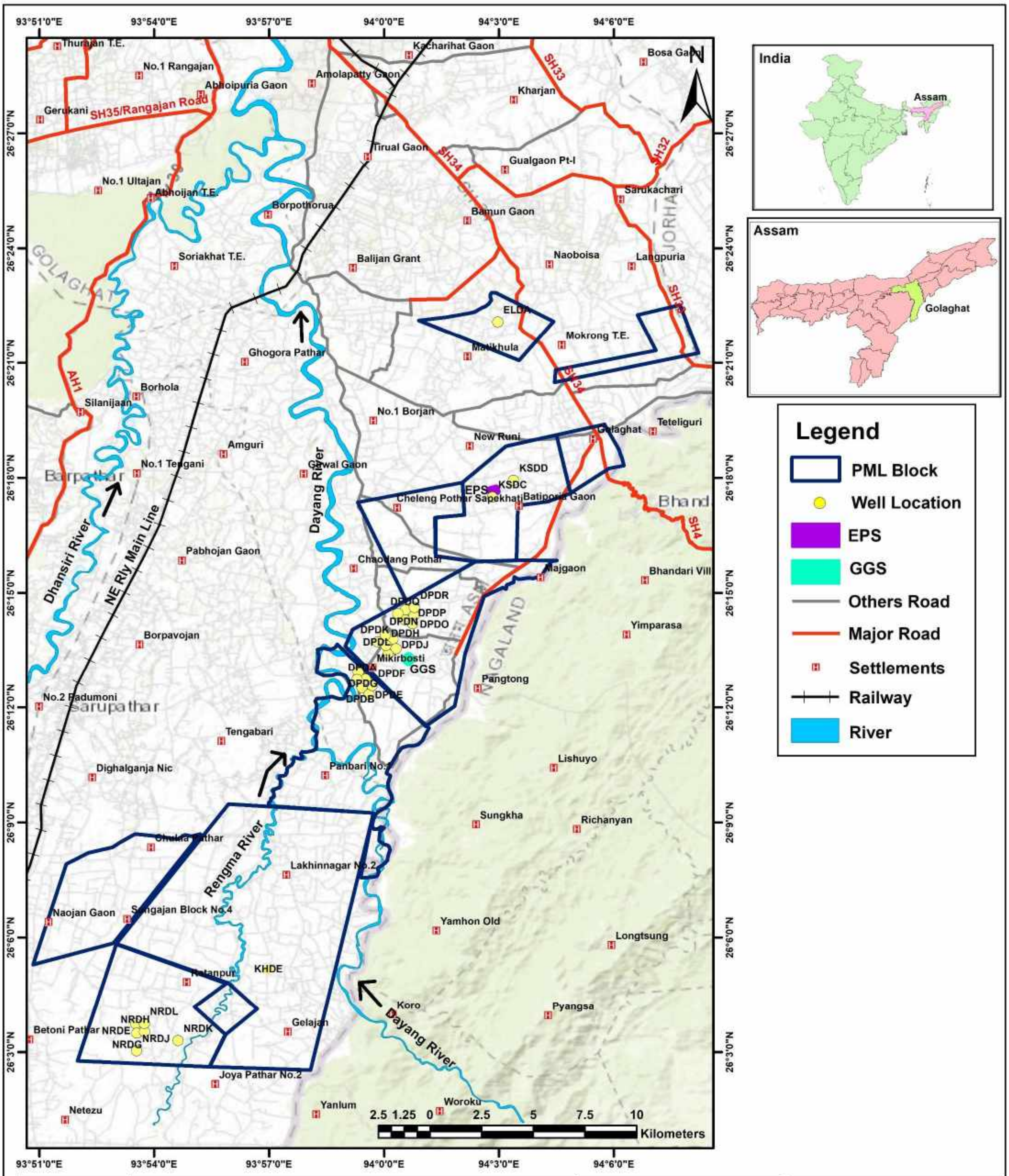


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					Title: Accessibility Map	AECOM
	Date: 21/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3 Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

Figure 4. Accessibility map of PML blocks

2.5 Environmental settings of the PML Blocks

- The PML blocks are present towards south of the river Brahmaputra in the valley of Dhansiri River. The total length of the total PMLs are approximately 38.56 km from north to south. The elevation of the PML is 108 -133 m from east to west and 103 – 134 m from the sea level. Naga Patkai hill is present at the eastern site of the region, which resembles as the interstate boundary of Assam and Nagaland, in the west of the site, Dayang river is flowing from north to south.
- Two reserve forests, Dayang Reserve Forest and Nambor Reserve Forest is present within 10 km boundary of the PML blocks. Nambor Reserve Forest is present at the North western direction of the block, some portion of Nambor and Khoraghat Extn -I PML is falling under South Nambor Reserve Forest. The block falls within Dayang Reserve Forest, however the landuse pattern of the area has shifted from forest land to agricultural and homestead land. Kasomarigaon PML (Additional area), Kasomarigaon PML, East Lakhibari PML are coming under Dayang Reserve Forest. A total of 29.162 Ha of land is involved in the PML area.
- Dhansiri river flows in the western side of the PMLs, from south to north direction., The nearest PML is Golaghat District PML (Cluster 1), which is almost 4 km from the nearest PML boundary. Dayang River and Rengma River, a tributary of Dayang River through are the main rivers flowing through PML area, while two other minor rivers, Ghiladhari and Sesapani runs within the PML area. These rivers are perennial in nature, and fed by the streams of Naga hills, which sometimes cause flash flood in the nearby villages.
- Major settlements are present in Merapani, Sarupathar and Golaghat, which are present within the block, some other villages like Kalyanpur, Sonitpur, and Athagaon having a moderate settlements present within the Block. Mokrong Tea estate is one of the largest tea estate present within the PML area.
- No major industries are located within the PML area, except some tea processing unit.

2.6 Well location and environmental settings of the wells, within the PMLs

The proposed well sites were selected based on environmental considerations viz. location of sensitive ecological habitats, settlements, schools/ hospitals, water bodies etc. Care had been taken to locate wells distantly from the above-mentioned receptors. Primarily, agricultural areas have been selected for the well drilling programme.

A GGS has also been proposed for the project in Kasomarigaon PML (Additional area), near an existing drill site of SUAB.

An EPS has been also proposed for the production of oil and gas from the two development wells KSDC and KSDD, near an existing drill site of KSAB, in Kasomarigaon PML.

The geo co-ordinate of the GGS, EPS and wells along with their names and types proposed to be explored and developed in the Block is given in Table 4.

Table 4. Coordinates of the wells

Sl No	Oil Field	Wells to be Drilled	Well Coordinate
1.	Nambor	NRDE, NRDG, NRDH, NRDL, NRDJ and NRDK	PROPOSED LOCATION (NRDE) 93° 53' 38.580" E 26° 3' 33.980" N PROPOSED LOCATION (NRDG) 93° 53' 38.685" E 26° 3' 33.712" N PROPOSED LOCATION (NRDH) 93° 53' 38.756" E 26° 3' 33.947" N PROPOSED LOCATION (NRDL) 93° 53' 38.932" E 26° 3' 33.914" N PROPOSED LOCATION (NRDJ) 93° 53' 35.170" E 26° 3' 1.540" N PROPOSED LOCATION (NRDK) 93° 54' 37.131" E 26° 3' 18.108" N
2.	Kasomarigaon	KSDC, KSDD	PROPOSED LOCATION (KSDC) 94° 2' 48.430" E 26° 17' 38.790" N PROPOSED LOCATION (KSDD) 94° 3' 26.196" E 26° 17' 58.452" N
3.	East Lakhibari	ELDA	PROPOSED LOCATION (ELDA) 94° 2' 58.190" E 26° 22' 4.730" N
4.	Kasomarigaon	EPS under GAGD project	A 94° 02' 51.73" E 26° 17' 37.33" N B 94° 02' 57.25" E 26° 17' 38.85" N C 94° 02' 55.32" E 26° 17' 44.53" N D 94° 02' 45.29" E 26° 17' 41.77" N E 94° 02' 45.27" E 26° 17' 40.08" N F 94° 02' 50.36" E 26° 17' 41.34" N
5.	Dayalpur (Kasomarigaon PML additional area, cluster 3)	DPDM, DMDN, DPDO, DPDP, DPDQ DPDR	PROPOSED LOCATION (DPDM) 94° 0' 30.421" E 26° 14' 16.320" N PROPOSED LOCATION (DPDN) 94° 0' 30.220" E 26° 14' 16.330" N PROPOSED LOCATION (DPDO) 94° 0' 30.020" E 26° 14' 16.330" N PROPOSED LOCATION (DPDP) 94° 0' 30.411" E 26° 14' 16.030" N PROPOSED LOCATION (DPDQ) 94° 0' 30.210" E 26° 14' 16.040" N PROPOSED LOCATION (DPDR) 94° 0' 30.010" E 26° 14' 16.040" N

Sl No	Oil Field	Wells to be Drilled	Well Coordinate
6.	Dayalpur (Kasomarigaon PML additional area, cluster 2)	DPDD, DPDH, DPDI, DPDJ, DPDK and DPDL	PROPOSED LOCATION (DPDD) 94° 0' 4.261" E 26° 13' 36.320" N PROPOSED LOCATION (DPDJ) 94° 0' 4.060" E 26° 13' 36.330" N PROPOSED LOCATION (DPDI) 94° 0' 4.250" E 26° 13' 36.140" N PROPOSED LOCATION (DPDL) 94° 0' 4.050" E 26° 13' 36.150" N PROPOSED LOCATION (DPDK) 94° 0' 3.850" E 26° 13' 36.150" N PROPOSED LOCATION (DPDH) 94° 0' 3.860" E 26° 13' 36.330" N
7.	Suphyam	GGS at Suphiyam -1	A 94° 0' 41.199" E 26° 13' 16.444" N B 94° 0' 38.309" E 26° 13' 19.501" N C 94° 0' 35.179" E 26° 13' 16.537" N D 94° 0' 38.296" E 26° 13' 13.490" N
8.	Dayalpur (Golaghat District PML)	DPDA, DPDB, DPDC, DPDE, DPDF DPDG	PROPOSED LOCATION (DPDA) 93° 59' 24.990" E 26° 12' 29.460" N PROPOSED LOCATION (DPDB) 93° 59' 24.790" E 26° 12' 29.500" N PROPOSED LOCATION (DPDC) 93° 59' 24.930" E 26° 12' 29.190" N PROPOSED LOCATION (DPDE) 93° 59' 24.740" E 26° 12' 29.221" N PROPOSED LOCATION (DPDG) 93° 59' 24.560" E 26° 12' 29.260" N PROPOSED LOCATION (DPDF) 93° 59' 24.610" E 26° 12' 29.540" N
9.	Khoraghat	KHDE	A:595052.18, 2885604.08 B:595007.06, 2885481 C:594886.75, 2885528.11 D:594931.98, 2885650.58 (ALL ARE DGPS COORDINATE)

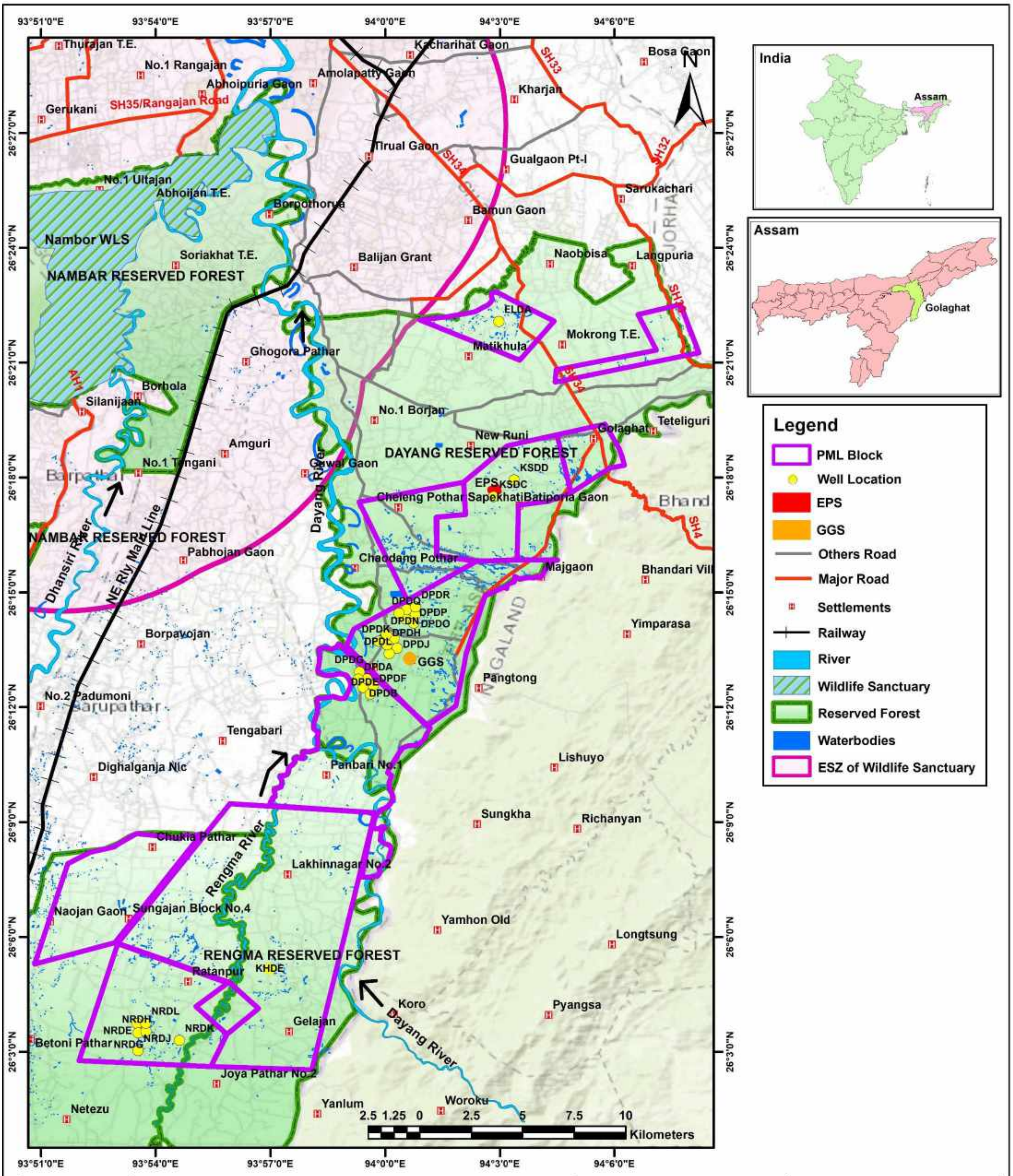


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					Title: Environmental Settings Map	AECOM
	Date: 21/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3 Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

Figure 5. Environmental settings map of PML

2.7 Developmental well drilling

The project activities related to development of wells has been outlined in the following sections in the above sequence.

Project Schedule

The lifecycle of project activities for the Development well Drilling has been divided into 3 distinct phases and each of them is described in detail in the subsequent sections. The project schedule for different phases of the project is shown in Table 5. The dates provided for future activities are estimated based on the planned schedule at the time of writing this EIA and may be subject to change. The Project schedule of the commissioning and decommissioning of the development wells will be the same except the lifecycle of the development wells will be prolonged for few years until the hydrocarbon is exhausted.

Site Preparation and access road construction

Site preparation will involve all activities required to facilitate the transport and operation of the drilling rig and associated equipment and machineries. The different stages involved in site preparation are described as follows:

- Site Selection.
- Land Lease.
- Construction of approach road.
- Rig mobilization and rigging up.
- Installation of support facility.

Site Selection

- The foremost requirement for site selection is the geological formation of the targeted area. All locations were selected by ONGC's drilling department based on the geological data available. A preliminary site survey was already undertaken by the ONGC drilling team. Suitable drilling locations were selected based on the physical (terrain and access) and technical suitability. Based on the above geological consideration, the following environmental considerations were adopted during selection of drill sites:
- Away from dense human habitat.
- Easy access road to reach the targeted area.

Land Lease

- The present project propose 28 development wells (DPDA, DPDB, DPDC, DPDE, DPDF, DPDG, DPDD, DPDH, DPDI, DPDJ, DPDK, DPDL, DPDM, DPDN, DPDO, DPDP, DPDQ, DPDR, KSDC, KSDD KHDE, ELDA, NRDE, NRDG, NRDH, NRDJ, NRDK & NRDL), along with 1 GGS and 1 EPS. The development wells will be drilled at existing locations, as well as new lands. An approximate 9 Ha of land is required for establishment of each GGS and EPS, and the land would be taken on long term renewable lease.

- No resettlement issues have arisen for the proposed project, as no acquisition of permanent land has been planned. Residential or built up area would not be acquired for the proposed project. Therefore, the proposed project does not involve any displacement of people.

Forest Land and Forest Clearance:

The total PML blocks lie in Dayang and Nambor Reserve forest. As per Forest Conservation Act, 1980 forest clearance is mandatory for using the land for drilling activities from the forest department of Assam. Application have already made for land diversion for construction of access roads and development drill site (NRAB drilling location 3.52 Ha), (NRAF drilling location 1.78 Ha), (NRDI drilling location 1.99 Ha), (SUAA drilling location 2.16 Ha), (DPDA drilling location 2.597 Ha), (DPDD drilling location 2.730 Ha) and (DPDM drilling location 2.629 Ha) to the forest department.

As described in the earlier paragraph, the entire part, where the PML area is located, is deforested and presently used for agriculture and human settlement. The people residing over are mostly non-tribal. However, their livelihood is dependent on these diverted forest land. Agriculture is extensively practiced by the inhabitants over several generations in these areas. ONGC will procure the proposed land (short term or long-term lease) from the villagers who are presently cultivating the land. The villagers will be adequately compensated for the above-mentioned period of activities and crop yield. For development wells, where the period of activity stretches for several years, long term renewable lease will be undertaken.

Construction of Access Road:

Access road would be made for the easy approach to the well site, for which diversion of forest land is required. The details of approach road and the forest land required for developing the road is given in Table 5.

Table 5. Forest land required for approach road

Drilling Location	Forest Area required (Ha)
NRAB	Existing approach road
NRAF	Existing approach road
NRDI	Existing approach road
SUAA	Existing approach road
DPDA	0.052
DPDD	0.17
DPDM	0.08

Construction of Drill site:

Cluster 1 Development wells (DPDA, DPDB, DPDC DPDE and DPDG) present in Golaghat District PML in Dayalpur area would be drilled from a single location, similarly Cluster 2 development wells (DPDD, DPDH, DPDI, DPDJ, DPDK and DPDL) in Kasomarigaon PML (additional area) would be drilled from single location. Cluster 3 development wells (DPDM, DPDN, DPDO, DPDP, DPDQ and DPDR) would also be drilled from a single location. KSDC and KSDD well location would expect to be drilled from the existing site of KSAB.

ELDA well location of East Lakhibari PML is present within the existing site of ELAA, similarly the well locations of Nambor PML are present within the existing site. Therefore, no site construction would be required for the above-mentioned wells. The following sub activities would be carried out for new drill sites:

<u>Fencing</u>: The proposed well site will be duly fenced to a height of about 2 m using chain link and barbed wires to restrict unlawful entry into the site.

<u>Top Soil Scraping</u>: The depth of the top soil of the entire drill site will be gauged scraped and stored in designated top soil storage site for future use (site reclamation and rehabilitation).

<u>Construction of Drill Platform</u>: Once the top soil removal process is completed, the entire drill site will be elevated and leveled and compacted. Drill sites may require filling of earth to elevate the drilling platform based on local topography and High Flood Level (HFL). Quantity of fill material required for each drill sites depends upon the site elevation and HFL. Fill material for pit, will be met from excavated material required for drill site and balance amount will be sourced from authorized quarry area. Pits will be required for storage of mud, drill cutting, waste water, formation water, etc. These are as follows:

- Construction of cellar pit for installation of well head and BOP.
- Construction of 1 HDPE lined pit of dimension 30’X 33’X 5’ at well site for temporary storage and disposal of drill cutting and waste mud.
- Construction of 3 HDPE lined pit of dimension 30’X 33’X 5’, 38’X 33’X 5’, 23’X 20’X 5’ for temporary storage and disposal of drilling wash water.
- Construction of 1 Oil pit of dimension 3’X 3’X 4’.
- Modular Sewage Treatment Plant (STP) shall be installed for treatment of sewage at the drill site.

<u>Construction of Bunds & Storm Water Drains</u>: The soil excavated from the pits will be used to build a raised bund/embankment bordering the periphery of the drill site. A storm water drain is constructed before the bund. Oil-water separator and silt-trap will be constructed at one end of the storm water drain.

Construction of Drill Pad: A flat rectangular/square drilling pad would be developed at site to facilitate drilling and testing of hydrocarbons. Reinforced Cement Concrete (RCC) will be used for the construction of foundation system.

Rig mobilization and Rigging up:

A rig building process will follow the site preparation activities. This process involves transport of rig and auxiliary equipment, assembling of various rig parts and equipment to drill a well. The rig including auxiliary equipment and camp facilities will be transported via trailer loads. Once the drilling rig is assembled, thorough rig inspection will be carried out to check equipment working capability and quality standards. The rig will have various allied equipment like mud tanks, mud pumps, compressors, fuel tank, DG sets etc. Well spudding is the start of drilling activity. Cellar Pit will be drilled to a desired depth based on well design. After drilling Cellar Pit, it will be cased with a pipe and this process is called “Casing”. Casing provides support to hole wall and secures hole section. Other than that, it isolates problematic hole sections such as loss zones, shale sections, over pressurized formations etc. After running casing, space between hole wall and “Casing” will be cemented by oil well cement with some additives like Retarder (R-53) and Friction reducers (FR – 22). Total requirement of the cement would be 100 metric ton/well. Casing details is provided in table 6.

Table 6. Casing details for vertical/inclined wells

Length of the drill hole	Hole size	Casing size
Upto 550 m	17.5 inches	13.37 inches
Upto 1950 m	12.25 inches	9.62 inches
Upto final depth	8.5 inches	5.5 inches

This process of drilling and casing the hole section continues until the final well depth (2200- 3300m) is achieved. Lengths and diameters of each section of the well are determined prior to drilling and are dependent on the geological conditions through which the well is to be drilled. Once each section of the well is completed; the drill string is lifted, and protective steel pipe or casing lowered into the well and cemented into place.

Installation of Support facility

To support the drilling operation, the following systems and services will be included at the rig package:

- Environmental Protection – Blow Out Prevention (BOP) system, wastewater treatment unit, cuttings handling equipment and shale shaker for separation of drill cuttings from drilling fluid

Drilling and testing of well

The exploitation of hydrocarbons requires the construction of a conduit between the surface and the reservoir. This is achieved by the drilling process. The well will be drilled using a standard land rig or a "Mobile Land Rig" with standard water-based drilling fluid treatment system. This rig will be suitable for drilling up to the desired depth of 2200-3300 meters as planned for the project. The typical configuration of a Drilling Rig is shown in the Figure 6. Drilling is a temporary activity which will continue for about 45-60 days for each well in the block. The rigs are self-contained for all routine jobs. Once the drilling operations are completed, and if sufficient indications of hydrocarbons are noticed while drilling, the well is tested by perforation in the production casing. This normally takes 2-3 days. If the well is found to be a successful hydrocarbon bearing structure, it is sealed off for future development, if any.

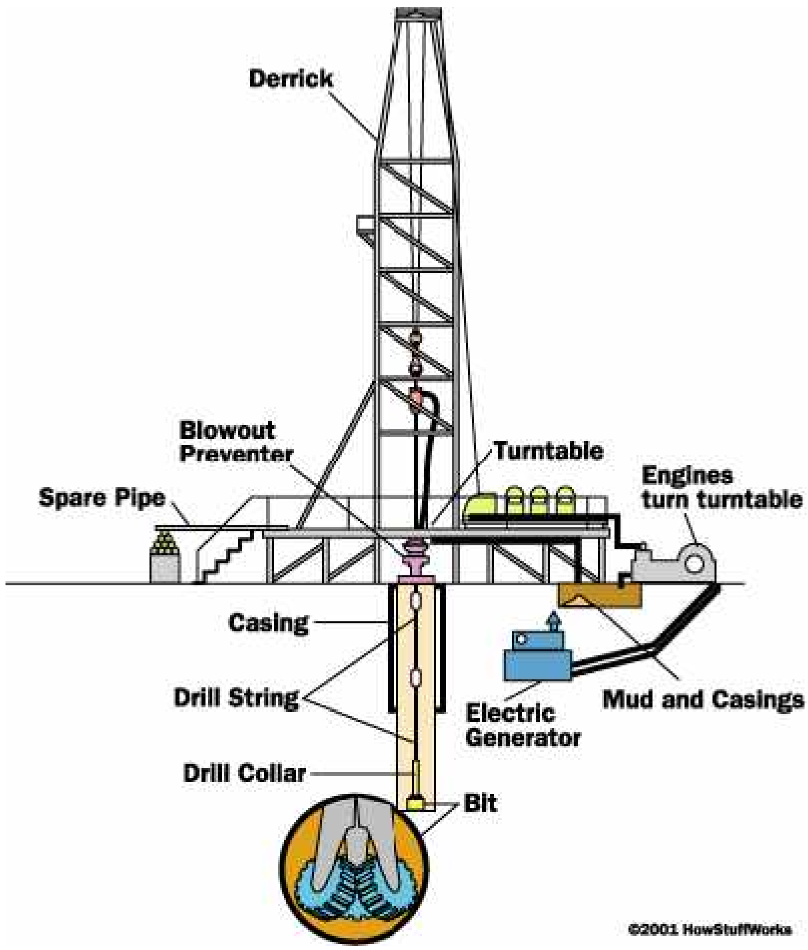


Figure 6. Typical drilling Rig configuration

Additionally, there will be other ancillary facilities like drilling mud system, ETP, Cuttings disposal, drill cementing equipment etc. and utilities to supply power (DG sets), water, fuel (HSD) to the drilling process and will be set up as a part of the project.

Mud system and Cuttings

During drilling process, a fluid known as drilling fluid (or 'mud') is pumped through the drill string down to the drilling bit and returns between the drill pipe –casing annulus up to surface back into the circulation system after separation of drill cuttings /solids through solids control equipment. Drilling fluid is essential to the operation and helps in controlling downhole pressure, lift soil/rock cuttings to the mud pit, prevent cuttings from settling in the drill pipe, lubricate, cool and clean the drill bit amongst other functions.

Drilling Mud

Drilling of wells requires specially formulated muds which basically comprise inert earth materials like bentonite, barite in water with several additives to give mud weight, fluidity and filter cake characteristics while drilling. The drilling muds have several functions like lubrication and cooling of the drill bit, balancing subsurface formation, bringing out the drill cuttings from the well bore, thixotropic property to hold cuttings during non-operations, formation of thin cake to prevent liquid loss along well bore etc. Several additives are mixed into the mud system to give the required properties. Water based mud will be used to the possible extent in exploratory drilling but use of synthetic based mud may require due to complexities associated with the geological formations and associated hole stability problems.

Drill Cuttings

Mud used during the operation will flush out formation cuttings from the well hole. These cuttings will be separated from the drilling mud by thoroughly washing. Cuttings will then be stored in the HDPE lined pits and after completion of the drilling activities, cuttings will be tested for hazardous nature and based on nature of the drill cuttings, final disposal pathway will be finalized by ONGC. The total amount of cuttings produced during the entire drilling period is projected to be about 225 m^3.

Once the cuttings have been separated, the drilling fluid will be reused or processed after further treatment in a system designed to remove suspended solids that are too fine for mechanical separation in solids control package producing inlet particles called ‘flocs’. The flocs will be removed in the decanting centrifuges and the resultant sludge disposed off in High Density Polyethylene (HDPE) lined pits. The cleaned waste water will also be stored in HDPE lined pits and disposed off, after testing and any necessary treatment, to meet the regulatory requirements. The estimated amount of drilling fluid and drilling waste water generated from the whole process would be 700m^3 and 15 - 20 m^3/day for each well.

The whole process by which the drilling fluid will be reused during the drilling operation is commonly known as a “closed loop system.” This system is ideal for drilling operations in sensitive environments as it cuts down immensely on the total water consumption for the formulation of drilling mud and also saves on the consumption of chemicals. Figure 7 shows the schematic layout of the drilling waste management. Figure 8 shows the drilling fluid circulation system which is designed to enable the drilling fluid to be recycled and maintained in good condition throughout the operation.

Various components of the drilling mud will be selected carefully to be able to provide desired properties to the mud. Mud chemicals will be added to the uniform mud system to adjust the mud properties and ensure fluid loss control/circulation, lubricity, shale inhibition, pH control and pressure control in the well during drilling.

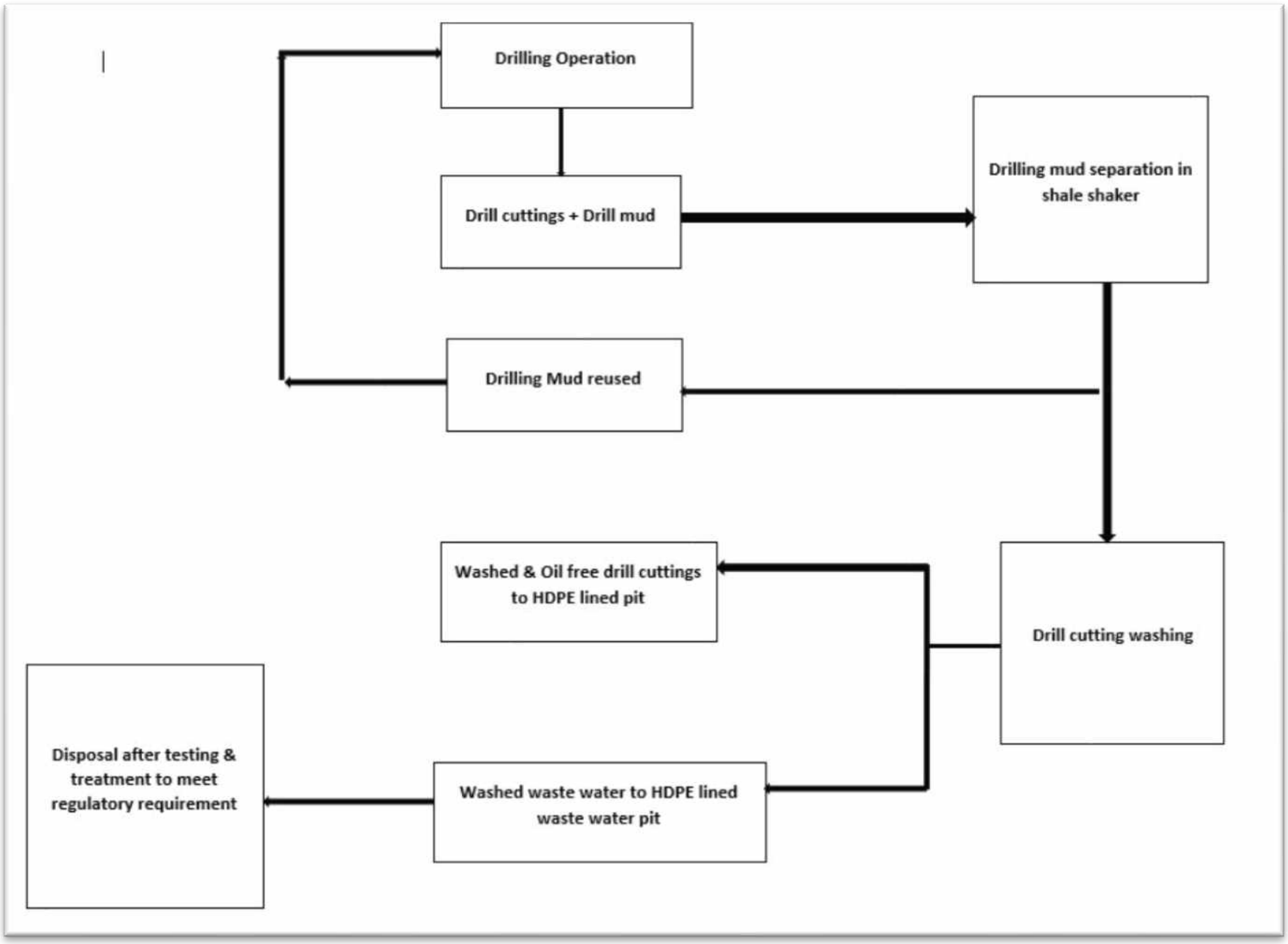


Figure 7. Drilling waste Management

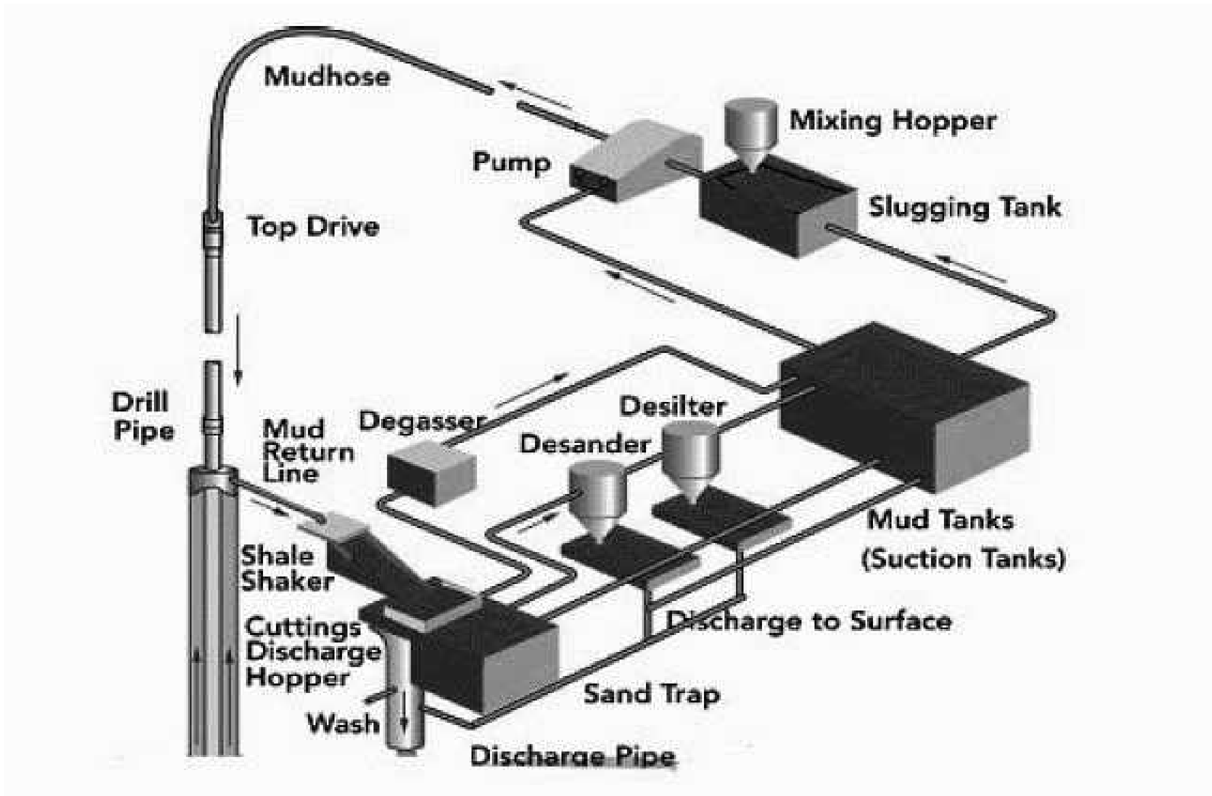


Figure 8. Drilling fluid circulation system

Well Testing

Between drilling operations for different zones, logging operations are undertaken to provide information on the potential type and quantities of hydrocarbons present in the target formations. Logging instruments (sensors) will be attached to the bottom of a wire line and lowered to the bottom of the well. They are slowly brought back, the devices reading

different data as they pass each formation and recorded it on graphs, which can be interpreted by the geologist, geophysicist and drilling engineer. There are no emissions to the environment associated with wire line logging activity. The radioactive source required for well logging activity will be kept in specially designed container. Oil produced during testing activities or during development phases will be stored at the oil pit and will be transferred to the nearest GGS by Oil tankers. A typical schematic figure and a process flow diagram of oil collection facility is given in figure 9 to show the method of oil collection once the EPS becomes operational.

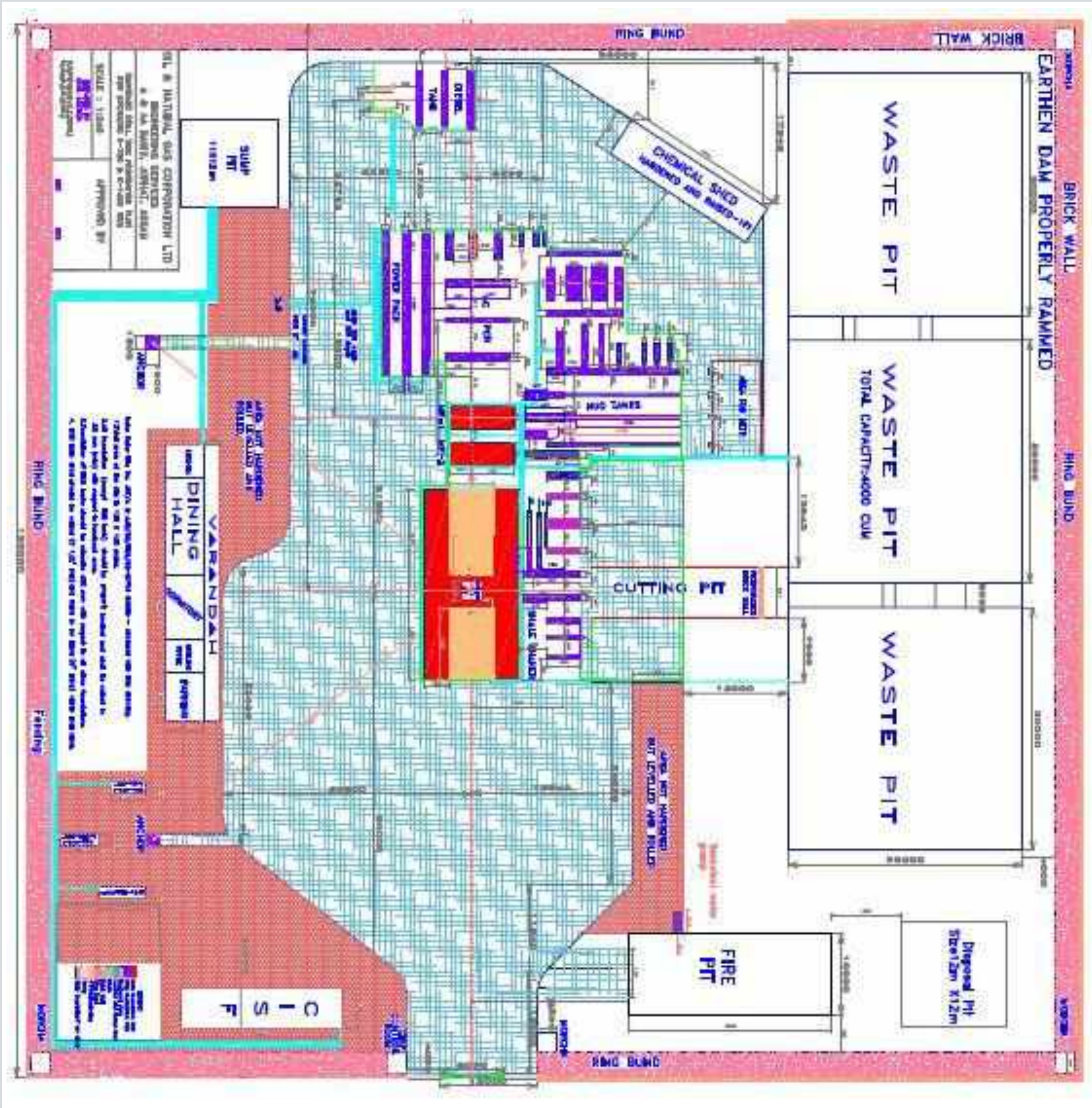


Figure 9. Layout of a well pad

2.8 Well Decommissioning

Well abandonment

On completion of activities, the exploratory wells will be either plugged or suspended. In the event of a decision to suspend the well, it will be filled with a brine solution containing very small quantities of inhibitors to protect the well. The well will be sealed with cement plugs and few wellhead equipment (Blind Flange) left on the surface (Cellar). After the development activities the well will be sealed with a series of cement plugs, all the wellhead equipment will be removed leaving the surface clear of any debris and site will be restored.

Site Closure and Decommissioning

After completion of the drilling activity, partial de-mobilisation of the drilling rig and associated infrastructure will be initiated if ONGC does not strike oil after drilling at the required depth. As discussed earlier, well testing may be carried out immediately after the drilling is completed or about 3 months depending on initial evaluation timing. The complete de-mobilisation of the facilities at site will happen after well-testing has been completed. This will involve the dismantling of the rig, all associated equipment and the residential camp, and transporting it out of the project area. It is expected that demobilization phase will last about 10-15 days and will involve the trucking away of materials, equipment and other materials from site to bring it back to original condition. It is estimated that about 60 truckloads will be transported out of site during this period.

Subsequently, following steps will be typically involved to restore and rehabilitate the area:

- The wellhead and all casing string will be cut off to a minimum depth of 3 m (10 ft) below ground level.
- All concrete structures will be broken up, and the debris disposed off as per the regulatory requirements.
- Drill cuttings and drill mud will be treated as per G.S.R 546 (E) dated 30th August 2005 to render them harmless.
- Drilling wastewater including drill cuttings wash water shall be collected in HDPE lined disposal pit, evaporated and treated and shall comply with the S No. 72, Schedule I-Standards for Emission or Discharge of Environmental Pollutants from Offshore Oil and Gas industry.
- All fencing and access gates will be removed.
- All pits whose contents will show regulatory compliance for on-site disposal, at the time of site closure, will be backfilled and closed out as per the legal requirements.
- Restoration of unusable portion of the access track, removal of pilings.

Site Restoration

All abandoned drill sites will be restored back to its near original condition. After decommissioning of site, it will be de-compacted, and the embanked top soil will be overlain on the de-compacted site with certain moisture conservation measures and seeding of leguminous plant for restoration soil nutrient level naturally.

2.9 Utilities and Resource Requirements

Power Requirement and Generation

The drilling process requires movement of drill bit through the draw works which require power. The electricity requirement for the project activities is high and continuous once drilling begins. Hence the dependency is more on DG sets. Moreover, the power requirement is for a small period of 8-10 months where the intensive period lasts only for 45-60 days. The power requirement will be met by using the six Diesel Generator Sets of 750 KW throughout the project period. The exhaust stacks of the DG sets are likely to vent the emissions. The power requirement at different stages of activities is given in Table 7.

Table 7. Power requirement for development wells

Activity	Power requirement	No. of DG sets
Site preparation	750 KW	1
Drilling operations	750 KW	3 operable and 1 standby
Lighting and other power requirement	750 KW	1
Drill site accommodation	750 KW	1

Fuel consumption, supply and storage

It is estimated that about 1-1.5 KLD diesel per day will be required to power the off-road construction equipment and vehicles during site preparation phase. During the drilling phase, consumption about 6 KLD of Diesel will be required. Out of this, a major part, about 85% will be consumed by the rig and about 15% will be required for the campsite. Fuel will be supplied onsite by local supplier through mobile tankers. Fuel in excess approximately 40 KL (7 days reserve) will be stored at onsite storage facility as per Petroleum Rules, 2002. In case the storage exceeds the threshold, limits specified in the Petroleum Rules, 2002, ONGC will comply with the relevant provision of such rules.

Water Requirements

Approximately 5 KLD water will be required for construction and 3KLD for workers during construction phase. The water requirement in a drilling rig is mainly meant for preparation of drilling mud apart from washings and domestic use. While the former two activities consume the majority of water requirement, the water requirement for domestic use is very less. The daily water consumption will be 25 m^3/day during drilling and testing of wells. The consumption of water during different activities during drilling is tabulated in Table 8, water balance diagram is shown in Figure 10.

Table 8. Water utilization per well

S.NO	Fresh water Required	Fresh water required (m^3)
1	Mud preparation and Treatment	10
2	Cutting, Washing/cleaning at Shale shaker	3
3	De- Sander and De Silter	4
4	Floor/Kelly washing	3
5	Mud Pump	2

S.NO	Fresh water Required	Fresh water required (m^3)
6	Domestic	3
	Total	**25**

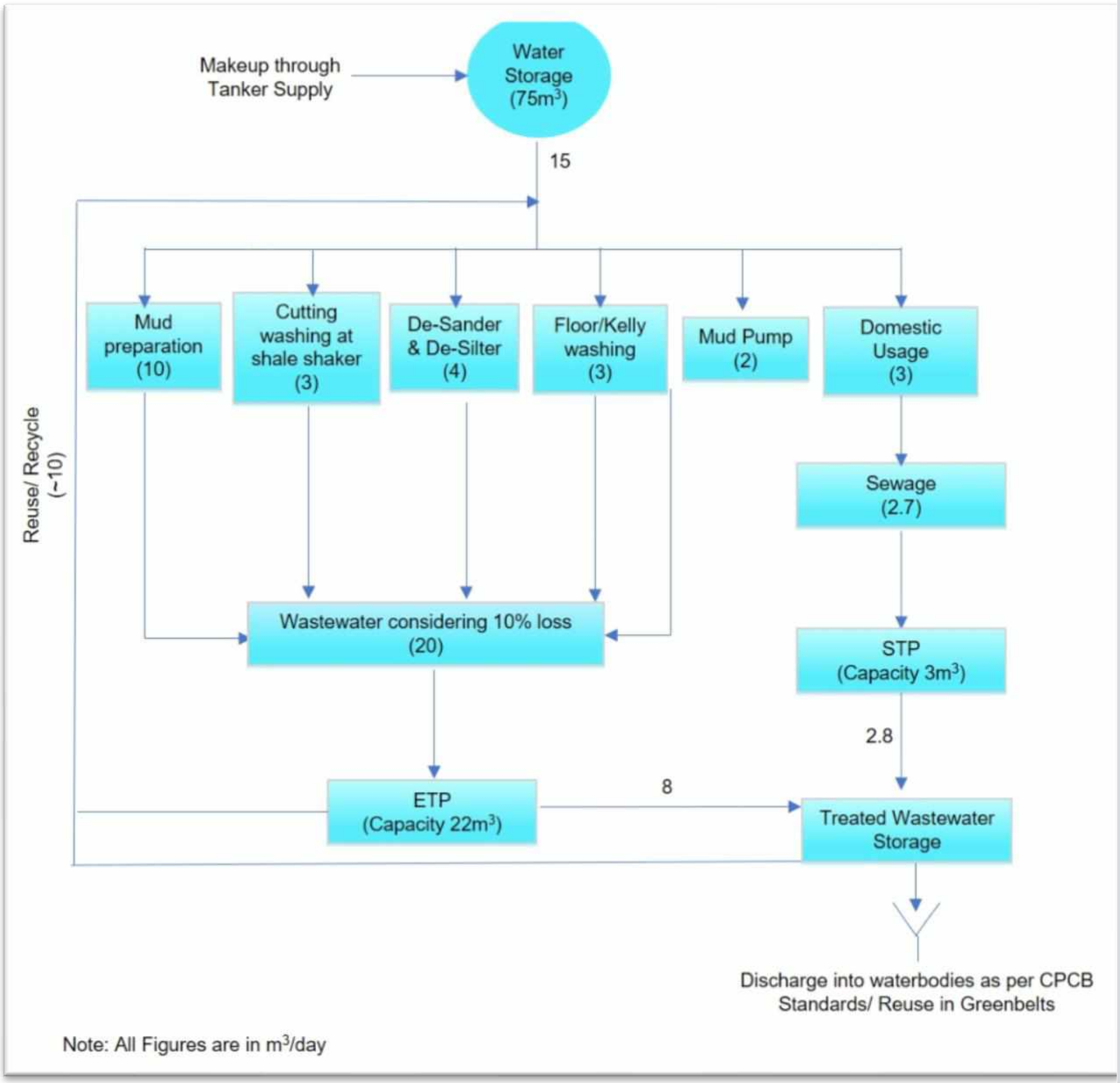


Figure 10. Water Balance Diagram

Water Source and Permission:

Water will be sourced from the local contractor, during the drilling period. The total requirement during the drilling period is given in table 9.

Table 9. Water Requirement

Description	Quantity
Total water requirement during drilling (KL)	1000
No. of days for drilling (days)	40 - 45
Average drilling water consumption per day (KL)	15
Total water consumption per day (KL)	10

Manpower

The drilling rig will be operated by approx. 30 persons on the rig at anytime. The manpower will operate in two shifts with continuous operations on the rig. This will include technical experts (including expats), who will be responsible for various drilling related activities and some local workmen who will be hired from nearby villages for the entire duration of the project. Technical staff will be housed in the Drilling Camp Site which will be adequately supported by facilities like kitchen, wash rooms, laundry, etc.

2.10 Group Gathering Station

A Group Gathering Station (GGS), has been proposed for this project in kasamarigaon PML (Additional area). The set up is meant for Oil/Gas/Water separation from the development drilling site, along with oil treatment and stabilisation gas treatment and compression. GGS would require a land of 9.0 Ha. The proposed land is coming under Dayang Reserve Forest. However, the forest land is now used for agricultural purpose. As described earlier, ONGC has already applied forest diversion and committed to provide compensation to present land users.

Construction Of GGS

The proposed GGS site is now used for agricultural purpose, so tree felling, or demolition of any other permanent structure would not be required. The following activity would be carried out, during the construction of GGS:

<u>Fencing:</u>

The proposed GGS facility would be duly fenced to a height of about 2 m using RCC cement and brick wall, to restrict any unlawful entrance into the site.

<u>Top soil Scraping:</u>

The depth of the top soil of the entire site will be gauged scraped and stored in designated top soil storage site for future use (plantation around the GGS).

Site Elevation:

Once top soil removal process is completed, the entire site will be elevated, leveled and compacted. The site may require filling of earth to elevate the drilling platform based on local topography and High Flood Level (HFL). Quantity of fill material required for the site depends upon the site elevation and HFL. Fill material will be sourced from authorized quarry area.

Details of GGS

The GGS will be constructed in two phases. Since the construction of GGS is a time-consuming process, hence to keep in tandem with the oil produced from development wells an Early Production Facility would be built. From development well, production will be taken to EPS. Parallelly, application for Forest Clearance has been given for land diversion for GGS. Once Forest Clearance will be obtained, production will be facilitated through GGS. Produced water would be treated in nearest treatment facility. The temporary facilities built at EPS will house the Manifold, Bath Heaters, Separators, Gas Scrubber, Crude Oil Storage and Dispatch System, Flare System and Fire Fighting System.

The Dedicated Facilities at the GGS in the second phase will be office building, chemical storage & dosing system shed, sheds for oil dispatch, pumps and fire water tanks and pumps. A Process Schematic Diagram of Group Gathering Station is shown in Figure 11.

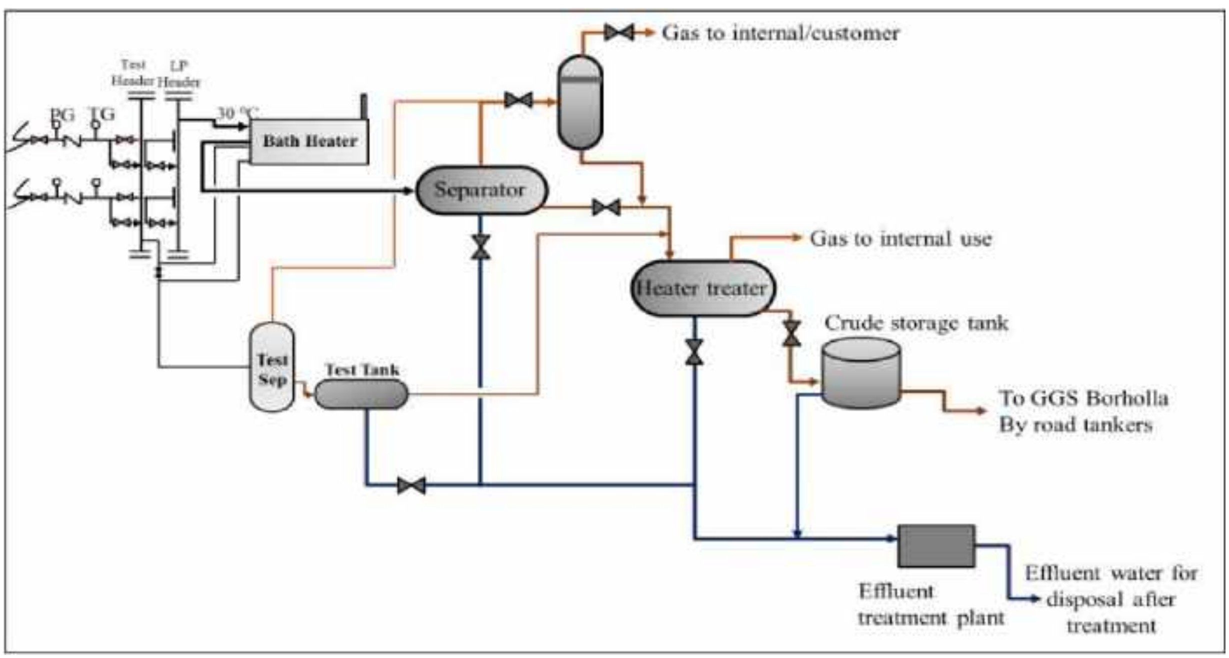


Figure 11. Process Schematic Diagram of GGS at Dayalpur field

The component of GGS would be discussed below:

I. 8-inch group header of suitable class.

II. 4-inch test header of suitable class.

III. Test Separator - There is a test separator connected to the Test Header (Diameter:1000 mm x Height 4100mm) 1 no.

IV. Chemical Dosing System - Dosing tank (1m3) where demulsifier chemical and PPD with the help of dosing pumps (400 ppm) and Rotameters is added to the emulsion at calculated dose before it is sent to the heater.

V. Bath Heater - the well fluid will be heated up to about 50˚C in the bath heater. The well fluid will be routed to HP separator from bath heater. The heat duty of the bath heater comes out to 0.3MMKCal/hr.

VI. HP Separator - The heated well fluids (50 ºC) enter the HP-Stage separators for initial separation of Gas from Oil and Water. The separator is a spill over weir type two phase separator and operates at 16kg/cm2g pressure rating. It consists of a horizontal carbon steel vessel where gravity separation of the gas occurs. Provision for nitrogen blanking will be kept. The associated gas flows to the CO_2 removal system. The gas from the HP separator will be supplied to the consumer and the liquid routed to LP separator.

VII. LP Separator - The LP Separator is a polishing unit to remove the residual portion of associated gas from the crude. This is done by flashing the liquid at low pressure. The liquid from the LP separator is stored in storage tank and pumped through pipeline to GGS. The gas from the LP separator will be used as fuel.

Table 10. Size of Separator

Parameters	HP Separator	LP Separator
Design pressure kg/cm^2	20	7.5
Diameter, mm	1000	700
Height, mm	4100	3320
Inlet nozzle, inch	8’	6”
Gas Outlet nozzle, inch	6”	4”
Oil outlet nozzle, inch	4”	4”

VIII. Crude storage tank - The capacity of crude oil storage shall be suitable to cater to store about five days of production during maintenance of facilities. There will be three tanks each of 500m^3 capacity. The tanks will be installed within a paved and dyke area. It will comprise fixed roof carbon steel tanks and will be designed as per applicable codes and standard and international practices. Each tank will be provided with hot oil heating coil arrangements. Crude oil booster pumps will be installed to boost and maintain adequate operating pressure in the system.

IX. Crude Dispatch Pump - The simulation results have shown that a pressure of 15kg/cm^2 is required to send the crude oil to GGS where the residual pressure will be about 4-5Kg/cm^2. Two pumps of 15m^3/hr capacity will be employed for dispatching the crude oil.

X. Flare System - The flare system caters to the need of flaring of associated gas from shut-down / emergency and normal operations. The normal operation flaring would primarily be the separated gas from the LP separator. Flares are equipped with gas pilots and igniters with purge gas. The flare system consists of Knock-Out Drum (KOD), crude transfer pump and header. Liquids from the flare knock-out-drum are routed to the oil buffer tank.

Drainage and sewage disposal in GGS

The GGS area would be equipped with a network of surface drains. The process drains will be closed type and will be kept segregated from the storm water flows. The rain-water flows from area that has a potential for contamination due to the facility operation will be routed to the process drain through suitable valve / isolation gate control. A check oil trap will be provided near the outlet of the storm water drain. Arrangements will be made to divert the storm water for rainwater harvesting.

Sewage from the toilets of the buildings will be connected to and treated in a package sewage treatment plant. The treated sewage will be used for greenbelt development.

Fire fighting Facilities in GGS

The dyke/paved and bunded tank area with proper containment would be provided. Water sprinkler system and other fire fighting provisions like portable fire extinguisher, sand filled buckets, fire water tank, fire water pumps, jockey pumps, fire hydrants, monitors firewater rings would be also provided in GGS facility, as per OSID 117 and 189. Further gas detectors Further gas detectors of gases like hydrocarbons, smokes would be placed in different locations. The tanks will be grouped so as to provide optimum containment arrangement and prevent any spills and leaks to spread throughout the tank farm area. A network of process drain will be laid within the paved area and routed to an oil water separator.

Resource requirement in GGS

Power: A key feature of GGS is that it is expected to have a high electrical demand because of the requirements for artificial lift wells (ESPs, PCPs), water injection, transfer of high viscosity fluids and the large distance between facilities. The power requirement will be met from the State Electricity Power Grid. An Emergency backup DG set would be kept in the premises. In general, all facilities will have the necessary electrical energy receiving, distribution, earthing and control systems. The systems will be designed and operated to international safety norms for oil field installations.

Manpower Requirement: It is assumed that 150 labourers and contractor personnel is likely to be involved during the project construction phase. A temporary rest room/shelter will be made available for the workforce at the terminals and pipeline spread during construction phase.

Instruments: Some essential instruments would be installed in the GGS facility, listed below:

- Air Compressor: Two air compressors each of 150m^3/hr.
- Air Dryer: 1

- Metering System: The following meters will be installed
- Orifice meter on gas line
- Mass Flow Meter on oil dispatch line
- Radar type tank level measurement system
- PLC based computer system.

Detail of EPS

Early Production System (EPS) would be installed for the processing of produced well fluid. An EPS would be a packaged/ modular mobile unit and will mainly consists of a heater-treater separator or a production heater followed with a three phase separator, electrostatic coalescer, oil storage tanks, oil tanker loading system, produced water separation and disposal system, power generation (GEG or DG), test separator skid, utility systems such as fuel gas, flare, Inst. Air package, diesel storage, firefighting equipment, etc. A QPF will be designed for a capacity of 2,000 BLPD (Barrels of liquid per Day) with water cut variation from 0 – 50 vol%. Typical process Flow of QPU/EPU is presented in the Figure 12.

Produced well fluid from one or more successful exploratory/ appraisal wells will be gathered & sent to heater-treater separator skid for primary separation & heating purpose. Gathered produced fluid will be heated & degassed in heater-treater separator skid operating at ~2.5 – 3 Bar and ~70 – 80 ^{0}C and separated in to gas, oil and water streams. The separated produced (associated) gas will be either routed to fuel gas system or to flare depending on the quantity and richness of produced (associated) gas. In case of sufficient quantity of produced gas, a part of the produced gas will be used for power generation using gas engine generator (GEG), for firing in heater-treater separator skid and for blanketing & purging purpose. The surplus gas post internal consumption (if any) will be routed to flare for safe atmospheric discharge.

Separated oil from heater-treater separator skid will be sent to electrostatic coalescer separator (if needed, based on oil properties) to separate the residual water and achieve BS&W specifications. The treated crude oil from electrostatic coalescer separator will be sent to oil storage tanks. From oil storage tanks, oil will be pumped & loaded in to road tanker using the tanker loading facility for evacuation of crude oil to the nearby available facilities like terminals/ depots of consumers.

Separated produced water (PW) from heater-treater separator skid will be sent to degasser vessel operating at low pressure. The evolved HC gases from degasser vessel will be routed to flare for safe disposal and the degassed water sent to PW treatment package.

The PW treatment package will consist of a compact flotation unit or other equivalent gas floatation based de-oiling (oil removal) system and a filtration system. The treated water from PW treated skid will be stored in PW storage tanks. The produced water will be treated to achieve MoEF/ CPCB/ SPCB specifications (discharge standards) and will be disposed off. The treated effluent (i.e. produced water) will be disposed-off using either a nearby down hole disposal well (by reinjection in abandoned well) or other available and suitable onshore disposal medium or solar/ mechanical evaporators depending on the quantity and feasibility.

The power requirement will be met through either state electricity grid and/ or installation of Diesel/ Gas Engine Generator(s) using produced gas. If produced gas is sufficient quantity, then power generation using produced gas will be preferred. Along with above processing facility, a well test separator skid will be installed at pad. It will be used for well testing purpose. Well under testing will be routed to test separator skid. The separated gas, oil & water will be sent back.

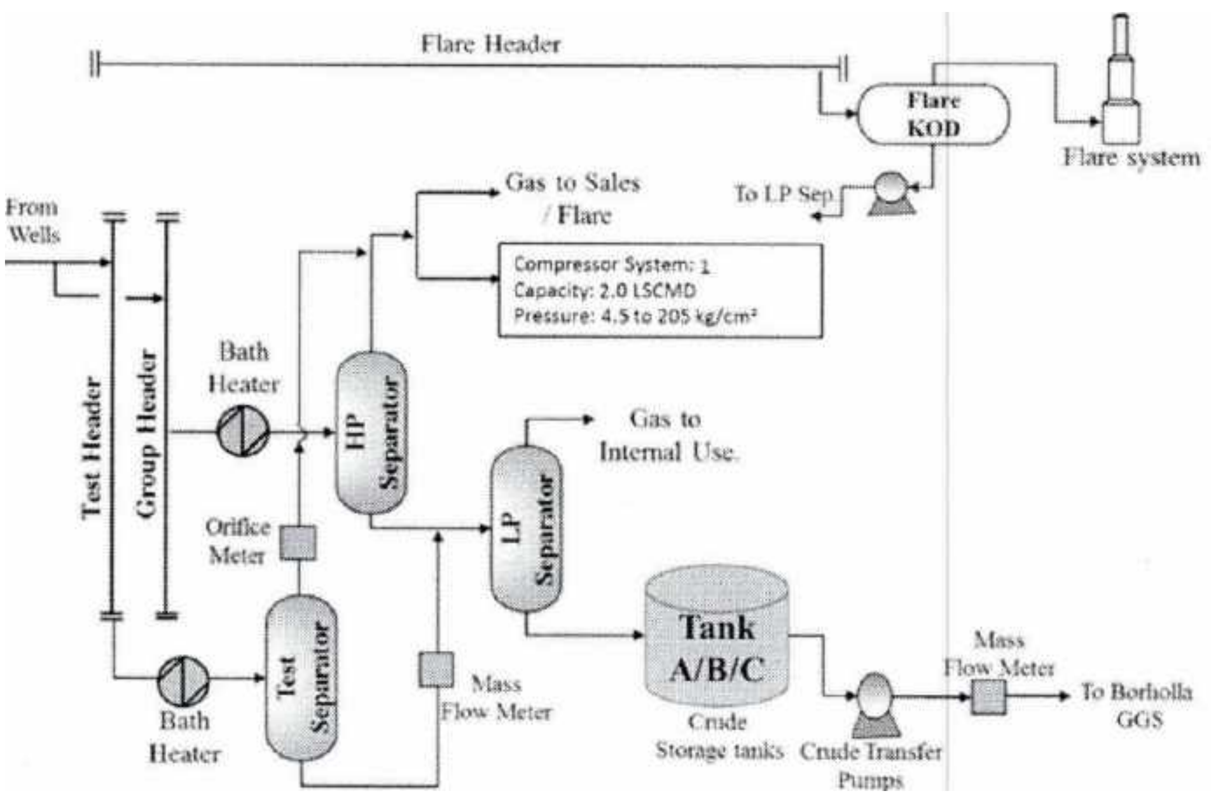


Figure 12. Process flow diagram of an EPS

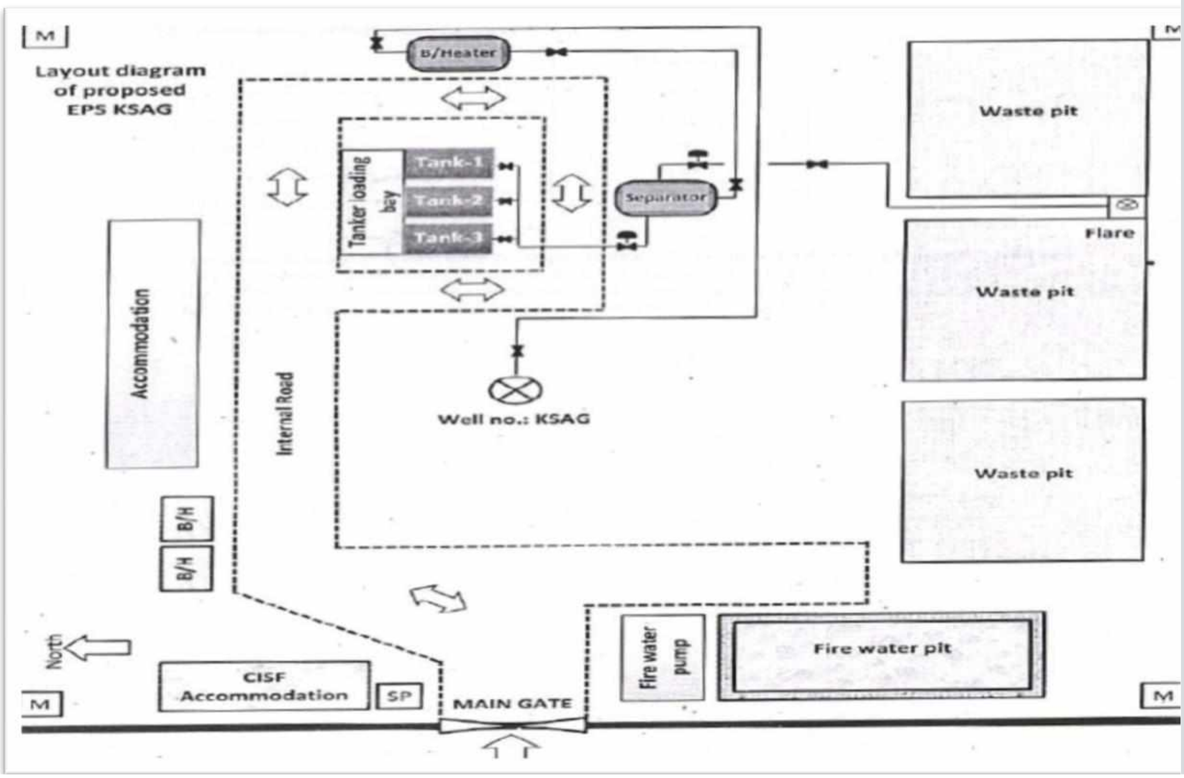


Figure 13. Layout of EPS

to inlet of heater-treater separator skid for further processing. Quick production set-up will have following utility systems & infrastructure for supporting the operations.

- Wells with selected artificial lift and flow lines.
- Fuel gas system consisting of filters & a super-heater.
- Instrument Air package or Instrument as system.
- Chemical dosing packages i.e. corrosion inhibitor, de-emulsifier& scale inhibitor etc.
- Elevated flare system or enclosed ground flare or ground flare.
- Closed drain system, storm water drain system.
- Fresh water storage.
- Diesel storage.
- Power generation (GEG and / or DG).
- Firefighting equipment.
- Domestic sewage treatment facility (Modular STP);

2.11 Pipeline Laying

The laying of pipeline from development well and EPS to GGS would involve various sequential activities. The pipeline laying would be conforming to the guidelines specified under OISD Standard "OISD-STD-141- Design & Construction Requirements of Cross-Country Hydrocarbon Pipelines". The construction details regarding the laying of pipeline have been discussed in detail below

Working Corridor Preparation

A working corridor preparation plan would be undertaken for the laying of pipeline. For this activity A detailed route survey would be undertaken to document the existing condition of the pipeline route and the access roads before starting the construction work. These records would be further used as the standard against which the quality of the restoration work will be judged when the construction work is completed. The exact route of the pipeline would first be fastened out, while simultaneously staking out the width of the work strip on both sides of the route. Obstructions such as walls, fences and paths will be disturbed to the minimum amount necessary for safe working. Records of buried underground utilities such as drains, OFC cables etc. would be prepared. Warning posts would be erected for overhead cables, and temporary crossing points clearly marked.

Topsoil and vegetation removal

The existing area would be cleared off vegetation and other obstacles such as boulders. Stripping of top soil would be undertaken and would be stockpiled in the form of a continuous ridge along the edge of the strip. Required height of top soil will be maintained to prevent depredation of the soil and would be kept free from disturbance to reduce the possibility of physical damage and compaction. The work strip will then be made level, using typical construction site machinery to eliminate irregularities, large stones, tree stumps and other features.

Pipe hauling and fabrication

The pipes would be carried out to the site from the designated pipe yard along the existing roads. The selection of access road for pipeline transportation would be based on detailed study to minimize adverse effects on the local traffic and commuters. The pipes transported through trucks would be offloaded using the pipelayer. Trailers and cranes would be used for the maneuvering of pipes. No pipe or other material shall be strung along the RoU before all cleaning and grading operations have been carried out. However necessary care will be taken during stringing to prevent any possible disturbance to the surrounding land use.

Trenching and Boring

Trenching and Boring would be a distinctive part for the laying of pipeline. The pipeline sections would be installed in separate, parallel trenches. The trenches would be excavated using mechanical excavators running alongside the pipeline trench. The width of trench shall be such that a minimum clearance distance of 200 meter for trench in normal soil and 300 metre for trench in rocky substrate would be maintained between edge of pipe and the trench wall, at the bottom of the trench. Pipelines shall be buried below ground level. The pipeline would be generally buried to a minimum depth of 1m however in case of rivers/water bodies, which are prone to scour and erosion, adequate safe cover (minimum 1.5 metre) shall be provided below the predicted scour profile expected during the life time of the pipeline.

Bending and Welding

The pipe would be bent using a bending machine to the appropriate angle to match the vertical and horizontal alignment of the trench. Followed by the alignment, those would be joined together using automatic and manual welding equipment along the length of the pipeline. The whole welding process would be carried out inside a mobile shelter that covers the welded section and the labours involved, to control the environment under which weld would be made. All welds will be subject to Non-Destructive Examination (NDE) prior to application of the field joint coating.

Lowering of Pipeline

Following weld and field joint coating of the welds, the joined pipeline sections would be carefully laid in their individual, parallel trenches. This operation would be completed using pipelayer tractors in a continuous operation. In rocky or uneven ground where the potential for pipe coating damage exists, the trench bottom will be given a protective bed of sand.

Backfilling

The pipe trenches would e backfilled in revers order as it was excavated during trenching, and where possible, using the same soil that was taken from the trench. In areas where the backfilling material seems to damage the pipe coating due to presence of rocks or stones, sand would be used as backfilling material in order to protect the pipe coating. Backfilling would be completed by covering the trench with topsoil from the previously established stockpile. To minimize damaging exposure of the excavated soils while they are in storage, the trench would be back-filled as early as possible after each pipeline section has installed, so creating a single, continually advancing work-front.

Reinstatement of the pipelaying site

After re- grading of the work strip to reflect the original ground profile, it would be decompacted using bulldozers to spike and drag the soil in all directions, followed by spreading of the remaining top soil over the entire surface. Large stones and debris will be removed prior to topsoil replacement. The final step in the restoration process will be the reconstruction of walls, fences and other such features that may have been affected by the works. After re-instatement, the area will be monitored and maintained, as required, over a fixed period until normal growth patterns are re-established.

Pipeline markers

After re-instatement, the only noticeable evidence of the pipeline would be marker post placed along the route for future monitoring and line working purpose. These posts would be installed at a maximum distance of 250 m to 300 m, depending upon the type of terrain. Each marker would have line of sight to its previous and following marker.

Major surface water crossings

The proposed pipelines likely to transverse through nalas, canals and major rivers (Giladhari, Sissupani and Dayang). Appropriate techniques like open cut, horizontal directional drilling is likely to utilized by ONGC. In this regard specific work procedures and method statements would be developed and implemented by ONGC to prevent and/or minimize any potential significant impact on the water bodies.

Manpower requirement for pipeline laying

It is estimated that 100 labourers and contractor personnel is likely to be involved during the project construction phase. A temporary rest room/shelter will be made available for the workforce at the terminals and pipeline spread during construction phase.

2.12 Pollution sources and Characterization

Noise and vibration

Noise would be generated during drilling, testing and operation of rotary drilling equipment as part of rig, diesel engines for power generation, mud pumps and operation of vehicles. Noise during the site preparatory phase will primarily be contributed by heavy construction machinery operating on site and vehicular sources for constructing the facilities for wells, GGS and pipeline. Average noise emission ranges for different types of construction machinery are provided in Table 11.

Table 11. Construction Equipment Noise level

Equipment	Sound level at operator (Db)
	Range
Earth Moving equipment	
Front End Loader	85-91
Back Hoe	79-89
Bull Dozer	89-103
Roller	79-93
Truck	89-103
Material Handling Equipment	
Concrete Mixer	<85.0
Crane/Hydra	<85.0
Derrick	97-102
Air Compressors	35-38

Source: British Columbia, "Construction Noise," Workers Compensation Board of BC

Air Emission

Air emission from point sources expected from the development drill site, from combustion of diesel in the diesel engines and in the power generators. The principal pollutants will comprise of Particulate Matter (PM), Sulphur and Nitrogen Dioxides (SO_2 and NO_2), benzene and Hydrocarbons (HC). The quantity of diesel consumed during drilling will be in order of 6 KL /day/drilling site. Additionally, the flaring and burning of oil during the testing of well and from GGS will also lead to the release of some pollutants including un-burnt hydrocarbons to the atmosphere. Some fugitive emissions of dust and air pollutants from vehicular exhaust will also happen during the project lifecycle, mostly during the construction and decommissioning activities. Additionally, there will be re-entrainment of dust from the approach road leading to the site mainly during the dry season.

Liquid wastes

The drilling waste water around 1000 m^3 will be generated during the entire drilling period from rig wash and dewatering of spent drilling mud and approximately 15 – 20 m^3 per day. To ensure that effluent from the project comply with the waste water discharge standards as mentioned in the S No. 72 A (ii) Schedule I Standards for Emission or Discharge of Environmental Pollutants from Onshore Oil Drilling and Gas Extraction Industry of CPCB, a mobile Effluent Treatment Plant will be installed.

The plant would be capable of handling drilling effluents. Domestic waste water generated (about 2.5 m^3 for the drilling camp) will be treated through a modular STP. Oily sludge would be collected and disposed by bio remediation.

As ONGC is proposing the use of water-based drilling mud, the potential for contamination of such waste water is significantly lower. The drilling wastewater will contain spent drilling fluid generated as a result of washings. The rig wash water and drilling wastewater generated is proposed to be collected in a wastewater pit (constructed at the drilling site. Domestic waste water generated would be treated through a STP. The quantities of the liquid wastes, their characteristics and anticipated disposal methods are given in Table 12.

Table 12. Liquid waste generated during drilling and their disposal

Waste Type Quantity Disposal	Waste Type Quantity Disposal	Waste Type Quantity Disposal
Drilling and Wash	15-20m^3/day	The water will be adequately treated in an ETP to ensure conformance to the CPCB onshore oil and gas extraction industry effluent standards and injected into effluent injection wells below 1200 meters depth as per CPCB guideline.
Domestic wastewater	2.5 m^3/day	Modular STP

Solid and Hazardous waste

The different solid and hazardous waste streams generated during drilling and their disposal methodology has been presented in Table 13.

Table 13. Waste generated during drilling and their disposal

Waste type	Quantity	Characteristics	Disposal
Kitchen waste	10- 15 kg/day	Organic waste (Non HW)	Will be stored in compost pits on daily basis.
Drill cuttings	225 m^3/well	Mainly Inert material Consisting of shales, sands and clay; about 1% of drilling mud. (Non HW)	Drill cuttings will be disposed off in a well-designed pit lined with impervious liner located on site as per 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.
Waste Drilling Mud (Fluid)	700 m^3	Barite, Bentonite and Traces of Heavy metals (HW).	The mud will be tested for hazardous contaminants and will be disposed as per 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
Acid – Lead batteries	------	Lead – Acid (HW)	Will be recycled through the vendors supplying acid – lead batteries as required under the Batteries (Management & Handling) Rules, 2001.

Waste type	Quantity	Characteristics	Disposal
Oily sludge	-	Used and waste oil	Treated through bio remediation
Recyclables viz. plastic packaging, paper waste etc.	-	Depending on usage	Proper segregation and storage of recyclable waste in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.

2.13 Drilling Hazards

Loss of well control / blow-out, fire, explosion and oil spills are the major potential hazards associated with drilling for oil and gas. Effective response plans to foreseeable emergencies will be developed by ONGC and communicated to the project teams. A risk assessment to be carried out as part of this EIA will also contribute towards identification of hazards, risks and formulating management plans for emergency response, blowout, oil spills.

2.14 HSE Policy

ONGC is committed to protecting environment, health and safety of the people who may be affected, directly or indirectly by its operations. The Drilling Management System (DMS) framework lays down the corporate Health, Safety and Environment Policy for the entire organization and the range of operations it undertakes as a part of oil and gas exploration. The overall corporate health environmental safety policy of ONGC may be supplemented by a local policy document whenever so required. It is understood that ONGC will try to formulate a local site level policy taking from the parent corporate policy of ONGC to adequately address the environmental impacts of the proposed development drilling projects in PML blocks through the DMS.

2.15 Project Cost

Estimated project cost along with development of GGS and EPS is approximately 625 Cr.

3. Description of the Environment

3.1 Introduction

This chapter describes the existing baseline environmental settings in study area of total forest PML blocks and its immediate surroundings. This includes the physical environment comprising air, water and land components, the biological environment, and socio-economic environment. Attributes of the physical environment like air, water, soil quality and noise level in the surrounding area were assessed primarily through monitoring and analysis of samples collected from field. Baseline monitoring has been carried out during post monsoon, 2019-2020 (November 2019 to January 2020). Information about topography, geology, hydrology prevailing natural hazards risks like floods, earthquakes etc. have been collected from different available literatures and information from various government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified against published information and literatures. The socio-economic environment has been studied through consultations with various stakeholders in the villages within the forest PML Blocks. Additionally, socio-economic data have been obtained from the Census of India 2011 reports.

3.2 Study Area

The study area for determination of environmental, biological and social baseline is the entire forest PML Block and 10km radius area from the Block boundary. The forest PML is located in Golaghat and Jorhat district of Assam. The entire study area is covered by SoI Toposheet no G46K/3, G46J/15 and G46J/16. The hydrocarbon Blocks lie between 26°02'45.28"N to 26°22'31.36"N Latitude and 93°50'52.58"E to 94°08'12.55"E longitude. The study area represents flat to moderately undulating terrain with ground elevation ranging between 110 – 135 metre above MSL from north to south.

3.3 Physiography and Geology

The forest PML block is located within Golaghat districts of Assam.

<u>Golaghat District</u>

Golaghat district of Assam bifurcated from old Jorhat district form a part of the vast alluvial plain of Assam and covers an area of 3,502 sq. km. The district is bounded on the North by the River Brahmaputra, on the South by the Nagaland state, on the East by Jorhat and in the West by Karbi-Anglong and Nagaon districts.

Physiographically, the district shows a monotonous plain topography towards north and southeast, while the southwestern part of the area represents an undulating topography. The general elevation of the elevated area is around 100 meters above Mean Sea Level (MSL) and low-lying areas show altitude about 80 m above MSL. Maximum height of about 128 m above MSL is observed in the southern parts of the district, where it merges with the hills of the Nagaland as well as Karbi-Anglong district of Assam. The slope of the district is towards north east from south.

Geologically the district is underlain by Quaternary formation followed by Archaean group of rocks. Quaternary formation comprises younger and older alluvial deposits consisting of different grades of sand, pebbles, cobbles, gravel and clay in the area. Major parts in the north of NH-37 passing in the east-west direction in the district show younger alluvial deposits. The older alluvial deposits occur mainly towards southern parts of the NH37. The hard crystalline of Archaean age covers extreme southern boundary of the district merging with Karbi-Anglong district. The rock types are granite, granite gneiss and quartzite.

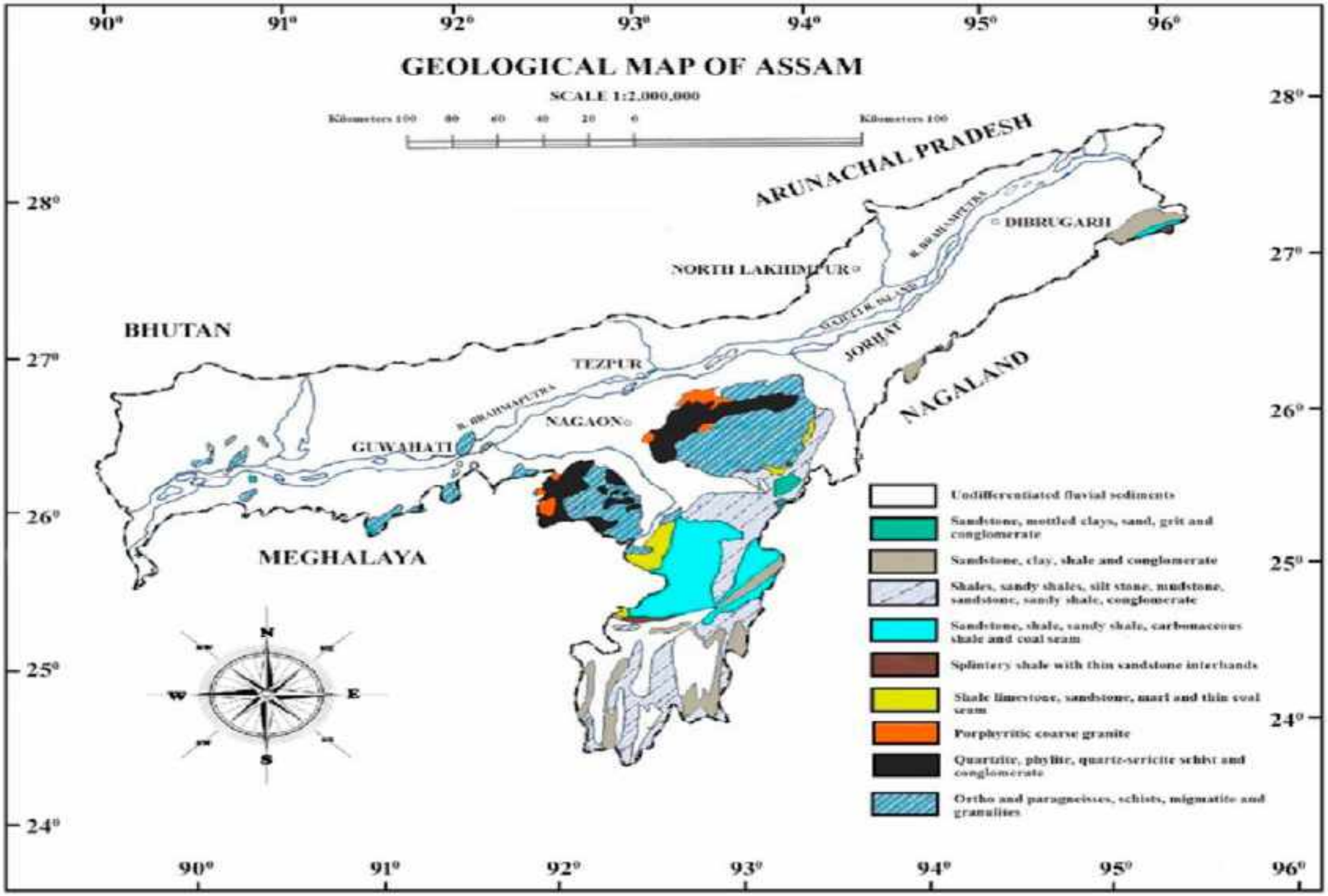


Figure 14. Geological Map of Assam

Source: Geological Atlas of Assam

3.4 Hydrogeology

Golaghat District

As per the report of CGWB (2013), Sub-surface geology as evidenced from available data infers that the potential aquifer pertaining to Quaternary formation exist down to the explored depth of 300 m. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the south-eastern parts, the thickness reverses considerably.

The hydrogeology of the district is characterized by ground water occurring under water table to confined conditions. Depth to water level in major parts of the district varies from 2 to 5 m. In the extreme southern and southwestern parts close to hills, the water level is found to be deeper and generally rests within 5 to 7 m. The movement of ground water is from south to north. The water level trend shows that there is gradual rising of water level in the district.

The study of water level fluctuation by CGWB during pre and post monsoon revealed that During pre-monsoon period about water level marked up to 3.8 to 7.96 m bgl. During post-monsoon period water level marked above 3.31 – 6.89 m bgl.

Hydrogeological map of Golaghat district is given in Figure 15.

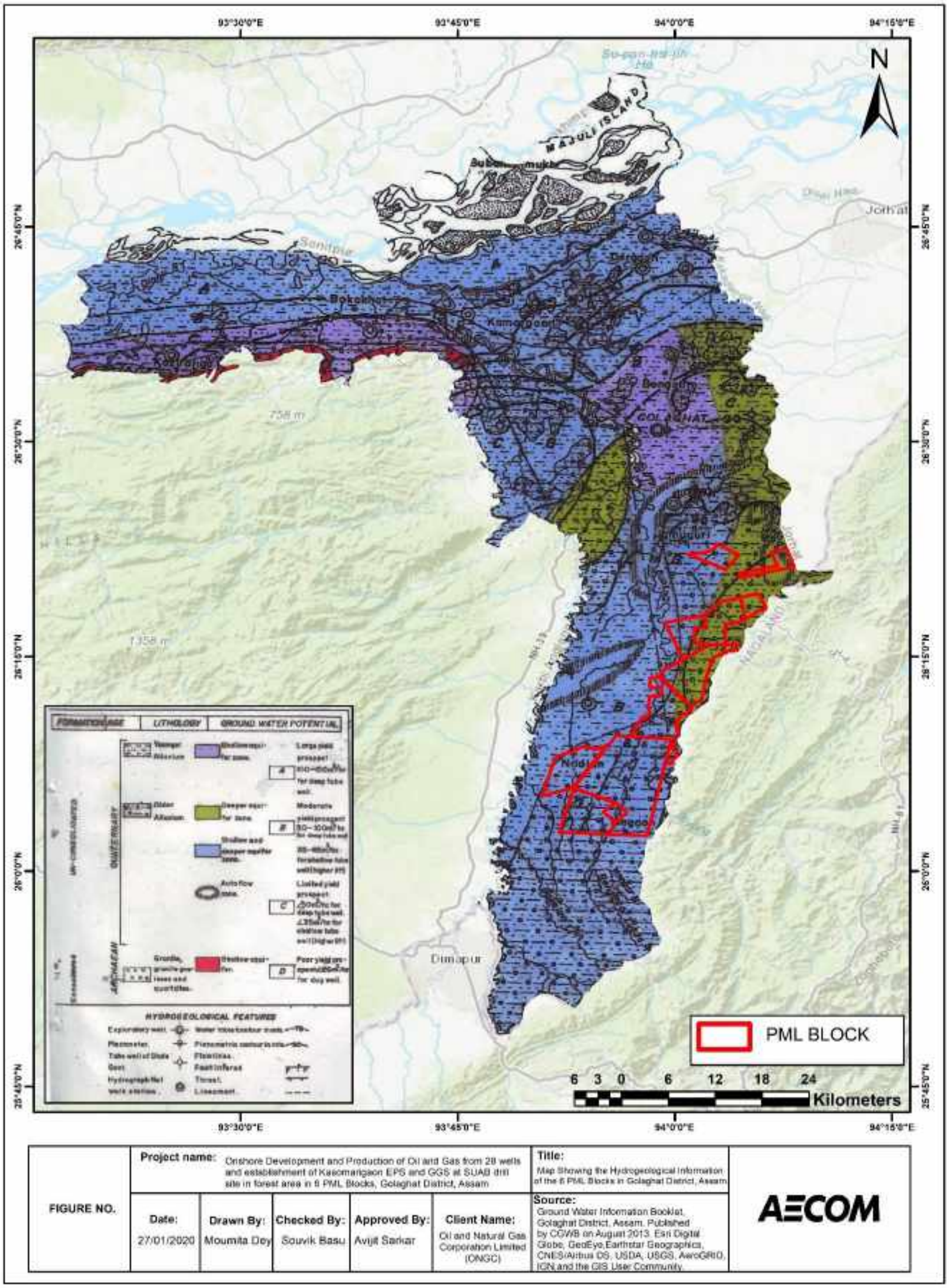


Figure 15. Hydrogeological map of Golaghat District

Source: CGWA report, Golaghat, 2013

3.5 Topography

Golaghat District

Topography of Golaghat districts shows a monotonous plain topography towards north and southeast, while the southwestern part of the area represents an undulating topography. The general elevation of the elevated area is around 100 meters above Mean Sea Level (MSL).and low-lying areas show altitude about 80 m above MSL. Maximum height of about 128 m above MSL is observed in the southern parts of the district, where it merges with the hills of the Nagaland as well as Karbi-Anglong district of Assam. The slope of the district is towards north east from south.

In general, the elevation of the forest PML blocks is below 100 m from the mean sea level. Elevation map of the block is presented in Figure 16.

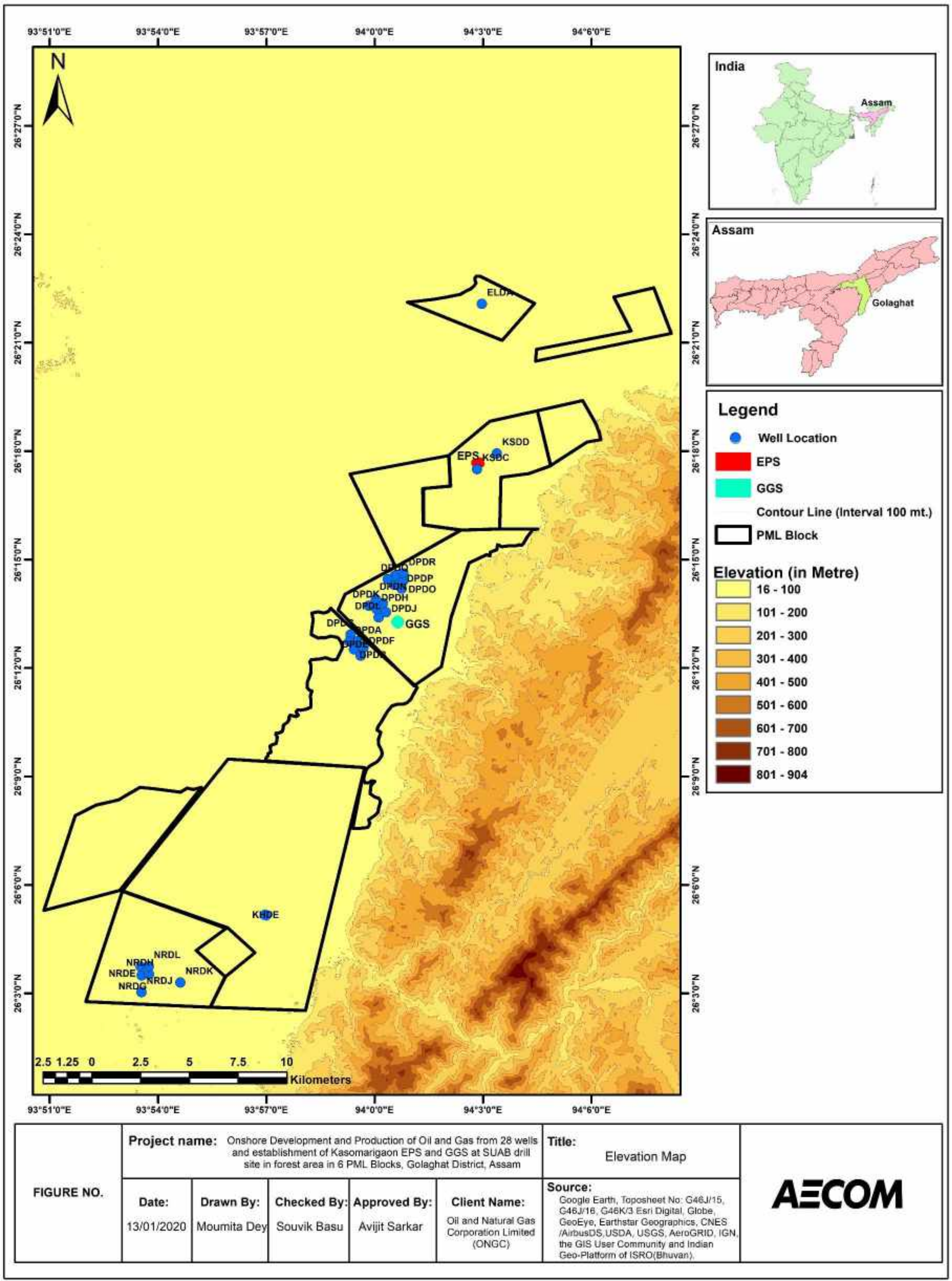


Figure 16. Elevation Map of PML

3.6 Drainage

Golaghat District

The drainage of Golaghat district is dominated by mighty Brahmaputra river which is flowing in east-west direction in the extreme northern parts of the district and its tributaries flowing in northern direction, control the entire drainage system of the district and plays an important role in the ground water occurrence and control of the district. Important Rivers of the district are Dhansiri and Dayang. These rivers have meandering courses with abandoned channels in the form of waterbodies and ox-bow lakes along their courses.

Drainage map of forest PML blocks is provided in Figure 17.

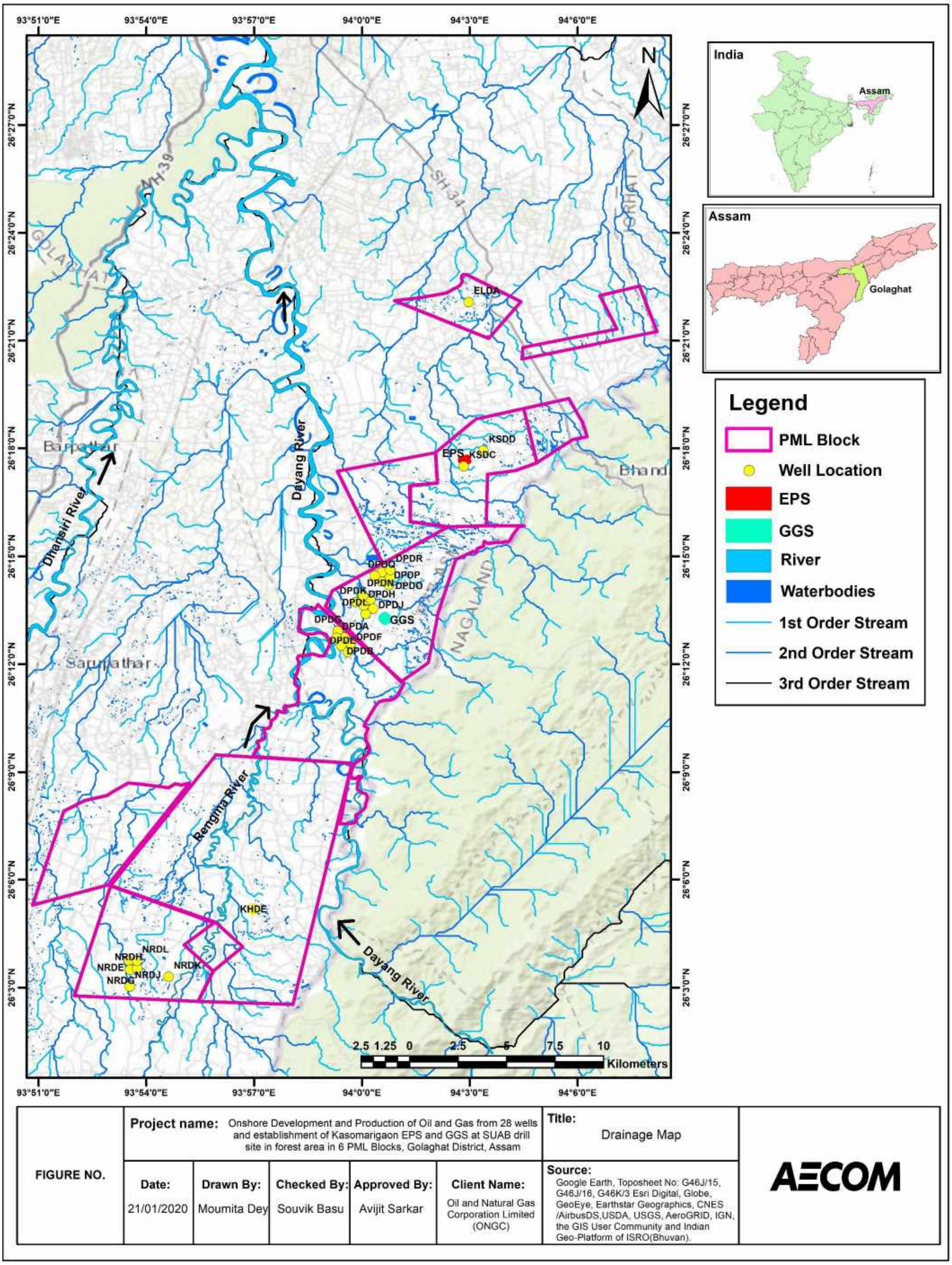


Figure 17. Drainage Map of PML

3.7 Vulnerability of the site

Seismicity

According to the study of Assam state Disaster Management Authority, the plate tectonics, Assam is in the eastern-most projection of the Indian Plate, where the plate is thrusting underneath the Eurasian Plate creating a subduction zone and the Himalayas. As per the Global Seismic hazard Assessment Program (GSHAP) DATA the state of Assam falls in the region of high to very high seismic zone. As per the 2002 Bureau of Indian Standards (BIS) map, this state also falls in Zone V. Historically, parts of this state have experienced seismic activity greater than 6.0, in Richter scale. The State has experienced two major earthquakes in the year 1897 and 1950.

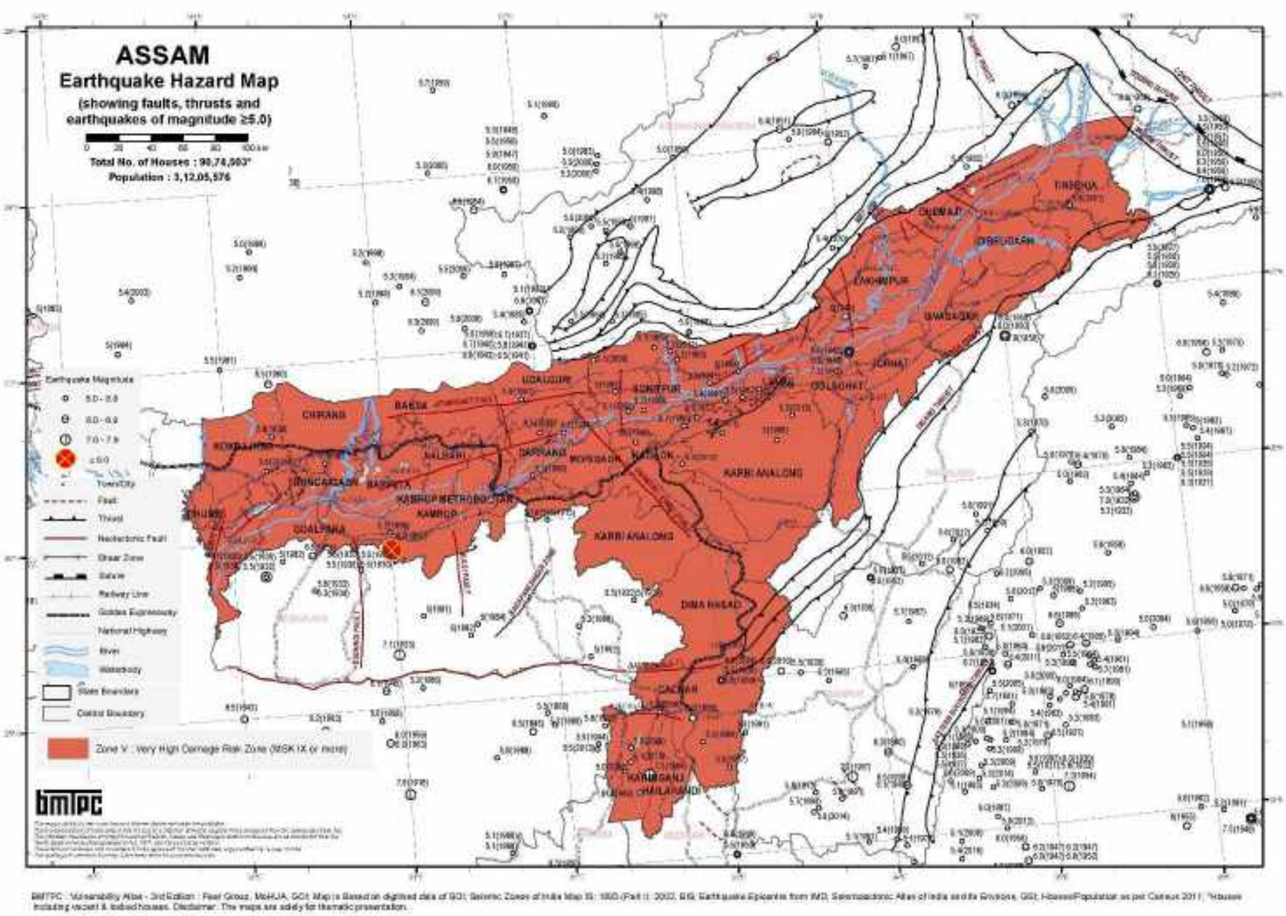


Figure 18. Earthquake Hazard map of Assam

Source: BMPTC: Vulnerability Atlas of India, Third Edition 2019

Floods

The entire state of Assam is affected by flood, in almost every year. River Brahmaputra, being the main drainage channel of the region, consisting of a total catchment area of 5,80,000 sq KM in Tibet, Bhutan, India and Bangladesh. The river flows for length of 918 km in India of which 720 km flows through the plains of Assam. In this valley about 20 major tributaries on its North Bank and about 30 on its South bank join the river Brahmaputra. The precipitation here is mainly due to South West Monsoon. Heavy rainfall occurs from May to September.

Golaghat District is also regarded as the flood prone district of the state Assam. River Brahmaputra and Dhansiri are the main drainage pattern of the district and causing a heavy flood situation. Most affected areas are Golaghat and Bokhakaht subdivision of the district.

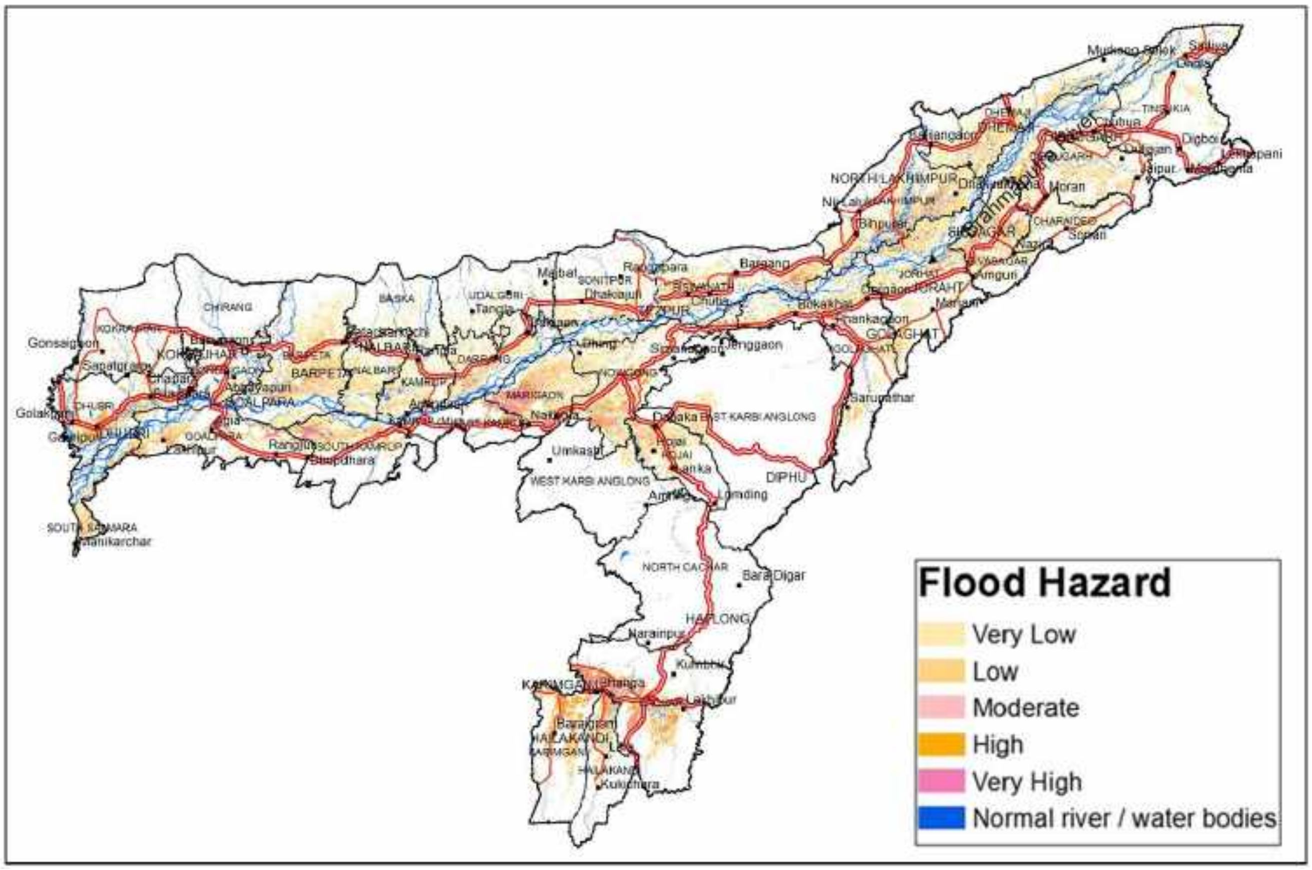


Figure 19. Flood zonation map of Assam

Source: Assam State Disaster Management Authority

3.8 Land-Use/Land Cover

Objectives

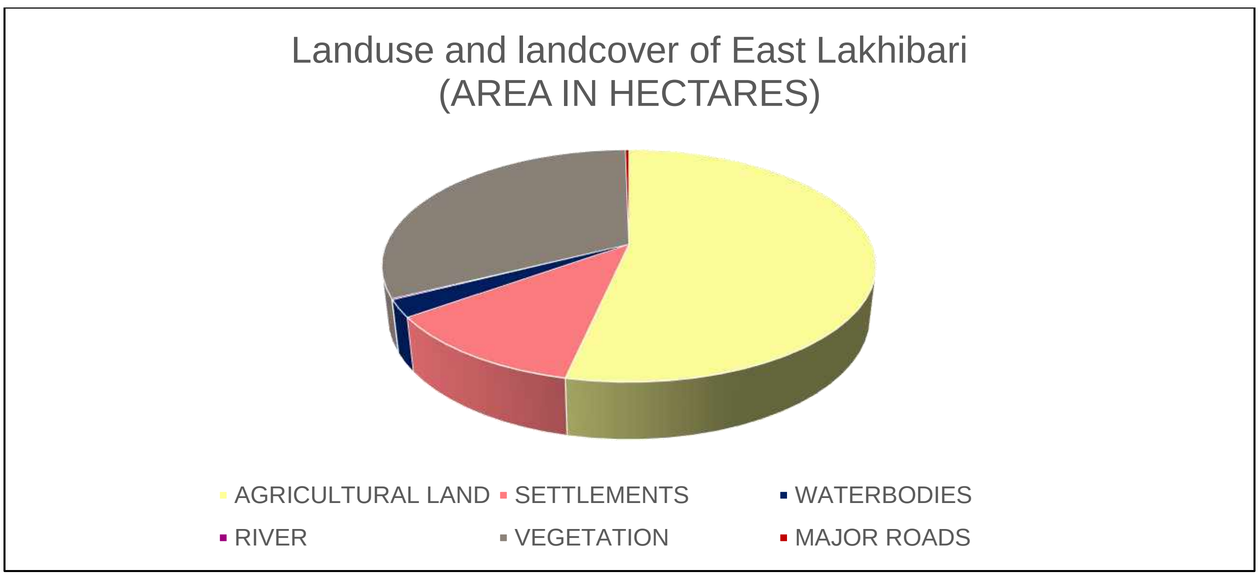
The objective of assessing the land use details of the area is to know the existing land use pattern of the area and understand how the land can be used for the proposed development activities in the study area. It also enables to envisage the scenario emerging due to the increase in demand for land with increase in population and the impacts arising due to the interface with various project activities.

Land use pattern of the study area

The land-use of the study area is provided below for each PML Block.

East- Lakhibari PML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	454.23
SETTLEMENTS	99.34
WATERBODIES	20.2
RIVER	1.23
VEGETATION	272.62
MAJOR ROADS	2.38
TOTAL	850



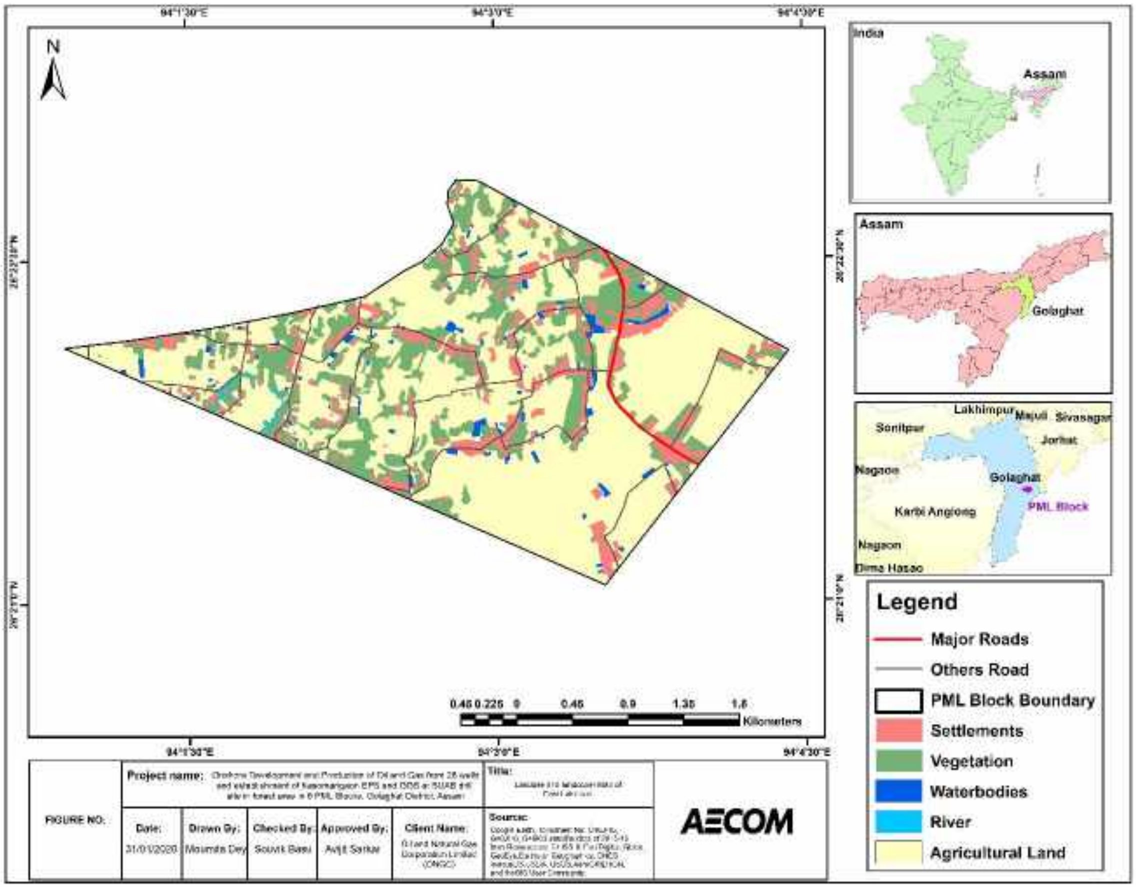
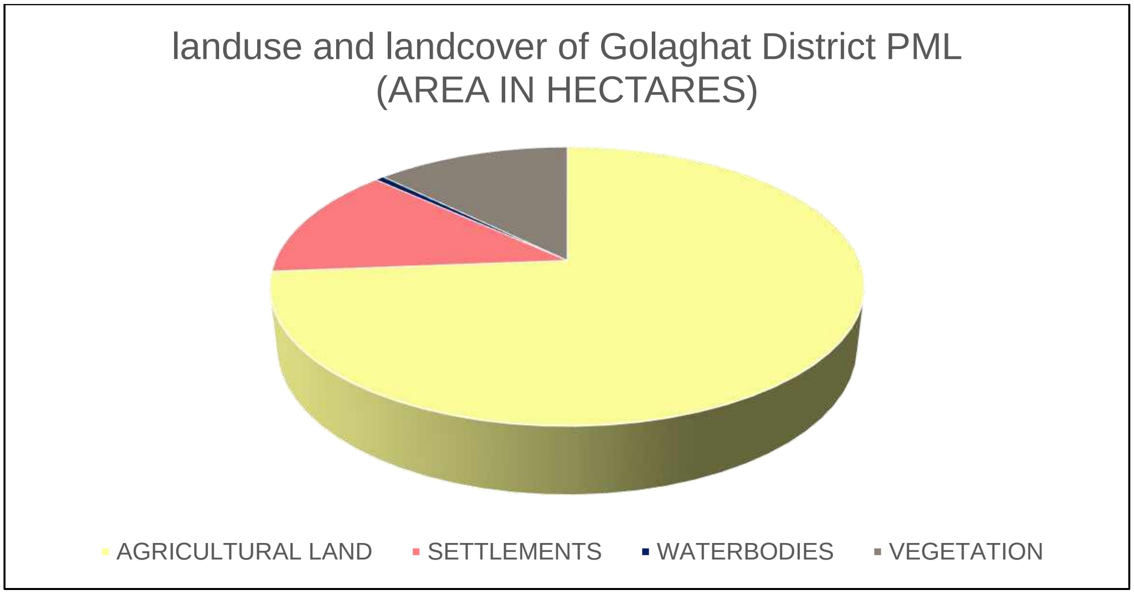


Figure 20. Land Use of East Lakhibari

Golaghat ML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	1622.21
SETTLEMENTS	287.53
WATERBODIES	12.69
VEGETATION	277.57
TOTAL	2200



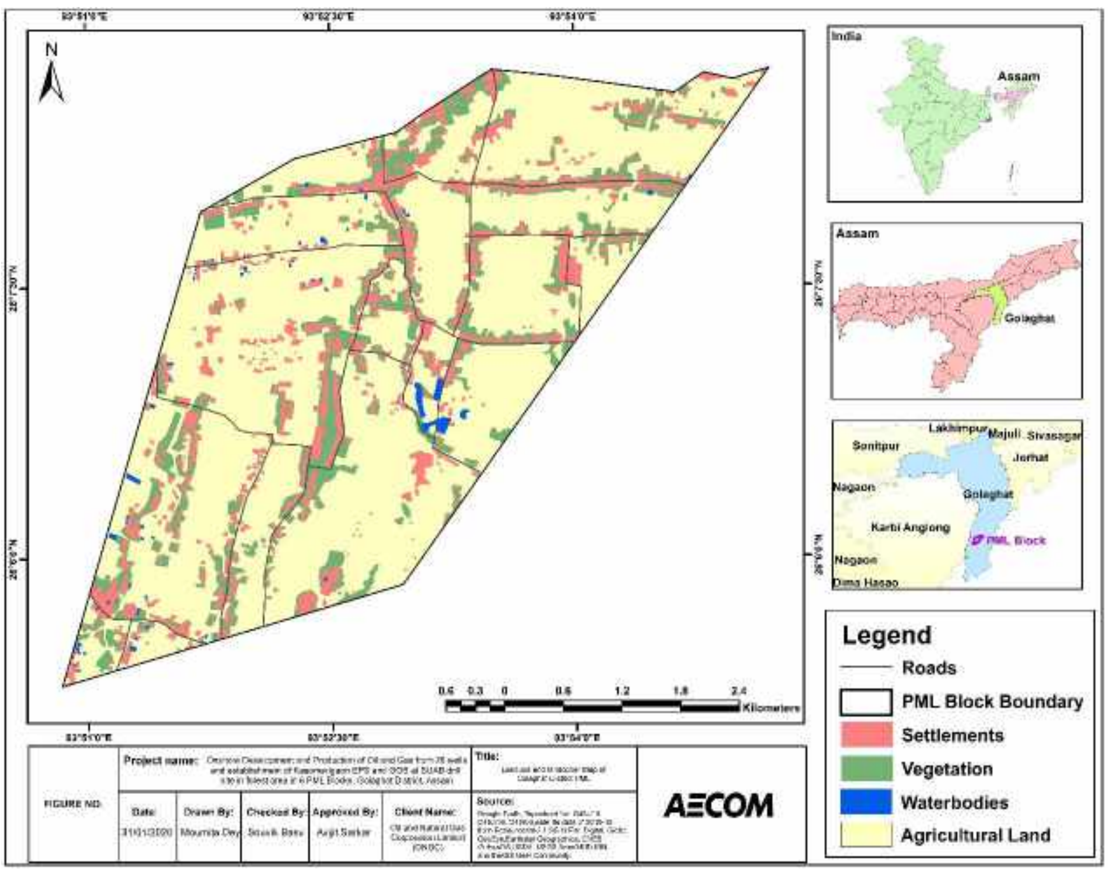
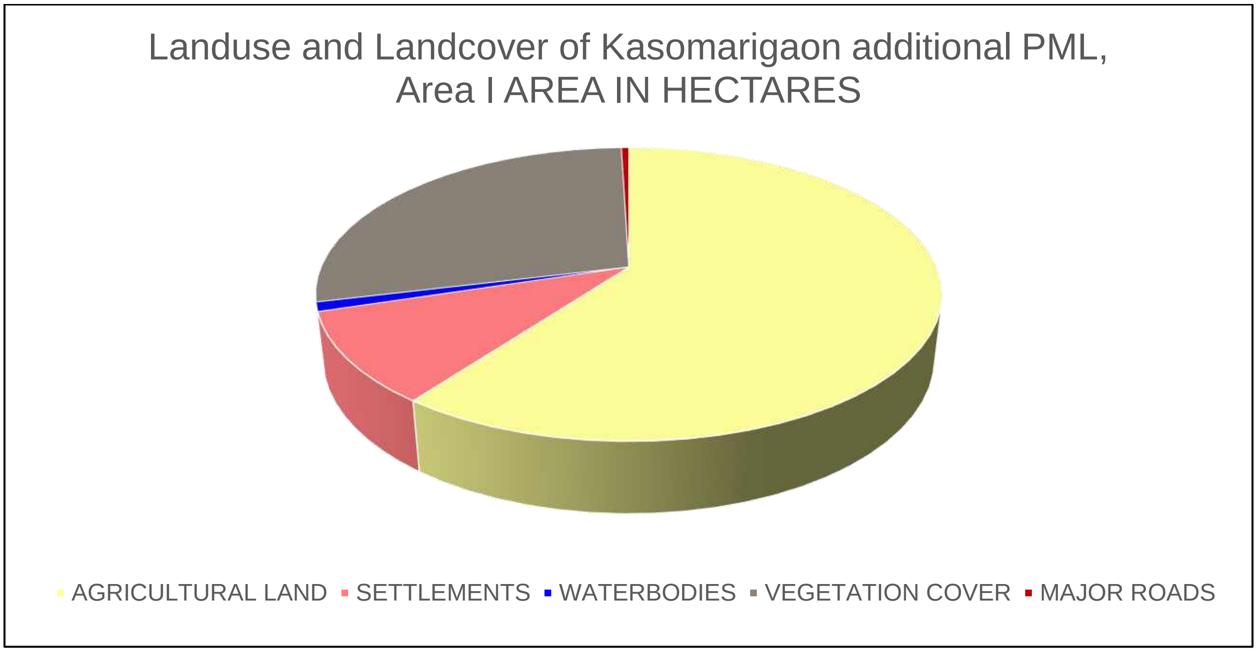


Figure 21. Land Use of Golaghat PML

Kasomarigaon Additional Area I PML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	415.08
SETTLEMENTS	69.21
WATERBODIES	7.01
VEGETATION COVER	195.51
MAJOR ROADS	3.19
TOTAL	690



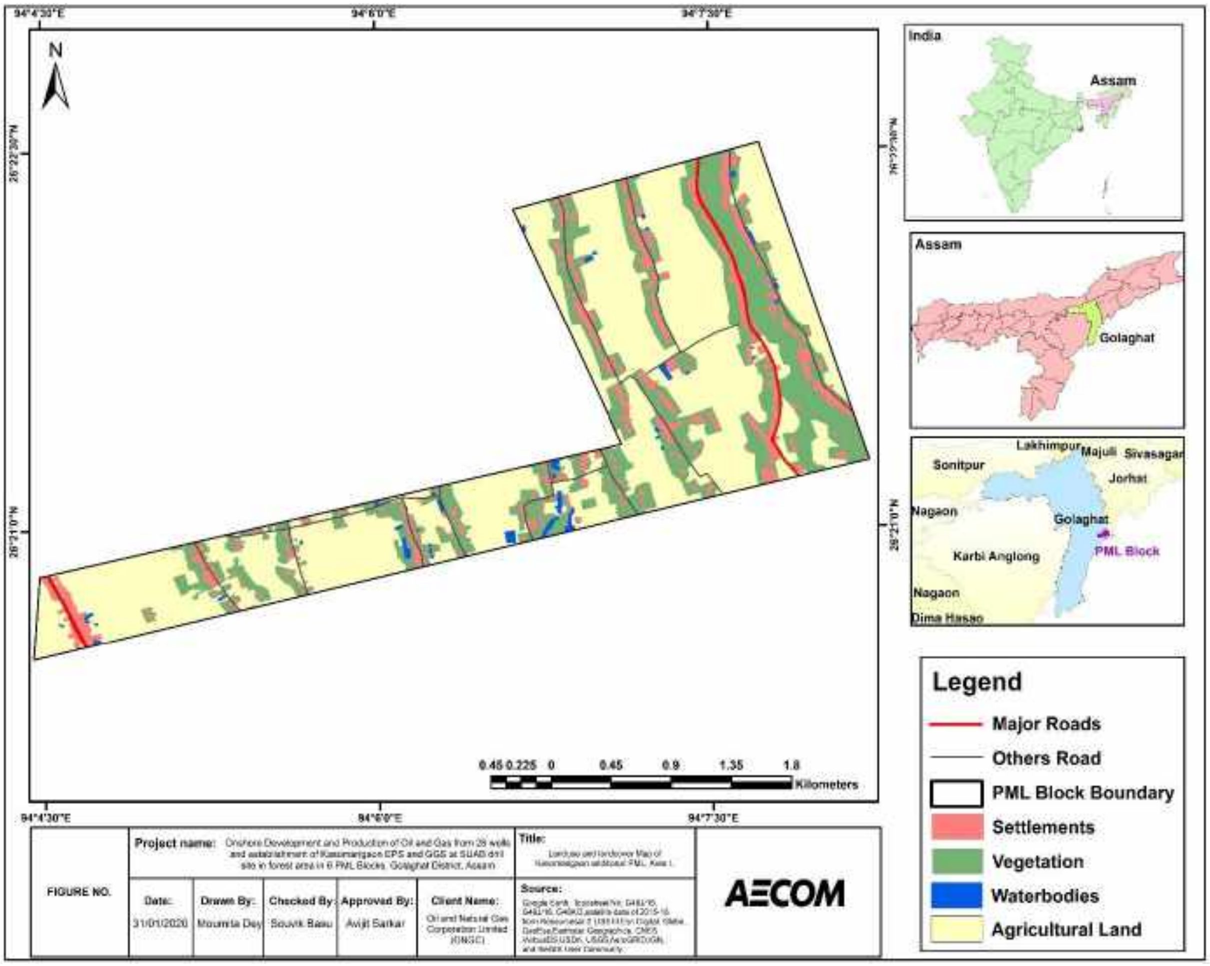
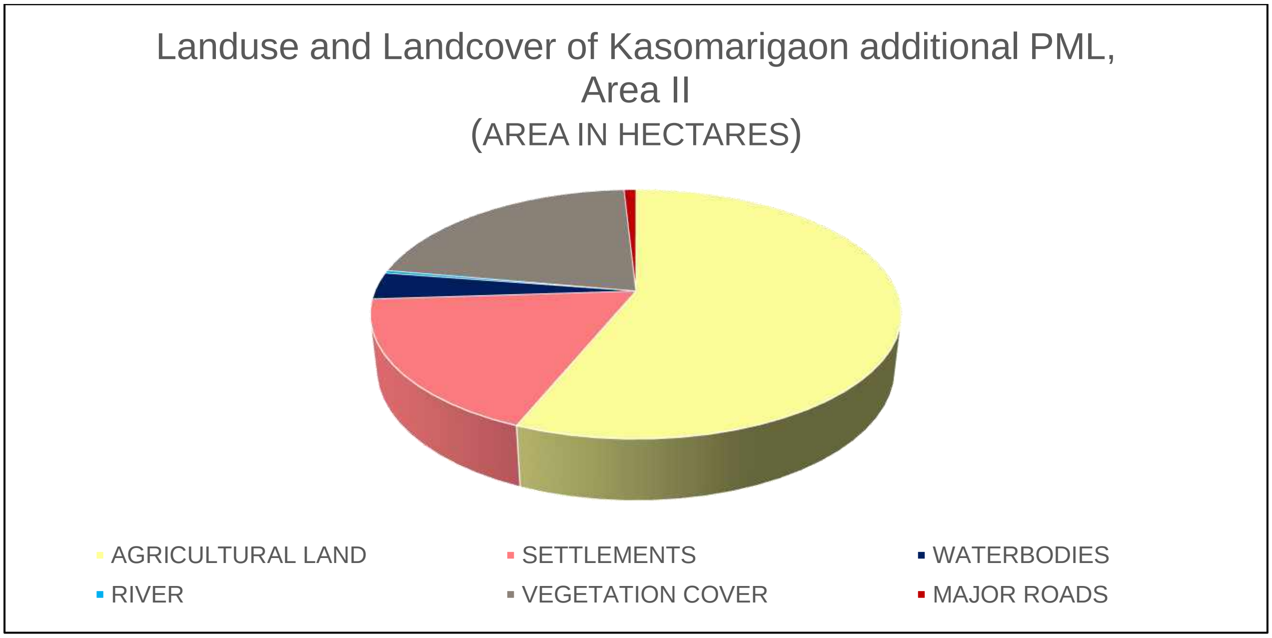


Figure 22. Land Use of Kasomarigaon PML additional area (Area – 1) PML

Kasomarigaon Additional (Area II) ML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	325.83
SETTLEMENTS	103.18
WATERBODIES	20.22
RIVER	2.11
VEGETATION COVER	123.67
MAJOR ROADS	4.99
TOTAL	580



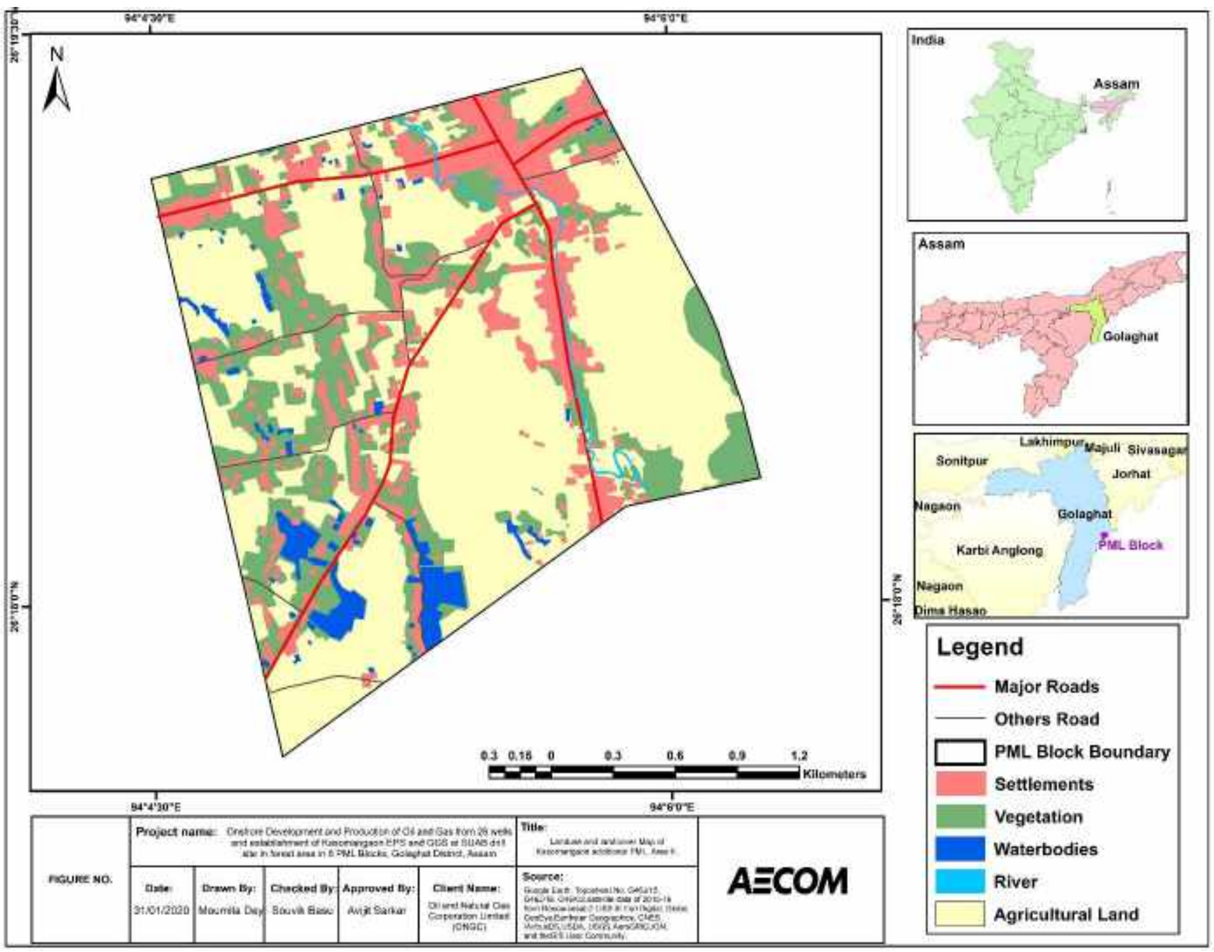


Figure 23. Land Use of Kasomarigaon Additional (Area II) PML

Kasomarigaon Additional (Area III) ML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	998.01
SETTLEMENTS	118.03
WATERBODIES	45.53
VEGETATION	300.69
MAJOR ROADS	4.74
TOTAL	1467

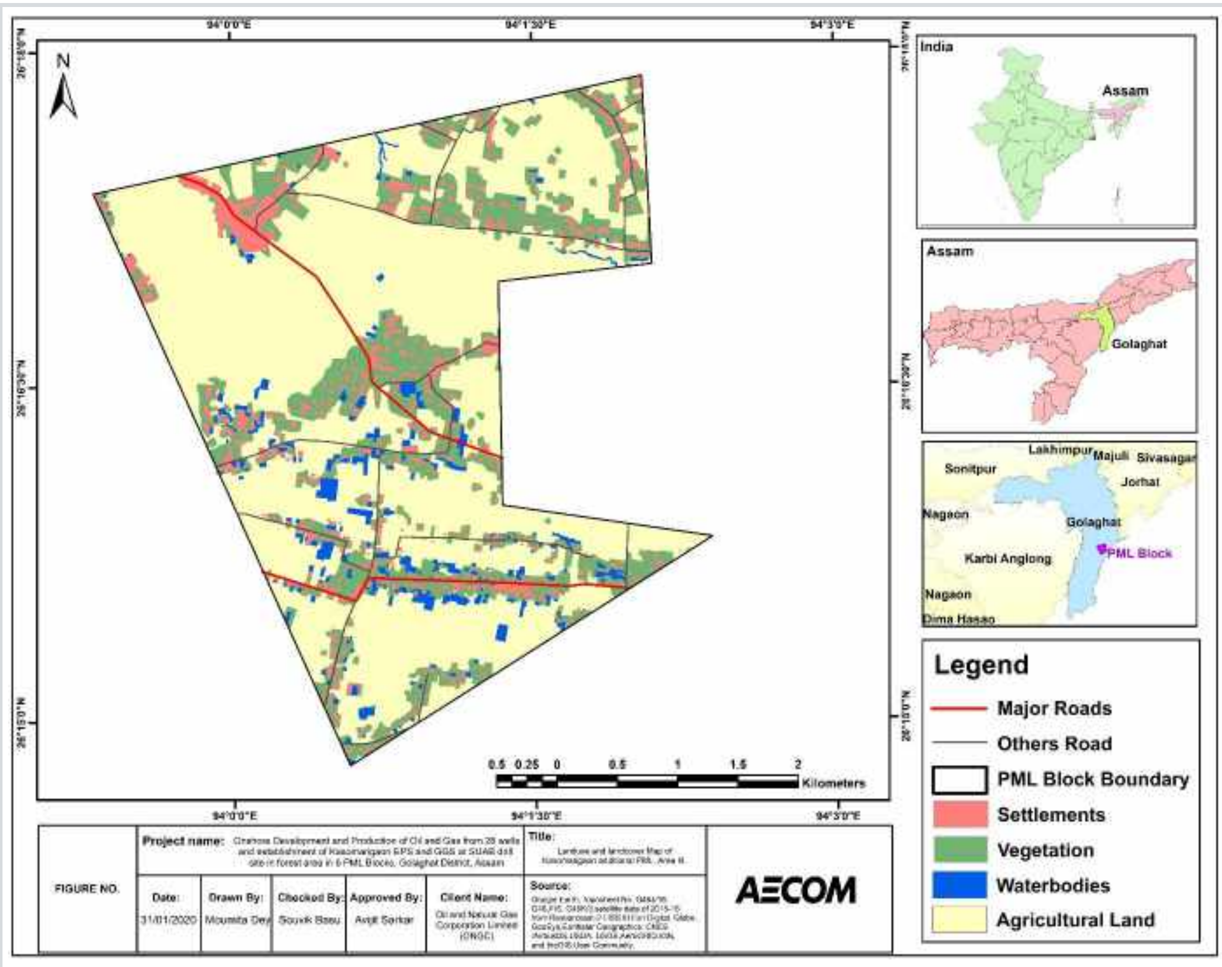
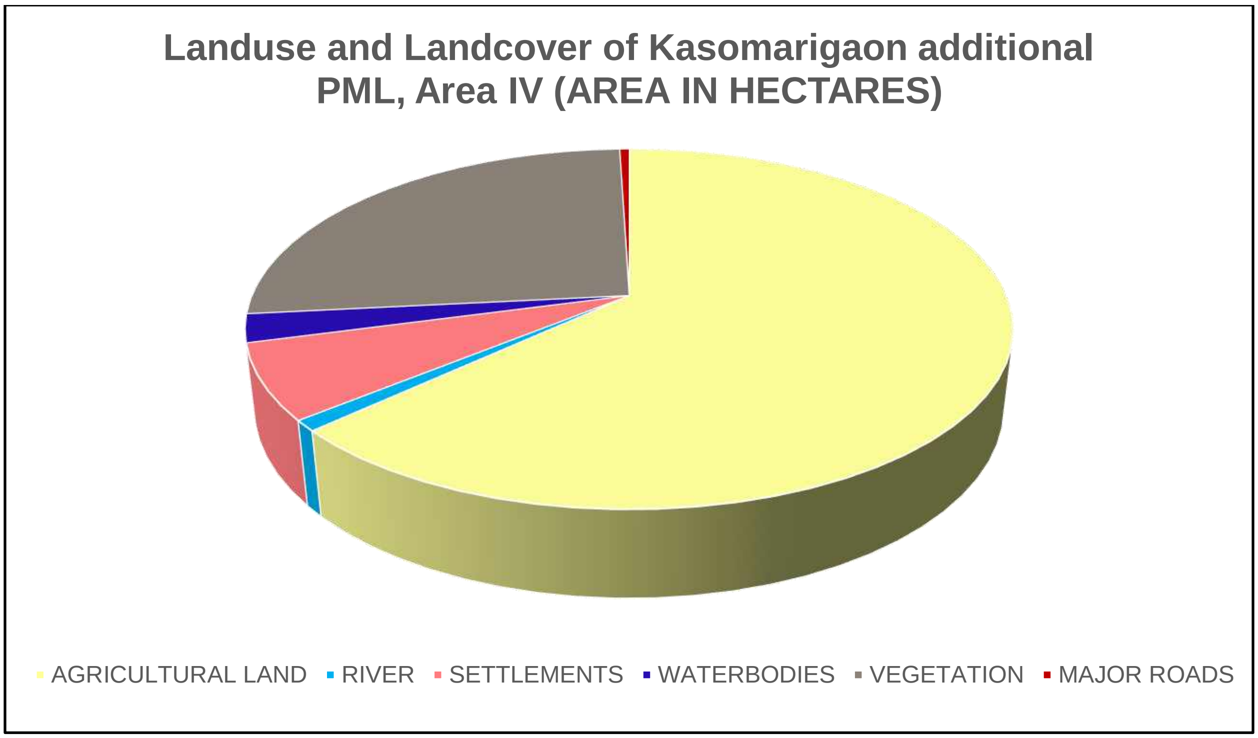


Figure 24. Land Use of Kasomarigaon additional (Area III) PML

Kasomarigaon additional (Area IV) ML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	1802.21
RIVER	27.36
SETTLEMENTS	193.11
WATERBODIES	72.62
VEGETATION	746.86
MAJOR ROADS	13.84
TOTAL	2856



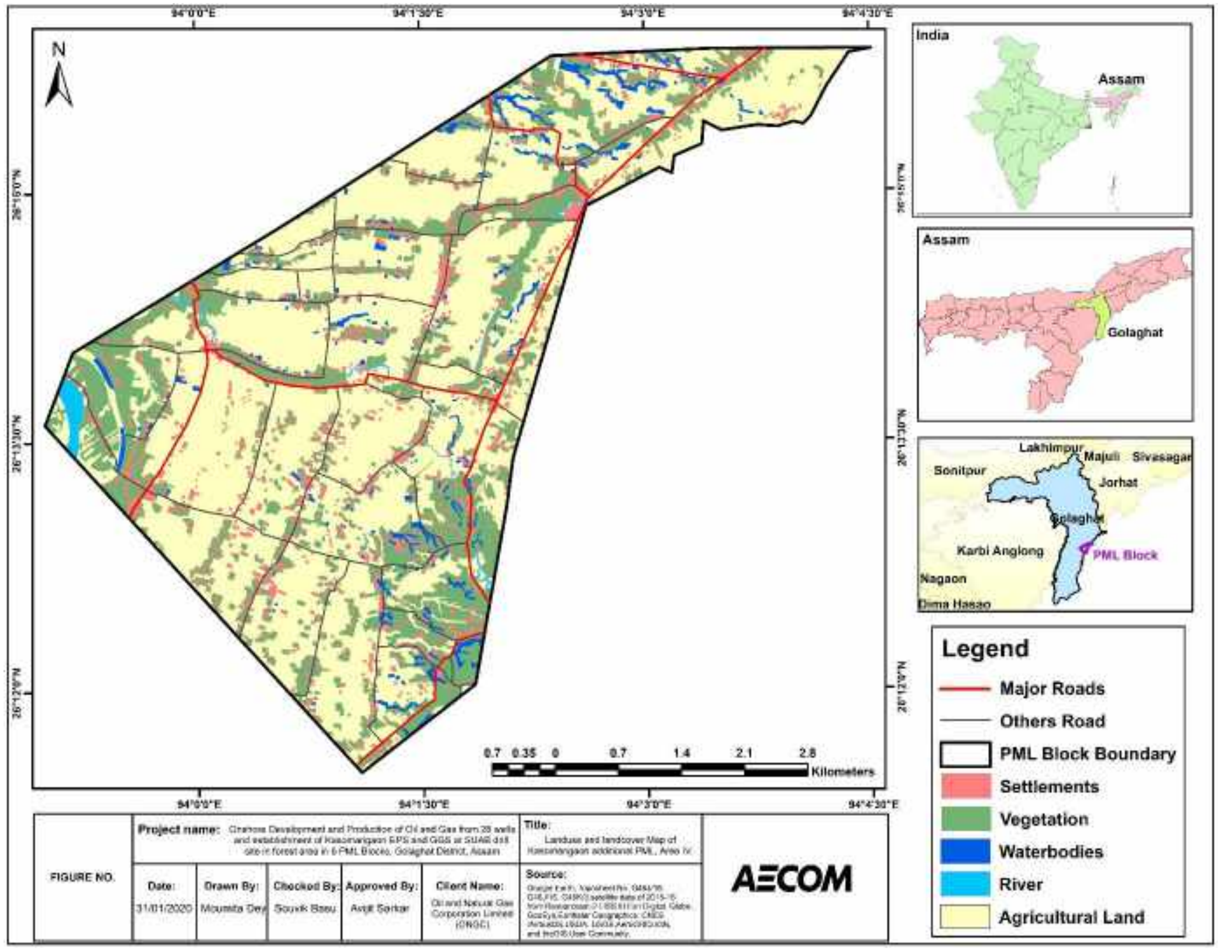
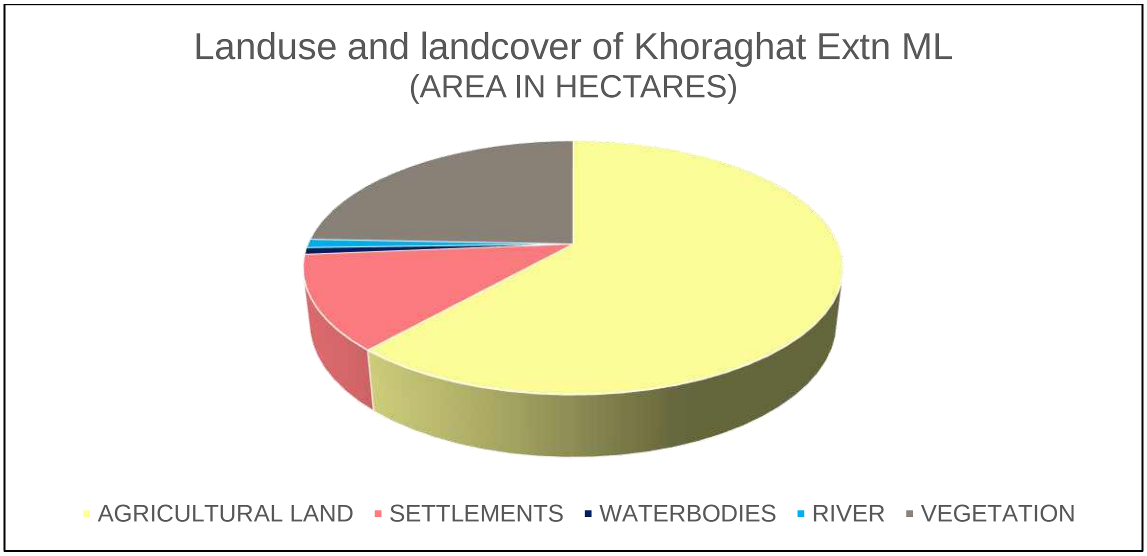


Figure 25. Land Use of Kasomarigaon additional (Area IV) PML

Khoraghat ML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	5113.28
SETTLEMENTS	1001.59
WATERBODIES	71.86
RIVER	89.56
VEGETATION	2023.71
TOTAL	8300



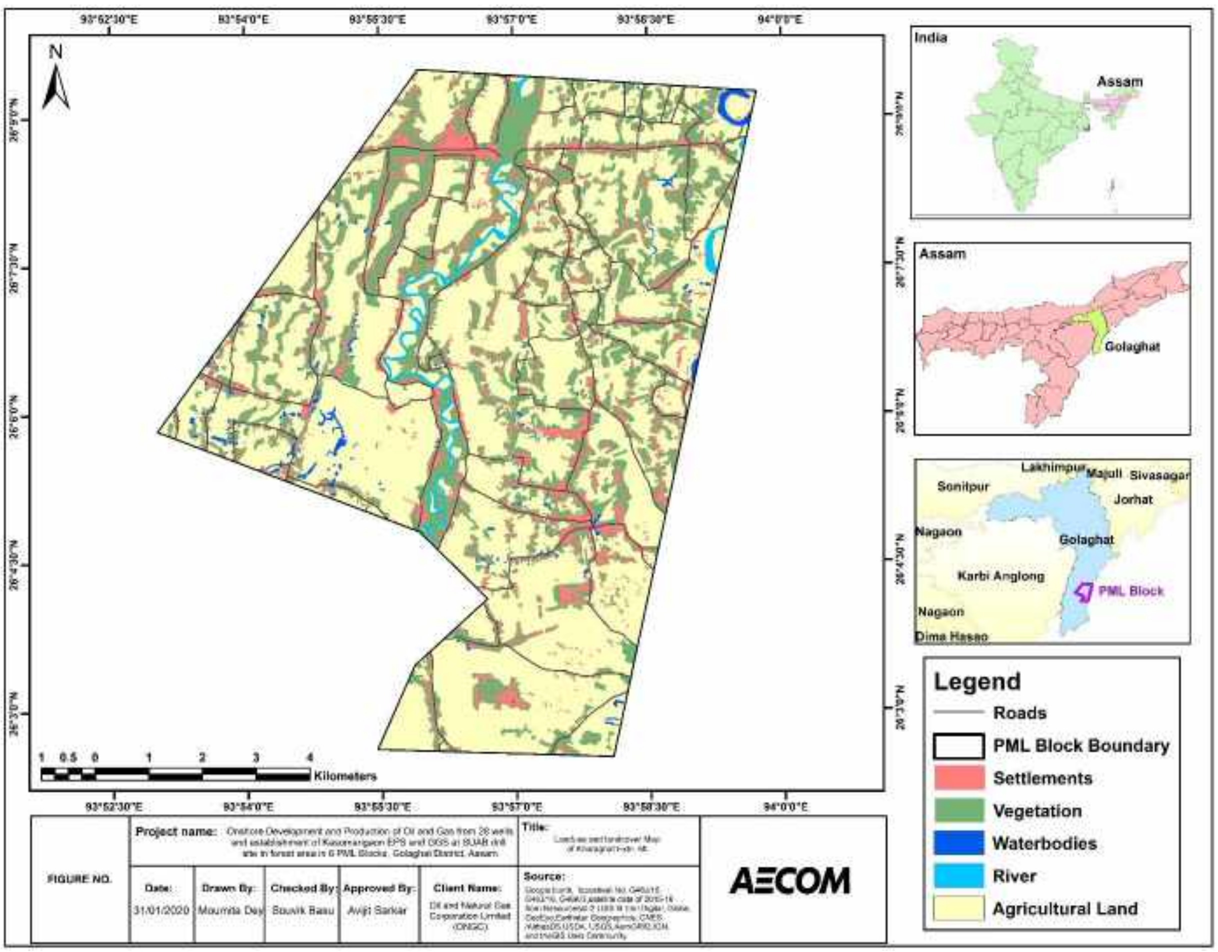
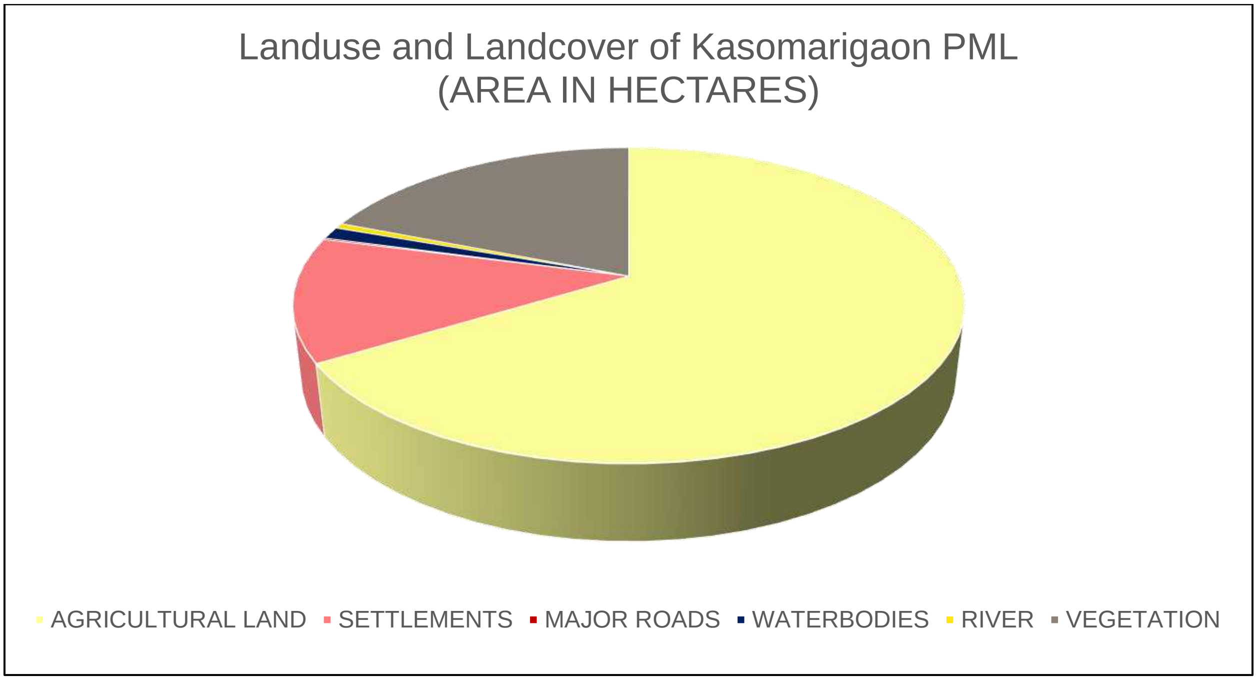


Figure 26. Land Use of Khoraghat area PML

Kasomarigaon PML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	1326.13
SETTLEMENTS	254.88
MAJOR ROADS	3.18
WATERBODIES	24.79
RIVER	11.03
VEGETATION	379.99
TOTAL	2000



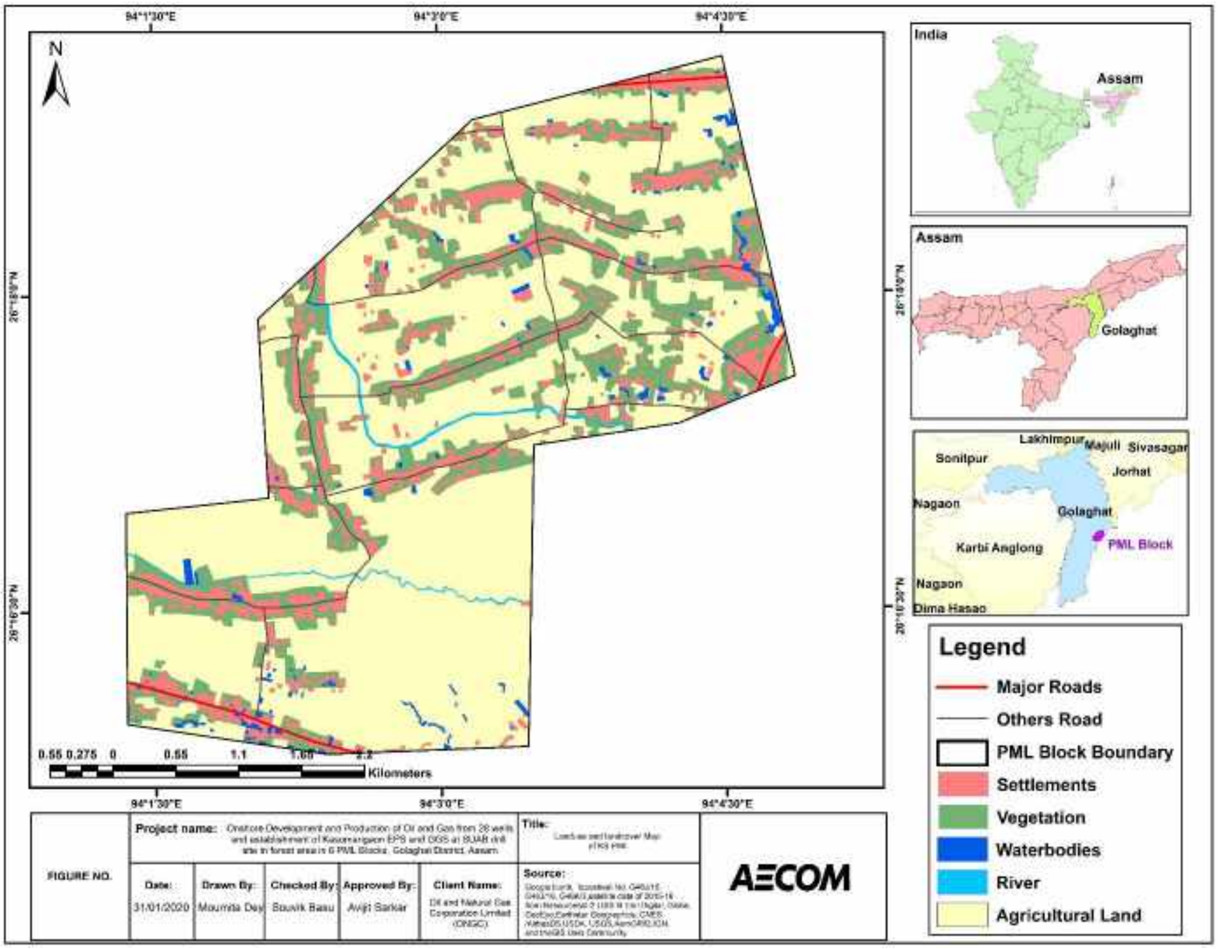
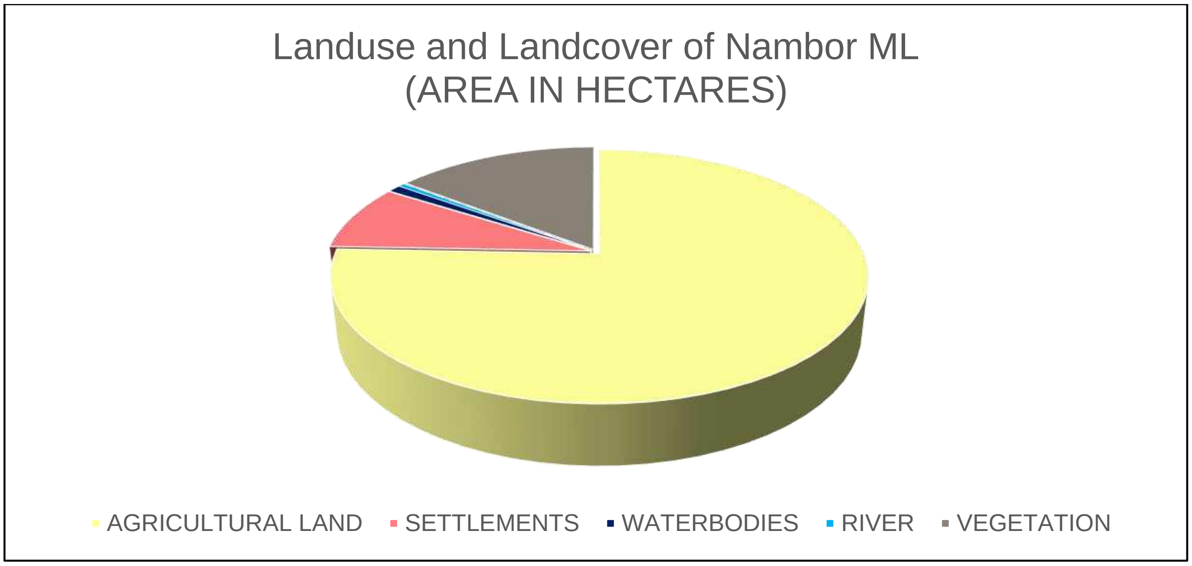


Figure 27. Land Use of Kasomarigaon PML

Nambor PML

NAME OF CATEGORIES	AREA IN HECTARES
AGRICULTURAL LAND	1966.04
SETTLEMENTS	218.17
WATERBODIES	24.31
RIVER	11.94
VEGETATION	379.54
TOTAL	2600



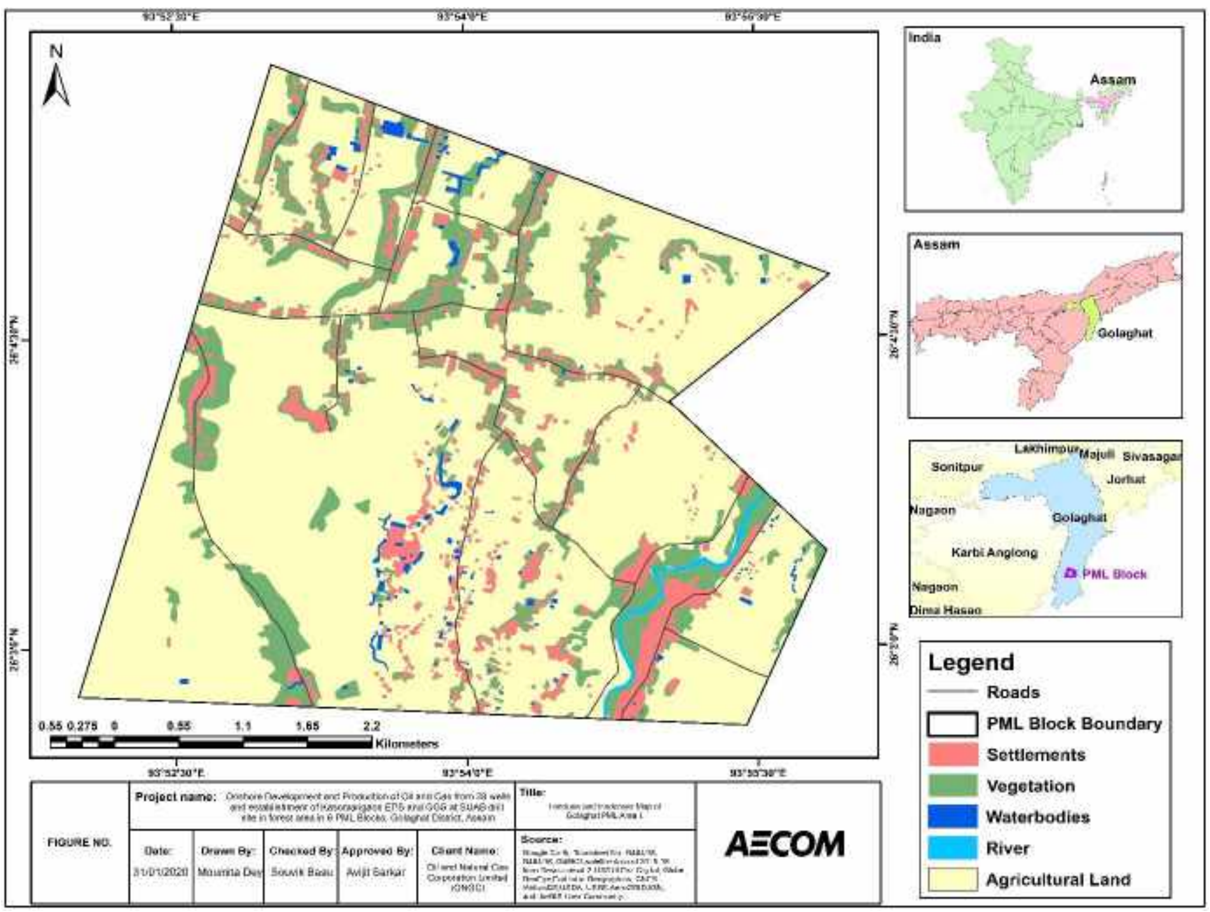


Figure 28. Land Use of Nambor PML

3.9 Climate and Meteorology

Climate and meteorology of a region regarded as a significant parameter to be considered for the implementation of any development project. Meteorology (weather and climate) plays a crucial role in understanding local air quality as there is an essential relationship between meteorology and atmospheric dispersion involving the wind speed/direction, stability class and other factors. The forest PML blocks falls under the humid sub-tropical climate zone, which is a normal climate profile for the whole state of Assam.

The seasons experienced by the area is described below:

Pre-monsoon: March-May
Monsoon: June- September
Post-monsoon: October- November
Winter: December- February

The meteorological data of IMD station at North Lakhimpur has been used for interpretation of longer-term temperature profile, relative humidity, wind speed and wind direction in the study area. In addition, monthly rainfall data obtained from Customized Rainfall Information System (CRIS), IMD has also been referred to understand the rainfall pattern of the area.

Temperature

Golaghat District

As per the CGWB booklet of Golaghat, the climate of the district is subtropical and humid characterized by moderate rainfall. The maximum temperature goes up to 36°C during June / July and minimum temperature falls to 6°C in December and January.

Relative Humidity

Golaghat District

As per the report of CGWB of Golaghat district, 93 to 95% during morning hours and during afternoon hours it varies from 53 to 75%. Which is a normal pattern of this region.

Rainfall

Golaghat District

Golaghat district gets a south-west monsoon rainfall of around 2012 mm from the month of April and continues up to September/October. The pattern of rainfall varies in the district, from south to north, the intensity of rainfall increases, and the maximum rainfall is recorded in the north eastern parts of the district.

As per the Climatological Normals (1971-2000), the mean annual rainfall was recorded as 3324.9 mm.

District wise rainfall map is presented in Figure 29.

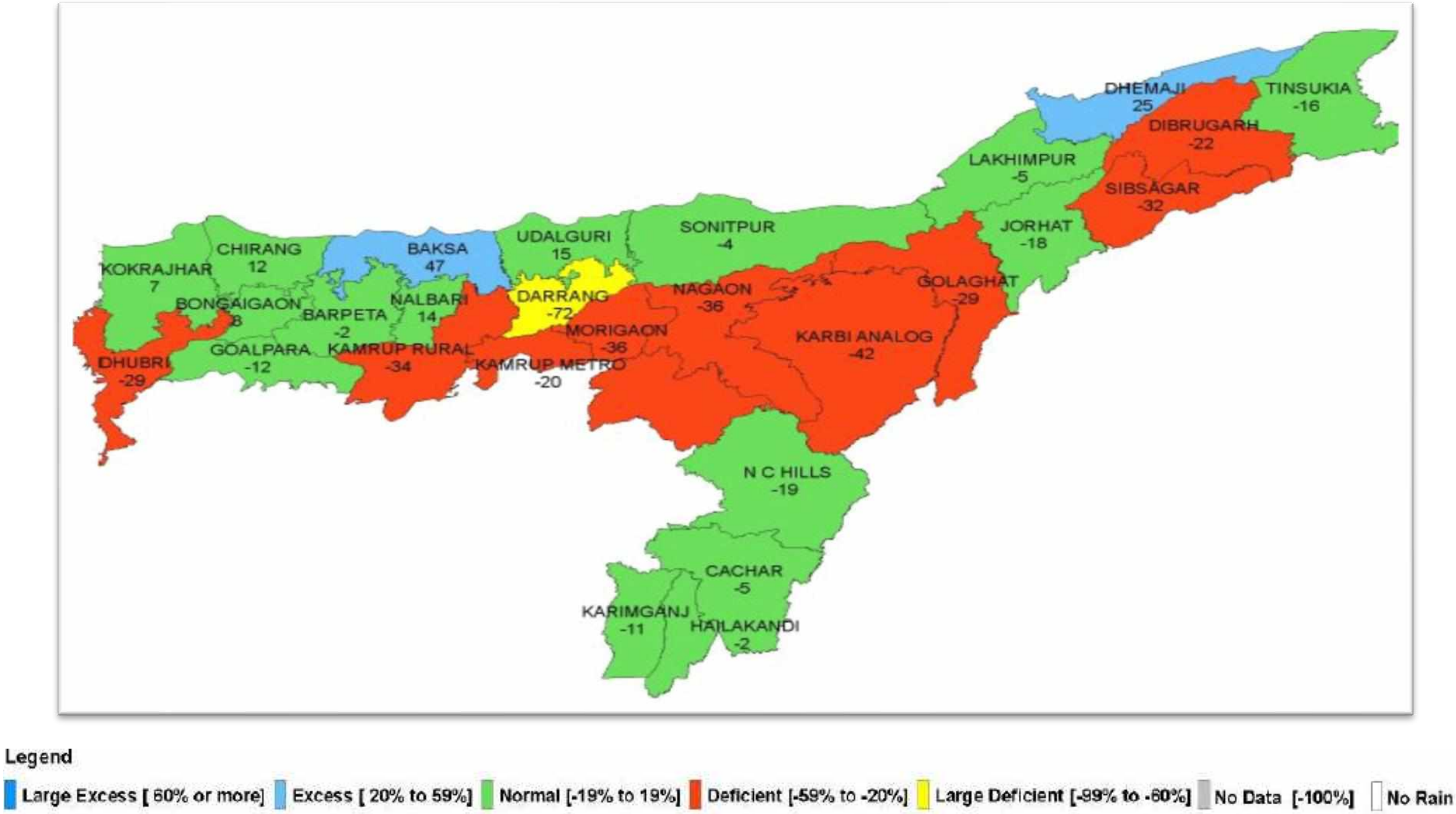


Figure 29. Rainfall Distribution pattern of Assam (CRIS)

Wind Speed and Wind Direction

As per the Atlas of Windrose (1971-2000) by Indian Meteorological Department, highest monthly mean wind speed is 6.5 m/s in the month of April and lowest monthly mean wind speed is 2.5 m/s in November. Predominant wind direction is north east (NE) direction.

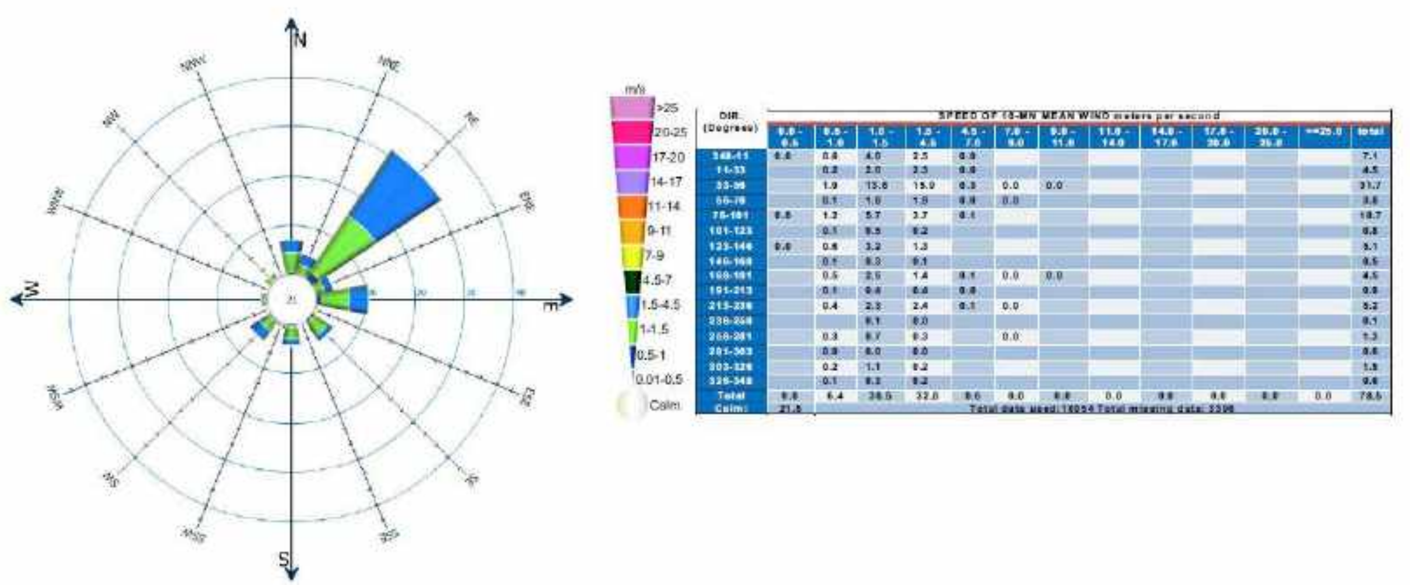


Figure 30. Windrose of North Lakhimpur

Table 14. Climatological Profile of North Lakhimpur

Seasons	Temperature (°C)		Relative humidity (%)		Wind speed (kmph)	Rainfall (mm)
	Maximum	Minimum	Day time	Night time		
Winter	28.4	9.1	78	75	2.7	31.23
Pre-monsoon	32.4	15.03	76	73.3	5.8	224
Monsoon	35.5	22.15	87	81.2	7.4	580.45
Post Monsoon	32	8.93	76	81.5	2.9	101.05

Micrometeorological Parameters

Block Micrometeorological parameters were observed to assess the local climatic condition of the study area. Micrometeorological setup was installed near sarupathar Police station (26°11′48″N, 93°51′57.05″E), which is almost 8 km north west from the nearest PML boundary. The micro met monitoring stations were installed at a height of about 10 m above the ground level, ensuring that there were no obstructions to the free flow of winds. A three-monthly (November 2019 to January 2020) monitoring was conducted, and the prevailing meteorological conditions are discussed below (Table 15).

Meteorological profile of this region characterised by low temperature with a disrupt amount of rainfall. Temperature of this region varies from, 8.7°C to 28°C, with an average of 18.9°C. Relative humidity accounts for 56.72%, on an average throughout the monitoring period. Average wind speed was measured as 1.96 metre/second throughout the study period with predominant wind direction from north east, the wind rose diagram of the study area is presented in figure 31.

Table 15. Micrometeorological parameters

Station name	**Temperature(°C)**		**Relative humidity**	**Rainfall**	**Wind speed**	**Wind direction**
	Max	Min	(Average)	(mm)	(m/s)	(Average)
Sarupathar (26°11′48″N, 93°51′57.05″ E)	28°C	8.7°C	56.72%	2.7	1.96	North east

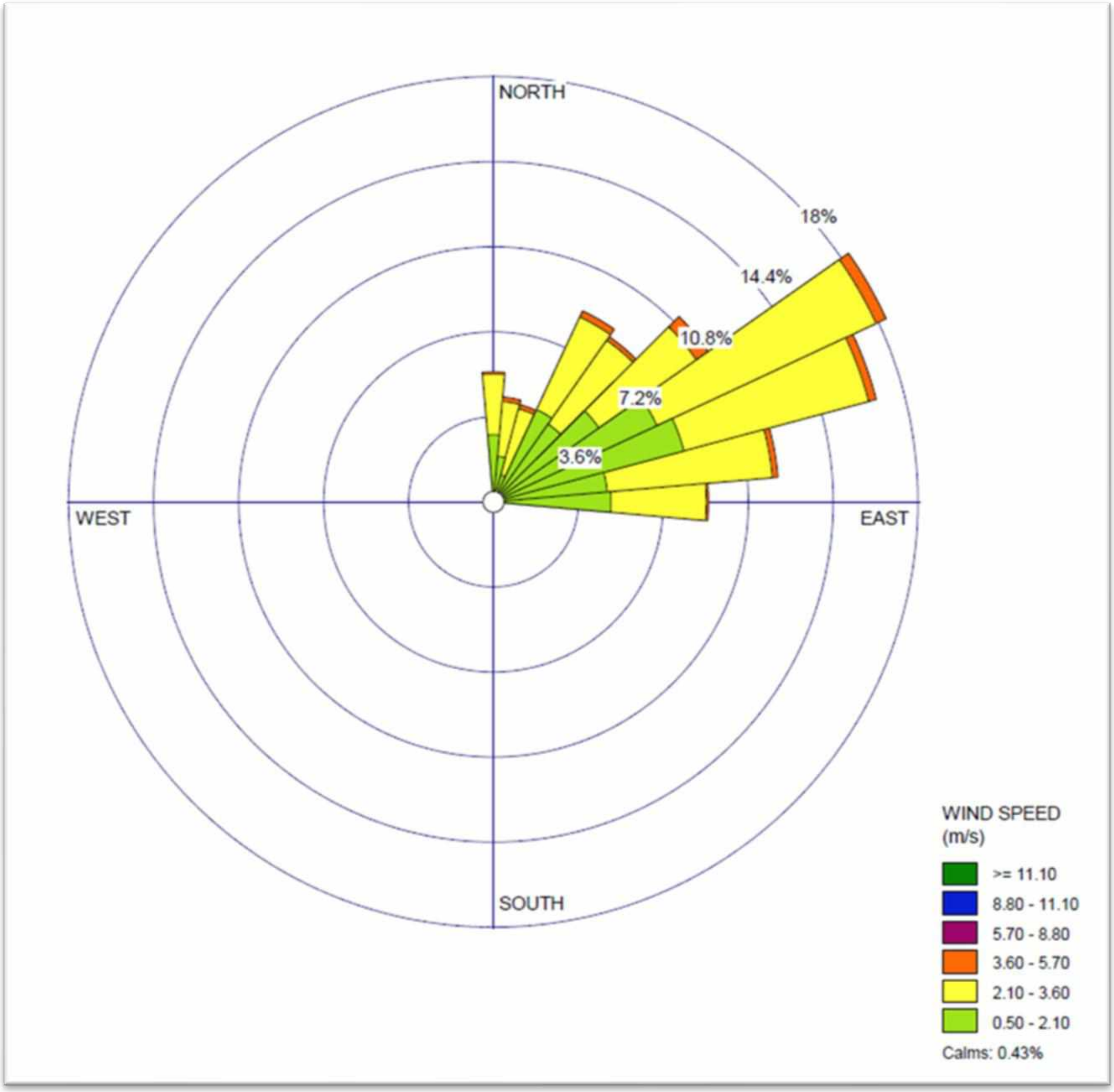


Figure 31. Wind rose diagram of the study area

Ambient Air Quality

The baseline status of the ambient air quality was assessed through a scientifically designed ambient air quality-monitoring network. The design of monitoring network in the air quality study was based on (i) meteorological conditions on synoptic basis; (ii) topography of the study area; (iii) representatives of regional background air quality for obtaining baseline status; (iv) representatives of likely impact areas and (v) location of sensitive receptors in the study area, (vi) settlement area and (vi) accessibility and availability of infrastructure. Criteria used for designing the network were principally governed by pre-dominant wind directions obtained from the wind rose pattern for the summer season and the accessibility of the selected sites.

Ambient air quality monitoring was conducted for following parameters:(i) Particulate Matter (PM10 & PM 2.5), (ii) Sulphur Dioxide (SO_2), (iii) Nitrogen Dioxide (NO_2), (iv) Carbon monoxide (CO),Ozone(O_3), Benzene(C6H6), Benzo alpha pyrene (BaP), Lead(Pb) ,Arsenic(As), Nickel(Ni) , Ammonia(NH3) ,Hydrocarbons(HC)- both methane and non-methane , Volatile Organic Compounds (VoC). Ambient air quality monitoring was conducted at forest PML Blocks in representative locations during post-monsoon season i.e. October 2019 to January 2020.

There are 8 locations have been selected in the study area for ambient air quality monitoring. The air monitoring activity was conducted as per the approved CPCB guidelines. The monitoring locations were selected after considering the upwind, downwind and cross wind direction of the proposed well location within the study area.

AAQ Monitoring Locations

The ambient air quality monitoring was carried out at eight (8) locations in and around the study area. The monitoring locations were selected taking into considerations factors such as predominant up & down wind directions and cross wind direction of the proposed well location, locations of the sensitive receptors in the Block area, and, any existing air pollution sources also taken into consideration during selection of monitoring location.

The Predominant wind direction (NE) for the period (October 2019 to January 2020) was found from long term climatic average as available from IMD (1981-2010) station at North Lakhimpur. The location of the 8 air monitoring locations is given in Table 16 and Figure 32.

Table 16. Ambient Air Quality Monitoring Stations

Location Code	Coordinates	Village	Justification
AAQ1	26° 22′ 17.9″ N, 94° 0′20.4″ E	Lakhibari	Cross wind of well ELDA
AAQ2	26° 20′ 4.9″ N, 94° 2′ 57.5″ E	Chowdang Pothar	Cross wind of KSDC and KSDD
AAQ3	26° 19′ 15.4″ N, 94° 5′ 44.9″ E	Merapani	Upwind of KSDC and KSDD
AAQ4	26° 15′ 11.2″ N, 94° 2′ 26.6″ E	Panbari	Down wind of DPDA drill site
AAQ5	26°15.121'N, 94°02.269'E	Sarupani	Upwind of DPDA, DPDD, DPDO
AAQ6	26° 07'44.2"N, 93°57'39"E	Sonaur	Downwind at Golaghat PML
AAQ7	26° 05'26.7"N, 93°51'49.02"E	Sonali Pothar	Down wind at Golaghat PML
AAQ8	26°04'01.3"N, 93°54'09.8"E	3No. Saluk pothar	Upwind of NRDJ and NRDK

Source: Primary Baseline survey

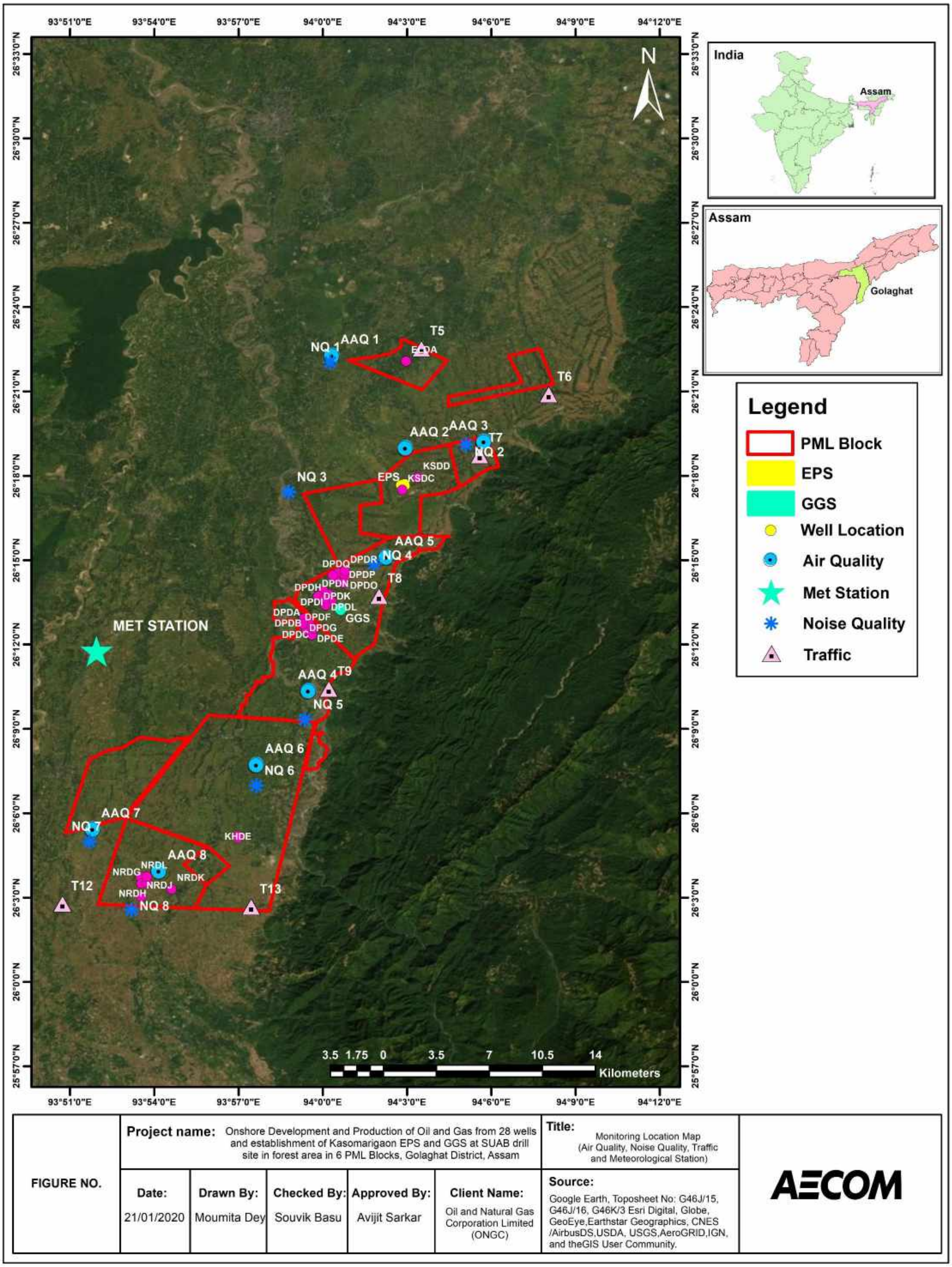


Figure 32. Ambient Air quality, Noise and Traffic monitoring location of PML

AAQ monitoring Results

Ambient air quality monitoring was conducted for twice a week 24 hourly for three months at eight (8) locations for each parameter as listed above in table below. Analysis of ambient air quality monitoring results for March to May'19 is presented in Table 17.

Table 17. Ambient Air Quality monitoring result in forest PML

Parameter	Results	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	AAQ-6	AAQ-7	AAQ-8
PM10 (µg/m^3)	NAAQS	100	100	100	100	100	100	100	100
	Max	76	86.94	76	74	75	74	79	77
	Min	67	58.24	60	67	63	63	65	62
	Average	71.41	70.91	70	71.05	70.04	70	70.26	69.72
	98th Percentile	75.6	82.98	75	74	75	73	77.74	75.16
PM2.5 (µg/m^3)	NAAQS	60	60	60	60	60	60	60	60
	Max	40	42	39	43	39	39	38	43
	Min	19	25	23	17	23	21	21	22
	Average	31.73	32.55	31	32.77	30.50	30	29.17	32
	98th Percentile	39.6	40.4	39	42.2	38.2	39	37.58	41.32
SO_2 (µg/m^3)	NAAQS	80	80	80	80	80	80	80	80
	Max	10.5	11.90	13	12.8	11.6	13	11.6	11.2
	Min	6.3	6	7	6.8	7	7	7.2	6.8
	Average	8.40	8.74	9	8.89	8.85	9	8.71	8.79
	98th Percentile	10.34	11.78	12	11.8	11.28	13	11.05	10.95
NO_2 (µg/m^3)	NAAQS	80	80	80	80	80	80	80	80
	Max	20.5	20	18	17.6	16.8	17	16.3	17.4
	Min	10.5	11.6	11	12.3	10.8	11	10.6	11.7

Parameter	Results	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	AAQ-6	AAQ-7	AAQ-8
	Average	14.12	15.21	15	14.84	14.35	14	13.81	13.77
	98th Percentile	16.88	16.90	18	16.98	16.6	16	15.65	16.77
CO (mg/m^3)	NAAQS	4	4	4	4	4	4	4	4
	Max	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Min	0.5	0.5	0.4	0.5	0.5	0.4	0.6	0.4
	Average	0.73	0.76	0.73	0.71	0.78	0.67	0.77	0.65
	98th Percentile	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
NH_3 ($\mu g/m^3$)	NAAQS	400	400	400	400	400	400	400	400
	Max	19.6	18.5	17.4	17.5	17.2	19.6	17.3	23.8
	Min	7.1	10.3	9.2	8.1	7.1	8.1	7.1	7.5
	Average	13.68	14.75	14.07	10.98	13.55	13.36	12.96	15.74
	98th Percentile	18.64	17.08	17.32	15.58	17.04	18.21	16.67	22.83
C_6H_6 ($\mu g/m^3$)	NAAQS	5	5	5	5	5	5	5	5
	Max	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Average	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98th Percentile	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	NAAQS	1	1	1	1	1	1	1	1

Parameter	Results	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	AAQ-6	AAQ-7	AAQ-8
BAP (ng/m^3)	Max	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Average	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98th Percentile	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
O_3 ($\mu g/m^3$)	NAAQS	100	100	100	100	100	100	100	100
	Max	22.7	22.3	19.7	22.4	21.6	21.5	22.5	20.4
	Min	11.6	10.8	10.8	12.6	13.4	10.4	13.8	12.1
	Average	15.51	16.11	15.57	17.02	17.96	16.33	17.86	18.13
	98th Percentile	21.74	21	19.25	21.93	21.56	21.22	22.5	20.4
Pb ($\mu g/m^3$)	NAAQS	1	1	1	1	1	1	1	1
	Max	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Average	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98th Percentile	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni (ng/m^3)	NAAQS	20	20	20	20	20	20	20	20
	Max	0.98	1.08	1.01	0.97	1.09	1.01	1.01	1.01
	Min	0.62	0.61	0.62	0.55	0.69	0.74	0.74	0.66
	Average	0.82	0.84	0.78	0.80	0.90	0.89	0.90	0.88

Parameter	Results	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	AAQ-6	AAQ-7	AAQ-8
	98th Percentile	0.97	1.07	1	0.97	1.07	1.01	1	1.01
As (ng/m^3)	NAAQS	6	6	6	6	6	6	6	6
	Max	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Average	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98th Percentile	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HC as Methane (µg/m^3)	NAAQS	--	--	--	--	--	--	--	--
	Max	2.6	2.9	2.6	2.5	2.4	2.7	2.7	2.3
	Min	0.9	0.8	1.0	1.0	1.1	0.7	1.1	1.0
	Average	1.6	1.7	1.6	1.6	1.6	1.5	1.7	1.6
	98th Percentile	2.5	2.7	2.5	2.3	2.3	2.5	2.6	2.2
HC as Non-Methane (µg/m^3)	NAAQS	--	--	--	--	--	--	--	--
	Max	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Min	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Average	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	98th Percentile	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: NAAQS = National Ambient Air Quality Standards; BDL = Below Detection Limit; NA = Not Available

DL = Detection Limit; DL for C6H6 = 2.0 µg/m3, DL for BAP = 0.5 µg/m3, DL for O3 = 10.0 µg/m3, DL for Pb = 0.01 µg/m3, DL for As = 0.5 ng/m3, DL for HC as Methane = 2.5 µg/m3, DL for HC as Non-Methane = 2.5 µg/m3, DL for VOC = 2.0 µg/m3.

Particulate Matter (PM10)

PM10 concentration in the study area varied from 69.72 µg/m^3 to 71.41 µg/m^3. The monitoring location at AAQ 2, observed the maximum concentration of PM10 i.e 86.94 µg/m^3, whereas minimum PM10 concentration was also observed at AAQ 2, i.e 58.24 µg/m^3. Graphical presentation of concentration of PM10 values is given Figure 33.

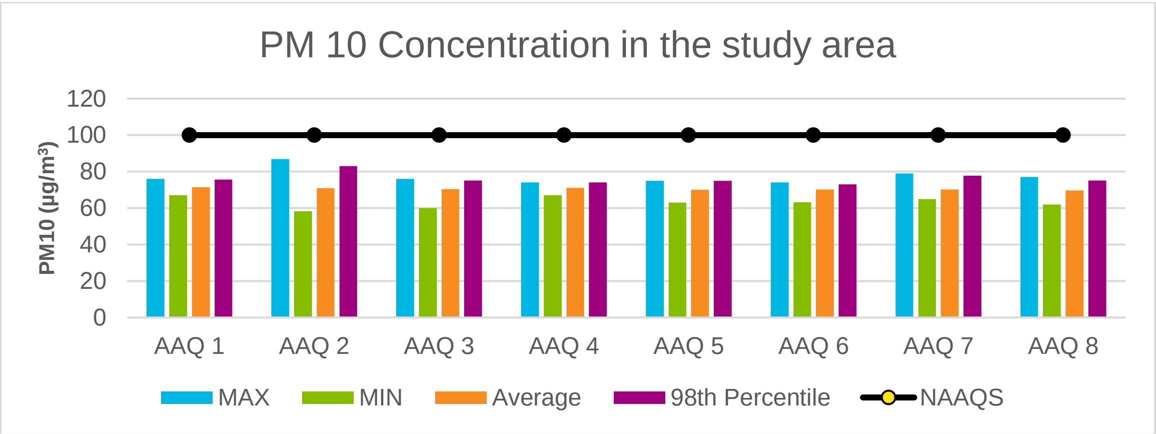


Figure 33. PM 10 Values for all monitoring locations

Particulate Matter (PM2.5)

PM2.5 concentration in the study area varied from 29.17 µg/m^3 to 32.77 µg/m^3. The highest PM 2.5 concentration was observed at monitoring location AAQ 8 which is 43 µg/m^3 and the lowest concentration of PM 2.5 is located at monitoring location AAQ 4 which is 17 µg/m^3. Graphical presentation of concentration of PM2.5 values is given Figure 34.

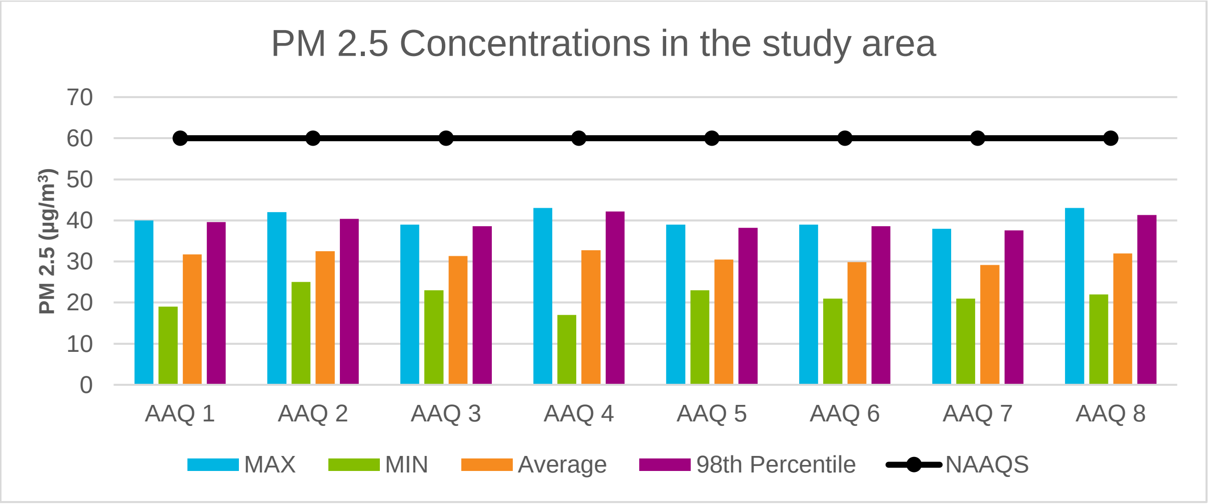


Figure 34. PM 2.5 Values for all monitoring locations

Nitrogen Di-Oxide (NO_2)

NO_2 concentration in the study area varied from 13.77 µg/m^3 to 15.21 µg/m^3. The highest NO_2 concentration was observed at monitoring location AAQ 1 which is 20.5 µg/m^3 and the lowest concentration of NO_2 was also recorded at monitoring location AAQ 7 which is 10.6 µg/m^3. Graphical presentation of concentration of NO_2 values is given figure 35.

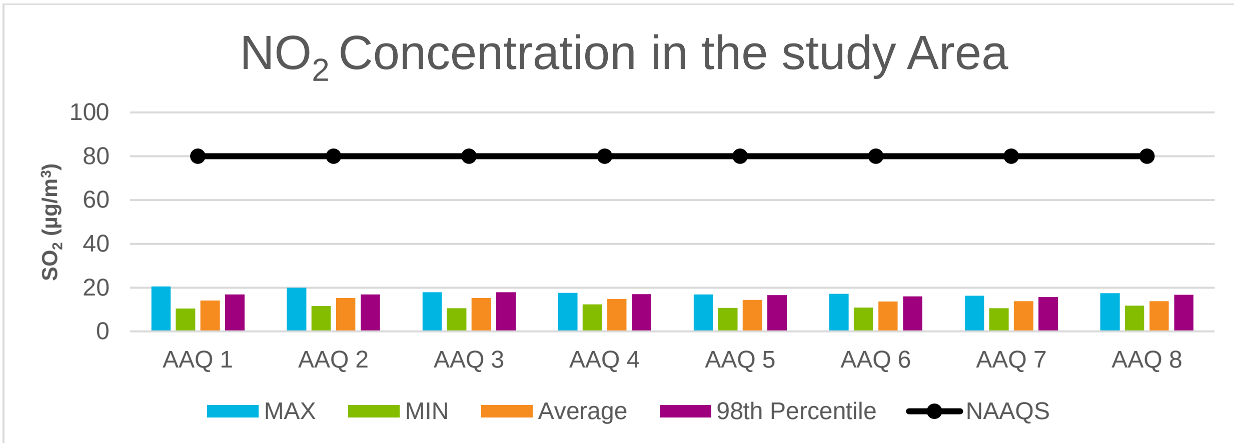


Figure 35. NO_2 values for all monitoring locations

Sulphur Di-Oxide (SO_2)

SO_2 concentration in the study area varied from 8.40 to 9 µg/m^3. The highest SO_2 concentration was observed at monitoring location AAQ 3 which is 13 µg/m^3 and the lowest concentration of SO_2 was recorded at monitoring location AAQ 2 which is 6 µg/m^3. Graphical presentation of concentration of SO_2 values is given Figure 36.

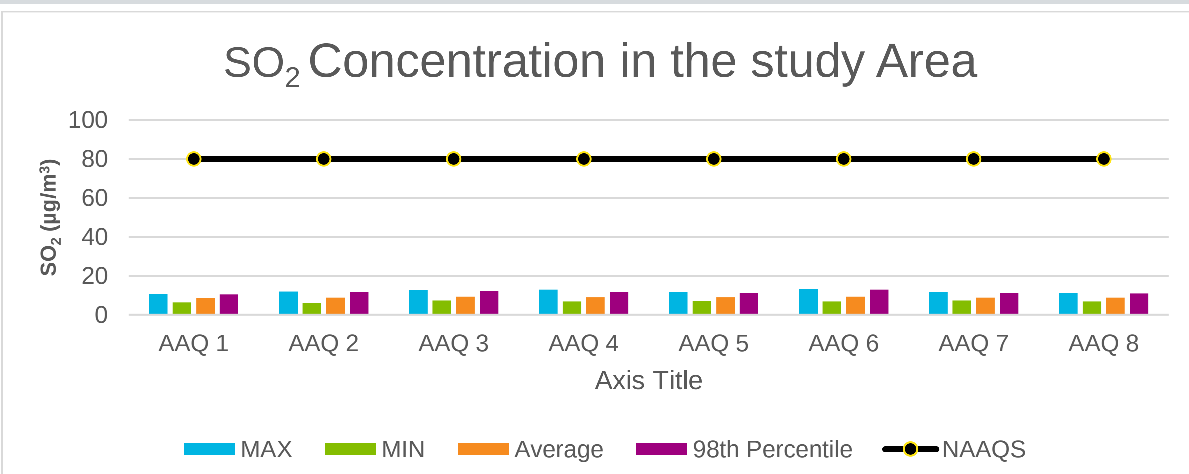


Figure 36. SO_2 Concentration in the study area

Other Parameters

The concentrations for CO ranged from 0.65 to 0.78 mg/m^3. The average concentrations for NH_3 ranged from 10.98 to 15.74 µg/m^3. The average concentration for Ni found to be within the range of 0.78 to 0.90 ng/m^3. The seasonal average concentrations for O_3 ranged from 15.51 to 18.13 µg/m^3.

Concentration of other parameters i.e. C_6H_6 (µg/m^3), BAsP (ng/m^3), Pb (µg/m^3), As (ng/m3), HC as Methane (µg/m^3), HC as Non-Methane (µg/m^3) were observed would be below detectable limit at all locations. Currently there are no ambient air quality standards for Hydrocarbon (as methane & as non-methane).

Photographs of Ambient Air Quality Monitoring

Air Quality Monitoring Station- AQ1

Air Quality Monitoring Station- AQ 2

Air Quality Monitoring Station- AQ 3

Air Quality Monitoring Station- AQ 4

Micrometeorological Station

3.10 Ambient Noise quality

Monitoring of noise levels around the study area has been carried out to assess the existing noise levels generated due to the existing operations on human settlements. Noise standards have been designed for different types of land use i.e. residential, commercial industrial areas and silence zones as per 'The Noise Pollution (Regulation and Control) Rules, 2000, Notified by Ministry of Environment and Forests, New Delhi, February 14, 2000'.

The ambient noise monitoring was carried out at eight (8) locations during baseline monitoring activity (March to May, 2019). The details of the noise monitoring locations is given in Table 18. Sound pressure level (SPL) measurements in dB (A) were recorded for every hour continuously for 24 hours at 15 minutes interval for the monitoring stations and equivalent noise levels in the form of Leq day and Leq night was computed. The day noise levels have been monitored during 6.00 am to 10.00 pm and night levels during 10.00 pm to 6.00 am at all the locations. The results obtained were compared with the standard specified in Schedule III, Rule 3 of Environmental Protection Rules.

Table 18. Ambient Noise monitoring locations

Location Code	Coordinates	Monitoring Locations
NQ1	26° 19′ 19.4″ N 94° 5′ 21.5″ E	Doyang College Merapani
NQ2	26° 17′ 16.6″ N 93° 59′ 57.8″ E	Kachomari Uccha Madhyamic Vidyalaya
NQ3	26° 14′ 53.8″ N 94° 2′ 36.4″ E	Simanta Uccha Madhyamic Vidyalaya
NQ4	26° 14′ 32.9″ N 93° 58′ 32.2″ E	Doyang Rubbr Producers Society
NQ5	26° 11′ 38.6″ N 93° 59′ 32.4″ E	Banedik Pather Prathomik Vidyalaya
NQ6	26° 19′ 19.4″ N 94° 5′ 21.5″ E	Doyang College Merapani
NQ7	26° 17′ 16.6″ N 93° 59′ 57.8″ E	Kachomari Uccha Madhyamik Vidyalaya
NQ 8	26° 14′ 53.8″ N 94° 2′ 36.4″ E	Simanta Uccha Madhyamic Vidyalaya

Map showing Monitoring Locations for Noise in the study area is given in Figure 30. The graphical representation of noise level is present in figure 37.

The summarized results of noise levels are given in table 19. The noise levels are compared with CPCB Standards in respect of Noise as per The Noise Pollution (Regulation and Control) Rules, 2000 stipulated for daytime and night time for residential land use.

Table 19. Noise Level in the study area

Location code	Leq Day Time (dBA)	Leq Night Time (dBA)	Applicable Daytime Standards	Applicable Night-time Standards
NQ1	53.7	46.1	55	45
NQ2	52.8	42.1	55	45
NQ3	52.4	41.5	55	45
NQ4	52.3	43.6	55	45
NQ5	53.5	42.9	55	45
NQ6	52.7	45.4	55	45
NQ7	52	43.6	55	45
NQ 8	51.3	42.6	55	45

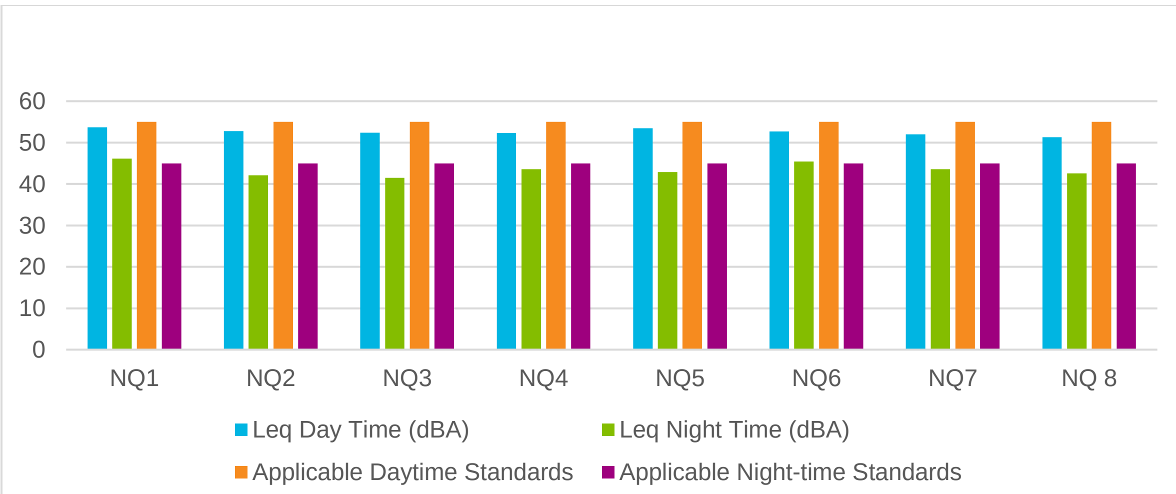


Figure 37. Day and Night time equivalent noise levels

3.11 Water Environment

Water quality assessment of different parameters of surface and ground water resources within Block area has been carried out for assessing the surface and ground water quality. Eight (8) ground water samples covering entire Block area were examined for physico-chemical, heavy metals and bacteriological parameters. It is observed that the water holding capacity of the soil is strong, which influences higher surface water availability in this Block. Monitoring programme was occurred in the post monsoon season during Month of December,2019.

Analyses of the water samples were carried out as per established standard methods and procedures prescribed by CPCB, IS 3025 Codes and APHA 22nd edition, 2012. Appendix 3-6 gives ground water quality monitoring results.

Ground water Quality

Primary monitoring of ground water quality was considered important to understand the probable impacts of the proposed project activities on the sub surface aquifers. Potential pollution of subsurface and unconfined aquifers may occur due to improper casing and cementing of well leading to infiltration or seeping of drilling chemicals or mud into nearby aquifer. Contamination of aquifers may also occur from disposal of drilling waste and mud in an open/unpaved pit.

Groundwater Sampling Locations

For the purpose of baseline assessment, total 8 locations were identified for groundwater samples covering the study area and were examined for physico-chemical, heavy metals and bacteriological parameters to assess the current status of water quality in the study area during the monitoring period. The groundwater quality is likely would be variable within the Block due to spatial heterogeneity in the aquifer. These locations are spatially distributed all across the Block and its surrounding areas. The sampling locations were selected to capture both shallow as well as deeper part of aquifer. All ground water samples were collected from bore wells/tube well. Sampling locations are given in Table 20 and Figure 38.

Table 20. Ground water sampling Locations

Location Code	Sampling Co-ordinate	Place	Type
GW 1	26° 22′ 39.06″ N 94°03′ 27.6″ E	Merapani Road	Borewell
GW 2	26° 19′ 13.04″ N 94° 05′ 46″ E	Merapani	Tube well
GW 3	26° 22′ 26.6″ N 93° 58′ 16.2″ E	Jamubari	Tube well
GW 4	26° 15′ 11.7″ N 94° 2′ 26.8″ E	Panbari	Tube well
GW 5	26° 7′ 41.2″ N 93° 50′ 54.7″ E	Ekroni village	Tube well
GW 6	26° 5′ 57.8″ N 93° 58′ 12.6″ E	Uriamghat	Uncovered well
GW 7	26° 3′ 19.1″ N 93° 50′ 42″ E	Chungajan	Tube well
GW 8	26° 3′ 34.7″ N 93° 55′ 30.7″ E	1 No. Lachit Gaon	Tube well

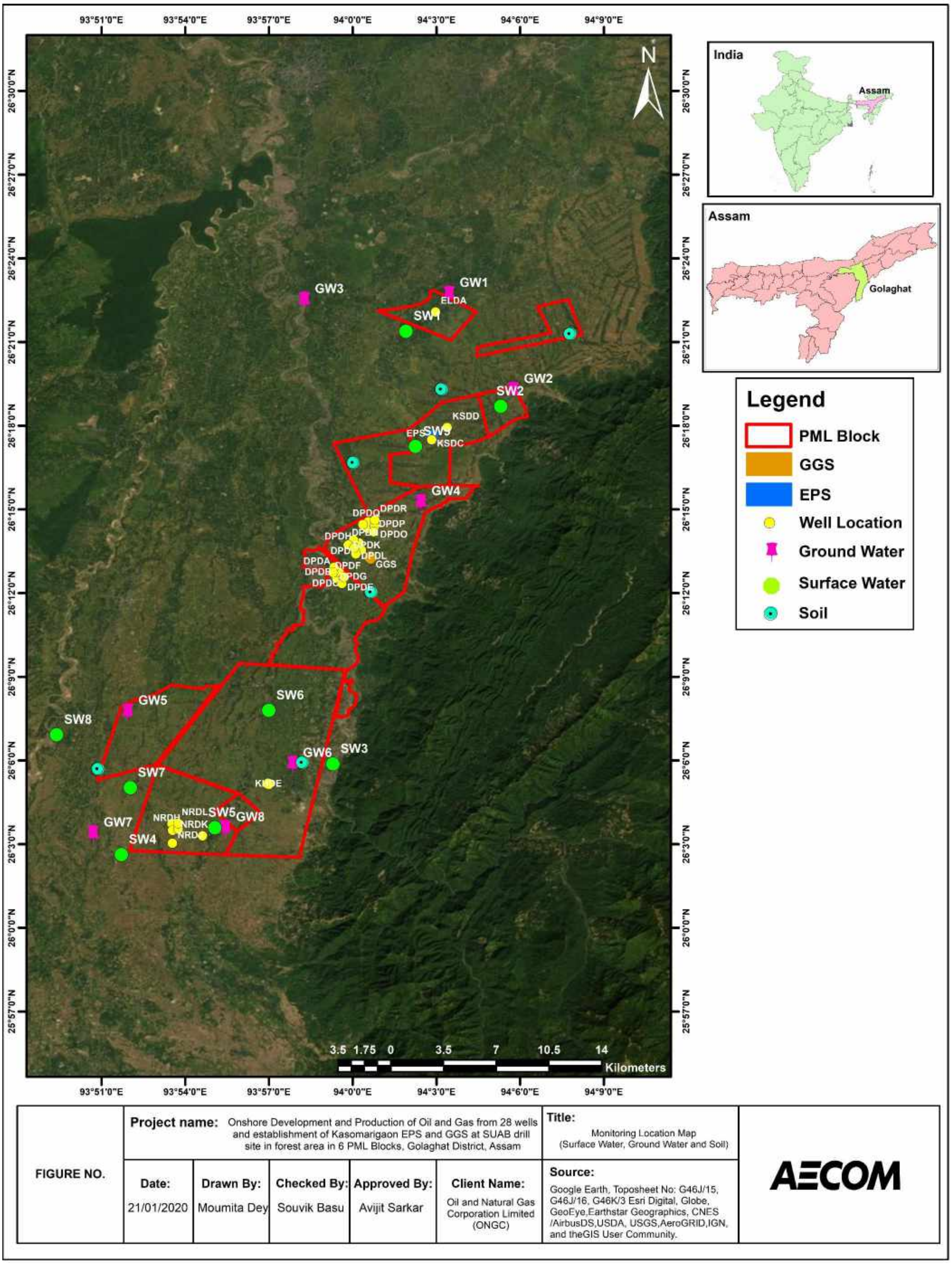


Figure 38. Ground water, Surface water & Soil monitoring location of PML Block

Table 21. Ground Water Quality Monitoring Result

Sl. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW- 8
1	Colour	Hazen	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	Odour	-	Agreeable	unobjectionable	Unobjectionable	unobjectionable	unobjectionable	unobjectionable	unobjectionable	Unobjectionable
3	Temperature	°C	24.7	24.8	24.6	24.8	24.6	24.8	24.7	24.6
4	pH	-	7.5 at 24.7 °C	7.4 at 24.8 °C	7.3 at 24.6 °C	7.5 at 24.8 °C	7.5 at 24.6 °C	7.3 at 24.8 °C	7.4 at 24.7 °C	7.4 at 24.6 °C
5	Turbidity	NTU	0.86	0.8	0.32	0.38	0.74	0.62	0.25	0.76
6	Total Dissolved Solids	mg/l	66	172	234	150	205	176	285	245
7	Electrical Conductivity	µS/Cm	117	303	416	264	351	306	490	415
8	Salinity	psu	0.07	0.15	0.22	0.14	0.18	0.16	0.26	0.21
9	Dissolved oxygen	mg/l	6.96	7.06	7.25	6.86	6.96	7.35	6.86	7.06
10	Anionic Detergent (as MBAS)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
11	Barium (Ba)	mg/l	<0.013	<0.015	0.016	<0.001	0.279	0.026	0.029	0.02
12	Chloride	mg/l	5.34	8.74	19.91	9.71	12.14	9.71	21.85	15.06

Sl. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW- 8
13	Copper(Cu)	mg/l	<0.001	<0.001	<0.001	<0.001	0.246	0.006	<0.001	<0.001
14	Fluoride as F	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
15	Iron (Fe)	mg/l	0.21	<0.001	<0.001	0.137	29.6	12.7	0.062	<0.001
16	Nitrate	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17	Sodium	mg/l	3.29	5.09	11.85	5.79	7.15	5.8	13.22	8.95
18	Total Alkalinity	mg/l	36	100	126	88	114	100	152	140
19	Total Hardness	mg/l	32	88	116	76	112	94	152	124
20	Zinc(Zn)	mg/l	0.048	0.016	0.005	0.001	0.912	0.055	<0.02	<0.001
21	Cadmium (Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
22	Lead (Pb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Mercury (Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24	Nickel (as Ni)	mg/l	<0.001	<0.001	<0.001	<0.001	0.685	0.014	<0.001	<0.001
25	Hexavalent Chromium(Cr+6)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
26	Arsenic(As)	mg/l	0.001	0.001	0.001	0.006	0.058	0.015	0.016	<0.001

Sl. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW- 8
27	Total Coliform	MPN/100ml	<2	<2	<2	<2	<2	<2	<2	<2
28	Faecal Coliform	MPN/100ml	<2	<2	<2	<2	<2	<2	<2	<2

Interpretation of Groundwater Quality Results

Physical Parameters

The colour of the samples was found <1 hazen units and with unobjectionable odour. The pH of water samples ranged from 7.3 to 7.5. Turbidity of all the samples found between 0.25 – 0.86, which is under the permissible limit of 5 NTU. The TDS in the water samples varied from 66 mg/l to 285 mg/l, which is incompliance with desirable limit of 500 mg/l.

Inorganic Parameters

The total alkalinity of the samples varied from 36 to 152 mg/l which falls within their corresponding permissible limit of 600 mg/l. Total hardness of the samples varied from 32 to 152 mg/l and was within the desirable limit of 200 mg/l. The concentrations of heavy metals such as Iron, Nickel, Copper, Zinc, Arsenic were below their corresponding permissible limit. Cadmium, Mercury, Lead and other parameters like Residual Chlorine, Hexavalent Chromium, polychlorinated bi-phenyls were found would be below detection limit.

Coliform

Faecal Coliform for all the samples were <2 MPN/100 ml. It can be assumed that all the samples of groundwater were free from any kind of sewerage contamination.

Other Parameters

No pesticides were detected in any of the samples. Most of the samples were below detectable limits for toxic substances. The groundwater quality was found to be suitable for drinking purposes in most of the locations as TDS, hardness was in compliance with the permissible limits, though primary and secondary treatment are preferable before consuming. The quality of groundwater is likely would be variable within the study area due to spatial heterogeneity in the aquifer.

Photographs of Ground Water Sampling

Photographs 1: GW 1 sampled from Merapani

Photographs 2: GW 3 sampled from Jamubari

Photographs 3: GW 4 sampled from Panbari

Photographs 4: GW 5 sampled from Ekroni village

Photographs 5: GW 6 sampled from Uriamghat

Photographs 6: GW 8 sampled from 1 No. Lachit Gaon

3.12 Surface Water Quality

Surface water quality monitoring locations

A monitoring network consisting of 9 locations for surface water monitoring was selected. Water sampling and analysis was done following CPCB standard guidelines for physical, chemical and bacteriological parameters. Surface Sampling Location is presented in Figure 38.

Table 22. Surface water sampling locations

Location Code	Sampling Location	Coordinate
SW 1	Pond, Matikhula village	26°21'24.38"N, 94° 1'54.26"E
SW 2	Pond, Navagram	26°18'43.21"N, 94° 5'17.47"E
SW 3	Dayang River	26° 2'27.21"N, 93°58'12.64"E
SW 4	Pond, 1 No. Amguri	26° 2'38.57"N, 93°51'42.02"E
SW 5	Rengma River	26° 2'5.41"N, 93°54'23.71"E
SW 6	Rengma River, Hatidubi village	26° 8'12.23"N, 93°56'52.11"E
SW 7	Pond, Jonali Pothar	26° 4'56.87"N, 93°53'56.65"E
SW 8	Dhansiri river, Bil Pothar Village	26° 6'44.70"N, 93°49'14.51"E
SW 9	Giladhari River	26°17'21.70"N, 94° 2'37.17"E

Interpretation of Surface water quality result:

Surface water quality results have been provided in in table 23. As discussed in the previous section the channels from which samples were taken and analyzed were primarily used for irrigation, bathing, cleaning and for catching fish. The analyzed values of the samples after comparing with the CPCB Water Use Criteria justifies their use in compliance to water use criteria.

Table 23. Surface water quality result:

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
1	Colour	Hazen	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	Odour	None	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Temperature	°C	24.8	24.7	24.6	24.7	24.7	24.6	24.6	24.8	24.7
4	pH value	None	7.6 at 24.8 °C	7.6 at 24.7 °C	7.5 at 24.6 °C	7.4 at 24.7 °C	7.6 at 24.7°C	7.6 at 24.6 °C	7.6 at 24.6 °C	7.5 at 24.8 °C	7.8 at 24.7 °C
5	Conductivity	µS/cm	171	323	178	172	227	230	151	140	445
6	DO	mg/l	7.55	7.55	7.45	7.55	7.64	7.35	7.35	7.55	7.64
7	Turbidity	N.T.U.	0.45	0.75	0.68	0.57	0.34	0.48	0.26	0.43	0.82
8	Total Dissolved Solids (as TDS)	mg/l	96	190	105	90	128	135	86	80	260
9	Biochemical Oxygen Demand (as BOD)	mg/l	1.5	1.7	1.5	1.7	1.8	1.6	1.2	1.3	2.2
10	Chemical Oxygen	mg/l	10.24	11.26	9.22	10.24	12.29	11.26	9.22	9.22	11.26

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
	Demand (COD)										
11	Total Hardness (as CaCO3)	mg/l	56	106	54	46	64	72	42	42	140
12	Alkalinity (as CaCO3)	mg/l	56	108	60	50	74	76	46	42	154
13	Sodium (as Na)	mg/l	3.56	5.25	3.49	4.18	4.06	4.53	4.78	3.14	5.98
14	Sodium Adsorption Ration (as SAR)	None	1.12	1.2	1.12	1.45	1.21	1.27	1.75	1.15	1.22
15	Phosphate	mg/l	0.11	<0.05	0.1	0.12	<0.05	0.11	0.15	0.1	0.12
16	Anionic Detergents (as MBAS)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
17	Barium (as Ba)	mg/l	0.01	0.01	0.006	0.021	0.011	0.009	0.02	0.009	0.005
18	Chloride (as Cl)	mg/l	5.83	8.74	5.83	6.8	7.28	7.77	7.77	5.34	10.2

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
19	Copper (as Cu)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20	Fluoride (as F)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Iron (as Fe)	mg/l	0.919	0.009	0.049	0.25	0.046	0.124	0.253	0.157	0.045
22	Magnesium (as Mg)	mg/l	3.4	6.32	3.4	2.92	4.86	5.35	2.92	2.92	12.15
23	Nitrate (as NO3)	mg/l	1.27	2.34	1.66	1.35	2.18	3.22	2.16	<0.5	2.14
24	Sulphate (as SO4)	mg/l	1.26	1.68	1.28	2.35	1.62	2.11	2.52	1.56	2.45
25	Cadmium (as Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
26	Lead (as Pb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
27	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Arsenic (as As)	mg/l	0.001	0.011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
29	Nickel (as Ni)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
30	Zinc (as Zn)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
31	Hexavalent Chromium (as Cr+6)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
32	Salinity	None	0.1	0.16	0.1	0.1	0.12	0.12	0.08	0.07	0.21
33	Polychlorinated biphenyls (as PCB)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
34	Total coliform	MPN/100ml	48	109	25	79	22	17	63	17	21
35	Faecal coliform	MPN/100ml	8	14	<2	21	7	<2	26	<2	<2

- **pH** – The pH value ranged between 7.4 to 7.8 in all monitoring locations and characterized as mild basic to neutral.
- **Dissolved Oxygen (DO)** –DO concentrations of the collected samples was found to be 7.35 to 7.64, which is above of the safe criteria of 5 mg/l, and good for aquatic life propagation.
- **Biochemical Oxygen Demand (BOD)** – The concentration of BOD for the water samples was found to be 1.2. to 2.2 in all the collected samples.
- **Chemical Oxygen Demand (COD)** – The concentration of COD for the water samples 9.22 to 12.29 mg/l in the collected surface water samples.
- **Coliform bacteria**–The load of total coliform was measured as 17 MPN/100 ml to 109 MPN/100 ml at all the sampling locations. Faecal coliform was also detected at all the surface water sample which could be due to the fact that the water body may be used for bathing and release of sewage in the water bodies. Highest faecal coliform count was detected as SW 7, accounted as 26 MPN/100ml.
- **Total Dissolved Solids (TDS)** - The TDS concentrations of all the samples ranged between 80 – 260 mg/l.
- **Sodium Absorption Ratio (SAR)** - Sodium absorption ratio for all the samples recorded as 1.12 to 1.75.
- **Total hardness** – Total hardness in all the water samples ranged between 42 – 140 mg/l, which indicated a soft water nature of the surface water.
- **Concentration of Metals -** like lead (<0.001 mg/l), mercury (<0.001 mg/l), cadmium (<0.001 mg/l), Hexavalent chromium (<0.02 mg/l) were found to be below detection limits for the only surface water sample.
- **Arsenic** – The concentration of Arsenic was found to be below detection limit.

The water samples were found to be suitable for “B” class of water, i.e. Outdoor bathing. The analysed values also reveal that all the samples complied to the CPCB Class D i.e. Propagation of Wild life and Fisheries.

Photographs of Surface Water Sampling

Photographs 1: SW 1 sampled from Matikhula village

Photographs 2: SW 3 sampled from Doyang River

Photographs 3: SW 4 sampled from Amguri

Photographs 4: SW 8 sampled from Dhansiri River

Photographs 6: SW 9 sampled from Giladhari River

3.13 Soil Quality

Golaghat District

The soils of district Golaghat is broadly classified in to two major groups.

Deep reddish soil, these are found in older geological formation and (ii) light grey to dark grey coloured soil covering the major parts of the district. Low nitrogen, low phosphate, medium to high potash, acidic characters of the soil are representative of the soil cover found in the hills. In the plain areas, the other type of the soil covers is found to be feebly alkaline.

Samples for soil quality study were collected from six (6) locations from the study area. Details of Soil Sampling locations, analysis results of soil samples are presented in table 24 and 25.

Table 24. Soil Sampling Locations

Location Code	Co-ordinates	Sampling Location	Land-Use Pattern
SQ 1	26°19'19.3" N, 94°3'11.3"E	Sonapur village	Agricultural Land
SQ 2	26°21'18.4" N, 94°7'48"E	Torani Gaon	Homestead Plantation
SQ 3	26°16'41.23" N, 94°0'1.56" E	Kasomari Gaon	Close to forest land
SQ 4	26°12'3.12"N, 94° 0'39.96"E	Chandanpur Village	Homestead Plantation
SQ 5	26°5'42.6" N, 93°50'52.7" E	Morijan Village	Close to forest land
SQ 6	26° 5'56.1" N, 93°58'12.3" E	Uriamghat	Agricultural Land

Table 25. Soil Quality Result

Sl. No.	Parameters	SQ 1	SQ2	SQ 3	SQ 4	SQ 5	SQ 6
1	pH	5.8	8.0	5.7	6.5	6.8	5.9
2	EC	105	462	163	177	146	488
3	Nitrogen (%)	0.63	0.81	0.76	0.83	1.37	0.97
4	Nitrate(mg/kg)	17.5	22.24	24.7	25.44	24.8	20.84
5	Phosphate(mg/kg)	162.68	184.47	92.16	143.70	104.65	78.43
6	Porosity (%)	17.15	16.63	13.75	13.08	25.02	19.57
7	Permeability(cm/min)	4.20	4.40	3.80	3.90	6.95	5.20
8	Nitrites(mg/kg)	5.2	6.7	5.5	4.3	5.6	5.9
9	Total Hydrocarbon	ND	ND	ND	ND	ND	ND
10	Texture	Loamy Fine Sand	Loamy Fine Sand	Sandy Clay Loam	Loamy Fine Sand	Loamy Fine Sand	Sandy Clay Loam
11	Phosphorus(mg/kg)	53.68	60.87	30.41	47.42	34.53	25.88
12	Cr (ppm)	25.44	6.24	6.02	26.59	21.54	20.78
13	Fe (ppm)	4098.00	4021.61	4776.23	4764.35	4467.64	4599.58
14	Ni (ppm)	18.619	3.578	3.484	19.112	29.012	28.368
15	Cu (ppm)	8.494	1.566	1.542	8.964	10.506	10.252
16	Zn (ppm)	23.856	8.396	8.237	24.716	38.422	37.801
17	As (ppm)	5.347	0.944	0.925	5.633	2.475	2.451
18	Cd (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

19	Hg (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
20	Pb (ppm)	7.941	2.629	2.600	8.267	7.889	7.880
21	Ba (ppm)	25.085	11.360	11.283	26.372	13.269	13.296
22	Potassium(K) (ppm)	168.78	203.59	197.45	197.20	184.82	191.09
23	Manganese (Mn) (ppm)	75.77	80.08	88.73	88.25	82.77	85.46
24	SAR (meq/Kg)	3.12	2.34	2.56	2.48	2.68	2.51
25	CEC (meq/100g)	30.24	28.14	28.18	28.08	36.72	35.62

ND = Not Detectable; LDL: Lower detection limit

India does not have any specific concentration-based soil contamination standards. In absence of any existing standards, Dutch standards have been considered for the purpose of analysis.

Table 26. Soil Remediation Intervention Values as per Dutch Standards

S. No.	Parameter	Intervention Values (mg/kg dry matter)
1	Zinc	720
2	Arsenic	76
3	Lead	530
4	Cadmium	13
5	Copper	190
6	Mercury (inorganic)	36
7	Nickel	100

Source: Soil Remediation Circular 2009, Minister of Housing, Spatial Planning and Environment, Netherlands.

Note: Concentrations are shown for standard soil (10% organic matter and 25% clay)

The physical, chemical and heavy metal concentrations of the soil samples were determined and compared with the standard soil classification provided by the Indian Council of Agricultural Research (ICAR) and as given in table 27.

Table 27. Standard Soil Classification

Sl. No.	Soil Test	Classification
1.	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.0 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mmho/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient

4	Nitrogen (kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5	Phosphorus (kg/ha)	Upto 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6	Potash (kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

Source: Handbook of Agriculture, Indian Council of Agricultural Research, New Delhi

pH

Soil acidity has a correlation with the availability of nutrients in terms of their deficiency and toxicity. A soil having pH less than 6 is considered as acidic. The soil samples in the study area was found would be very acidic to slight alkaline in nature and it ranges from 5.7 to 8.

Texture and Electrical Conductivity

Texture is an expression to indicate the coarseness or fineness of the soil as determined by the relative proportion of the various sized primary particles in the soil mass. The textures of the collected soil samples were found would be loam to clay loam in the study area, and higher proportion of silt particle had been observed. The presence of clay and silt in the soil gives a better water holding capacity of the soil, hence showed a permeability of 4.74 on an average. The EC values for the soils monitored at the study area range between 105 to 488 µs/cm. For a productive soil, the electrical conductance (EC) would be < 100000 µs/cm.

Macronutrients and Organic Carbon

Nutrient status of the soil samples can be determined from the concentration of available N, P, K and organic carbon in soil samples. Standard rating chart for soil nutrients is provided in Table 25.

Nitrogen contents in the soil samples ranged between 51,660 – 106110 kg/ha, phosphorus content in the soil samples ranged between 152.69 – 380.43 kg/ha, and potassium contents ranges between 1344 – 1749 kg/ha, with comparison to the rating chart, nutrient status of the soil is more than sufficient.

Metals

Heavy metals such as copper (1.5 – 10.50 mg/kg), lead (2.6 – 8.2 mg/kg) and zinc (8.23 – 38.42 mg/kg) were detectable in the soil of the study area. The concentration of copper, lead, Zinc and the other heavy metals in the soil sample was much below the soil remediation intervention values specified in Dutch Soil Remediation Circular (Refer table 24).

Sodium Absorption Ratio (SAR) - Sodium absorption ratio for the samples varied between 2.34 – 3.11.

Conclusion

The soil samples were found would be sandy loam to clay loam, with comparatively low pH, typically represents the soil of flood plain of Brahmaputra valley. The macronutrient contents viz. NPK values of the soil samples were found would be more than sufficient. Metal contamination has not been observed in the analysed soil samples.

Photographs of Soil Quality Sampling

Photographs 1: S1 sampled from Sonapur village

Photographs 2: S2 sampled from Torani Gaon

Photographs 3: S4 sampled from Chandanpur Village

Photographs 4: S6 sampled from Uriamghat

3.14 Traffic Survey of Forest PML

In order to appreciate the traffic and transport system characteristics traffic surveys were conducted within the study area. The brief methodology adopted, location, nature and extent of data collected under each of the above-mentioned surveys is discussed below. The field data collection activities were carried out in May & June 2019.
The major roads in the study area include 2 No. Nabyojoyti to Godapani road, Torani Gano 1No to Golaghat(SH33) Road, Merapani to Nagaland (WOKHA) Road, MU Rd to Sonalipathar Road, Merapani Road to Sarupani Road, Chungajan to salukpatyar(Naojan MV Road), Woroku to Uriamghat. The survey was conducted by travelling along the identified road network and by collecting details on road characteristics by visual observation, inspection and measurements.

The main objective of classified traffic volume counts was to assess the traffic characteristics in terms of average daily traffic, hourly traffic variation, peak hour traffic,

traffic composition and directional distribution. The surveys were conducted manually, on a normal working day and weekend. The survey has been conducted continuously for 24 hours. In order to express the intensity of traffic, it would be convenient to express all these different vehicle types in single unit terms. For this purpose, the PCU factors (IRC 106:1990) have been adopted and are given in Table 28.

Table 28. Adopted Passenger Car Unit

PCU	Two-Wheeler	0.5	Light Motor Vehicles	1.5
	Three-Wheeler	1.0	Heavy Motor Vehicles	4.5
	Car	1.0	Camel-Drawn Vehicle	4.0

Source: IRC-106:1990

These roads cater to inter and intra city travel needs of various facilities and population residing in study area. Other roads provide links connecting to various facilities inside the study area.

The hourly variation of PCUs at above mentioned road intersections are presented below.

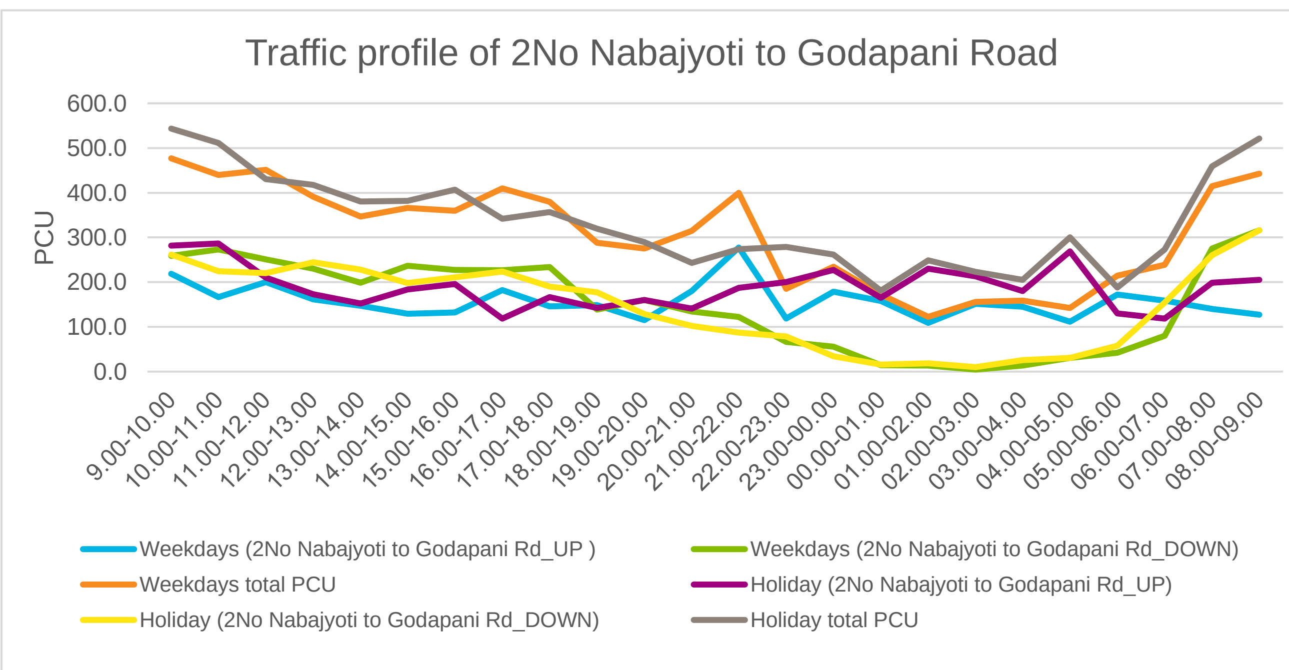


Figure 39. Trafic Profile at 2No Nabajyoti to Godapani Rd

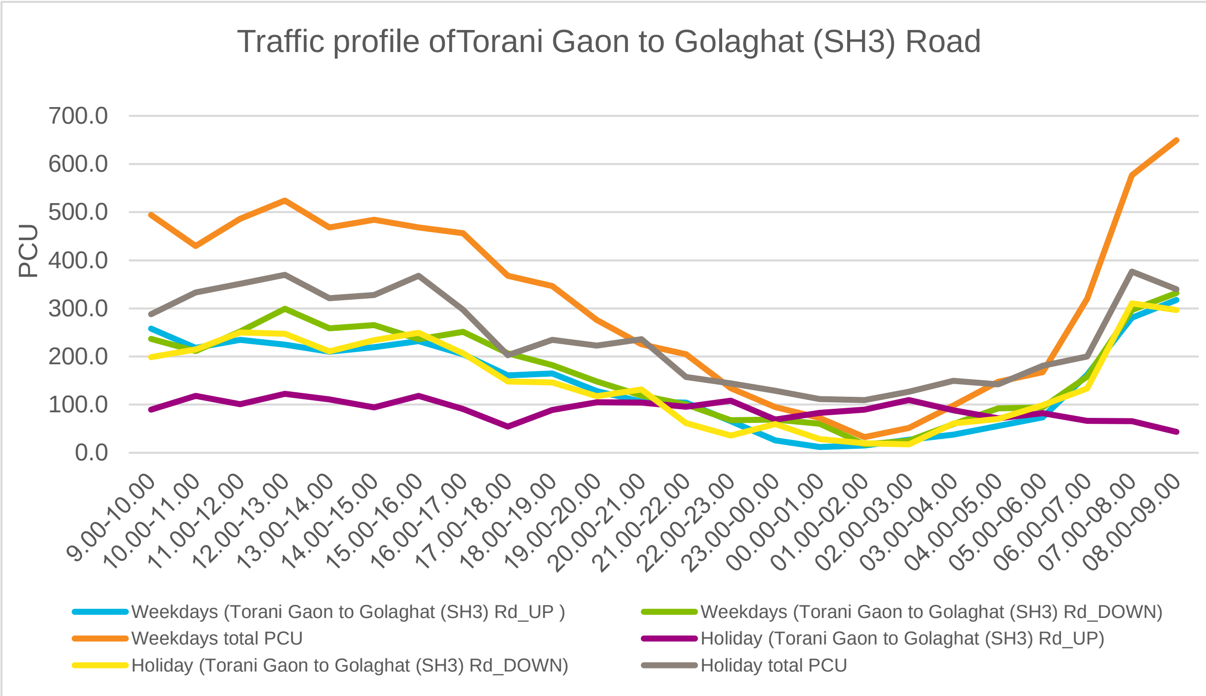


Figure 40. Traffic Profile of Torani Gaon to Golaghat (SH3) Road

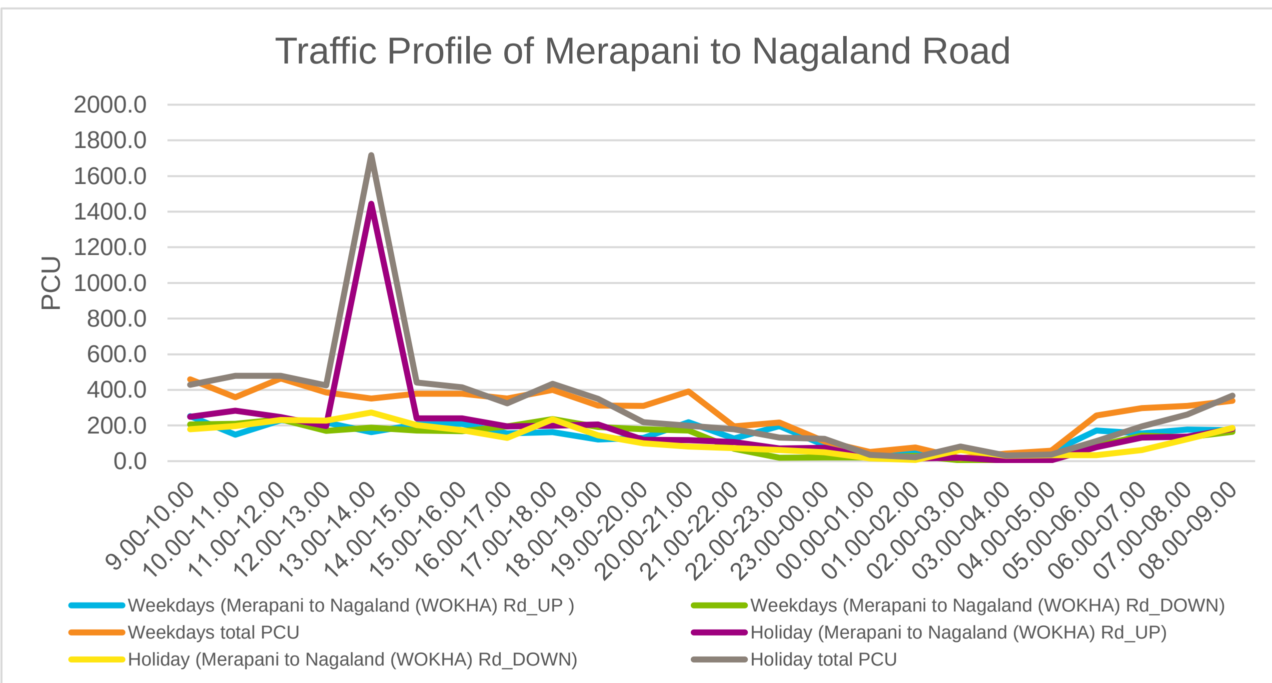


Figure 41. Traffic Profile of Merapani to Nagaland (WOKHA) Road

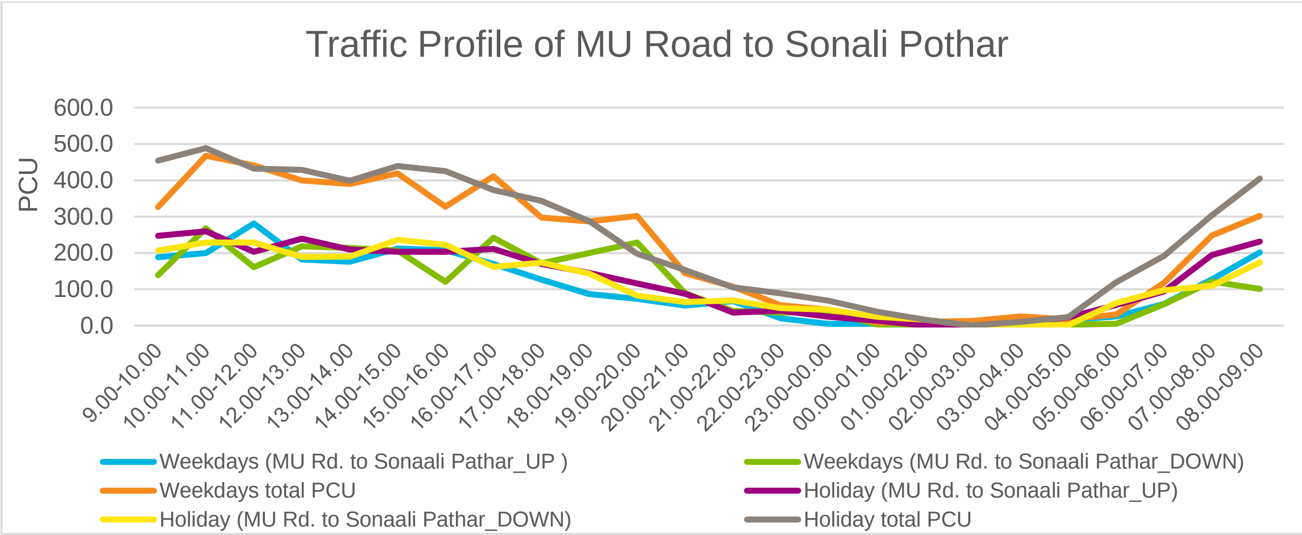


Figure 42. Traffic Profile of MU Road to Sonali Pothar Road

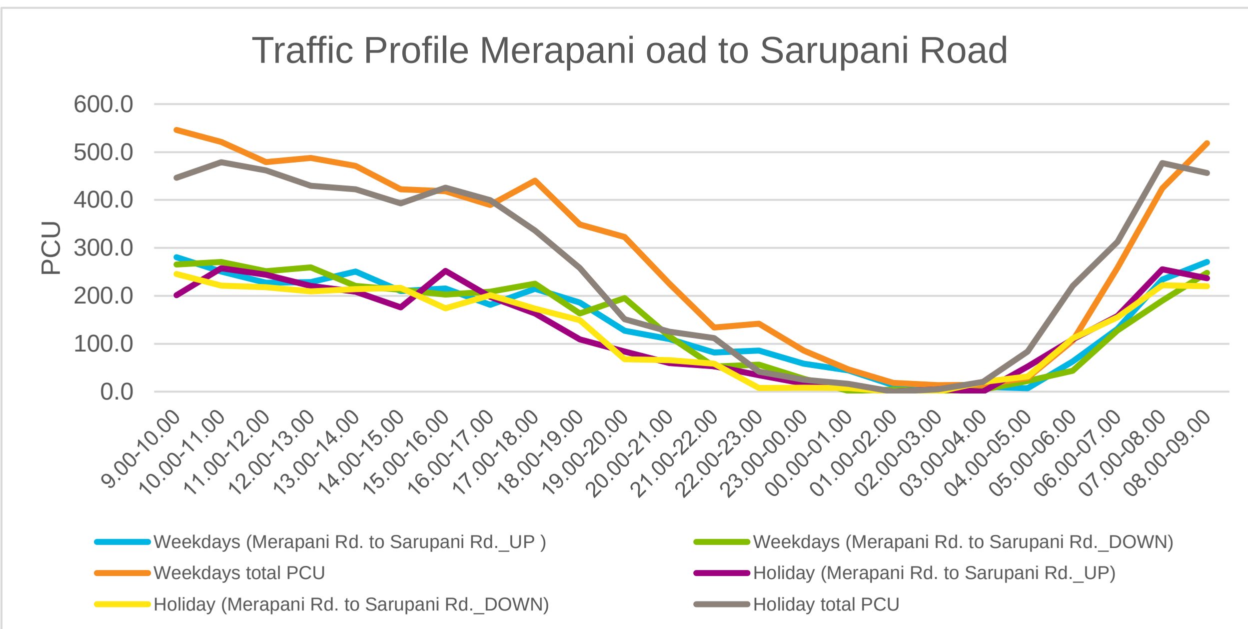


Figure 43. Traffic Profile of Merapani Road to Sarupani Road

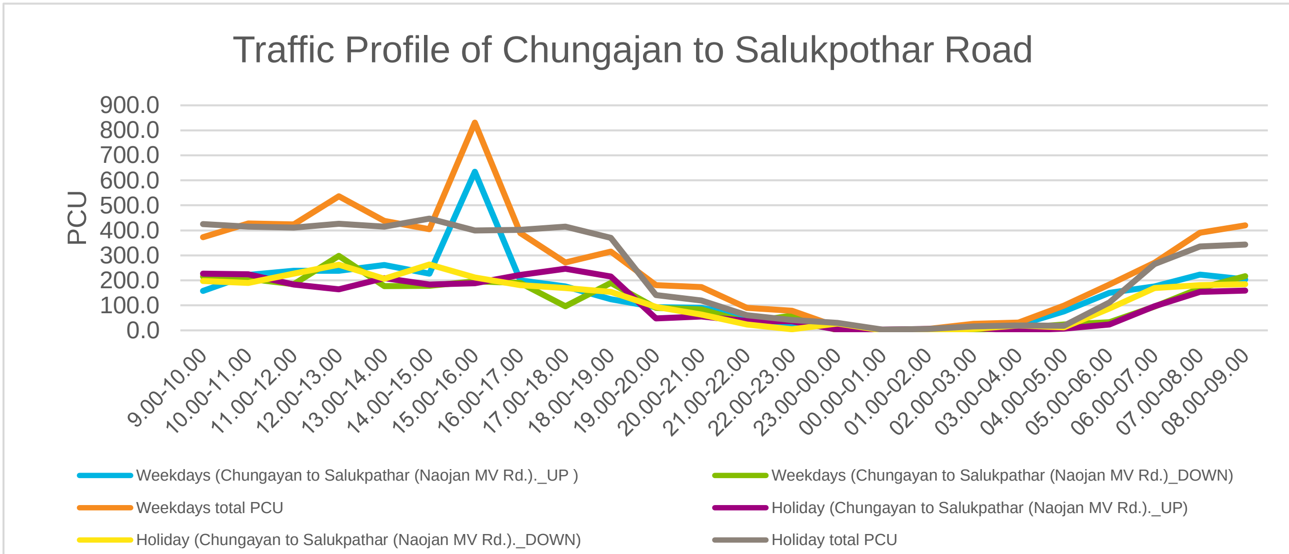


Figure 44. Traffic Profile of Chungayan to Salukpathar (Naojan MV Road.)

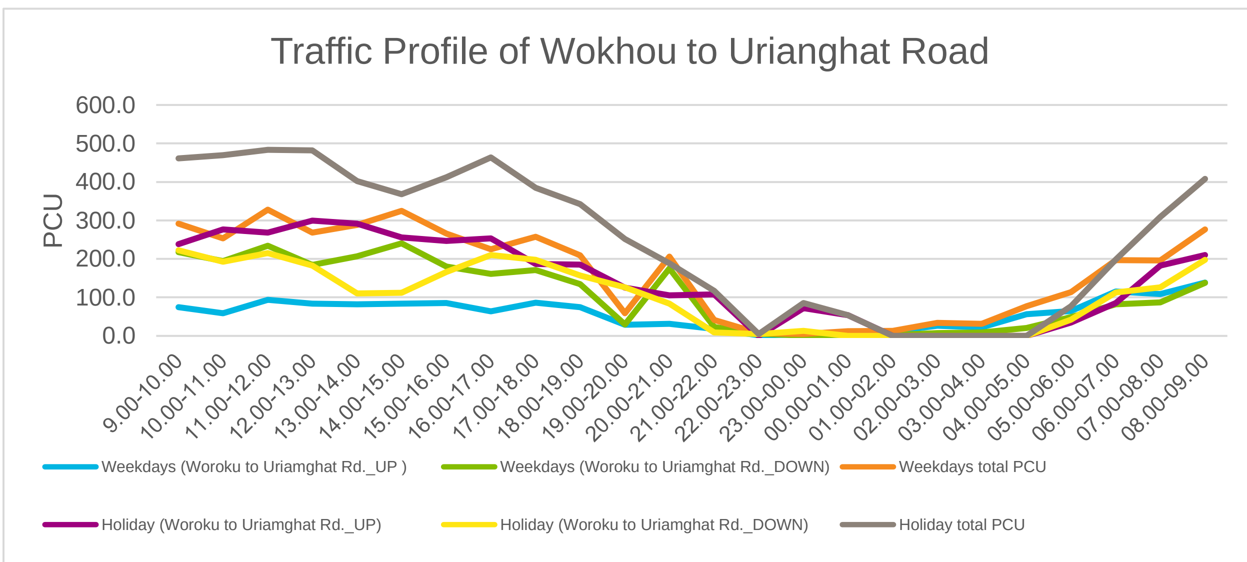
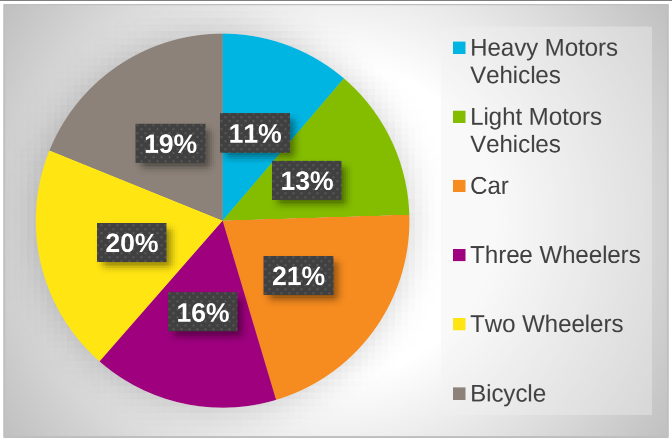


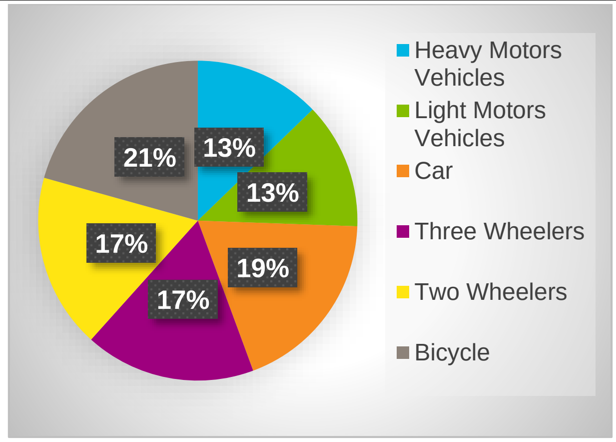
Figure 45. Traffic Profile of Woroku to Uriamghat Road

Peak Hour Traffic

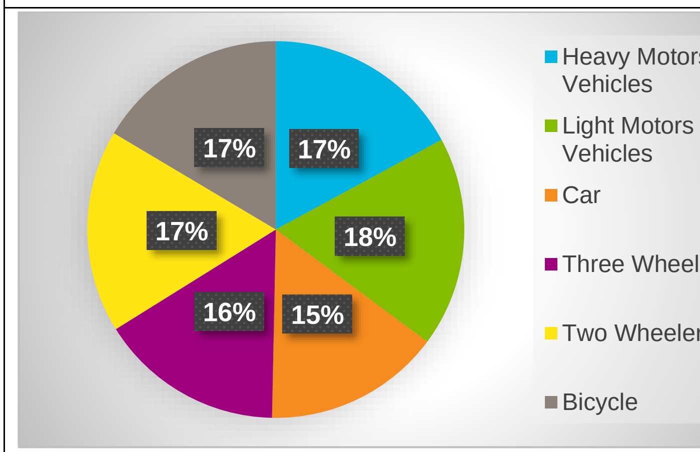
Peak hour traffic composition was also analysed for weekdays and holidays to understand the peak traffic timing and the diversity of vehicles at that time. Peak hour traffic composition has expressed through pie charts for each junction.



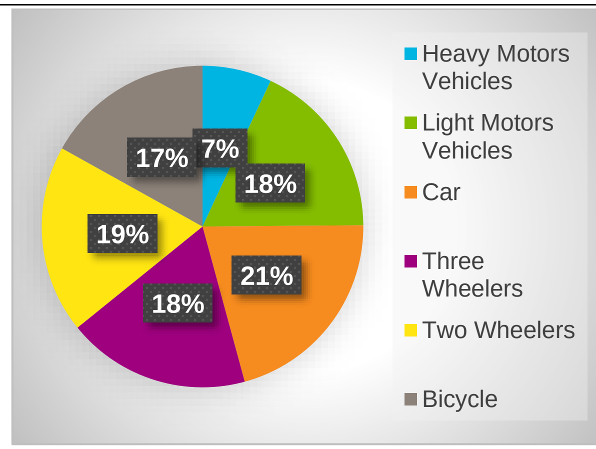
Peak hour traffic composition at 2No Nabajyoti to Godapani Road (weekdays)



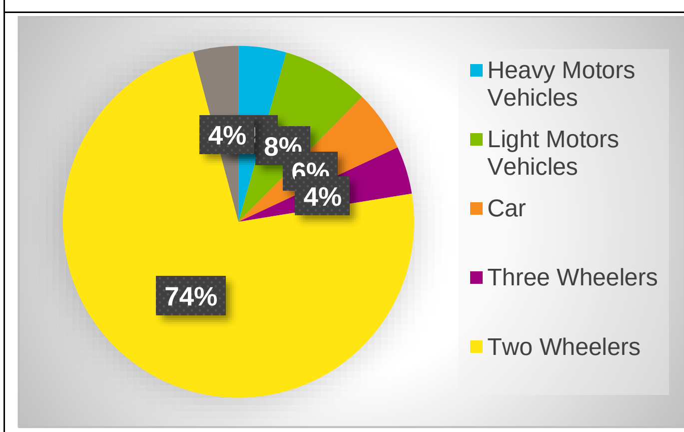
Peak hour traffic composition at 2No Nabajyoti to Godapani Road (Holidays)



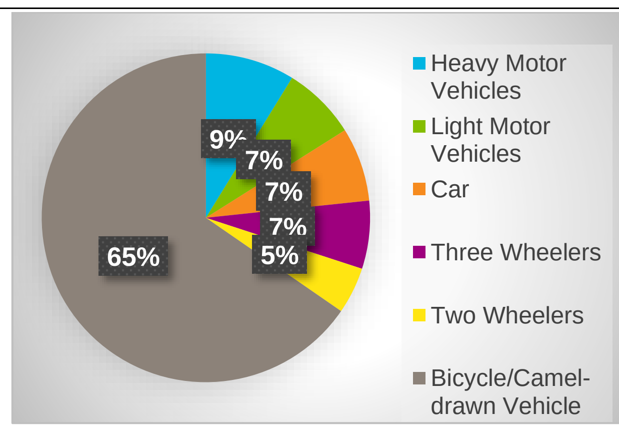
Peak hour traffic composition at Torani Gaon to Golaghat (SH3) Road (weekdays)



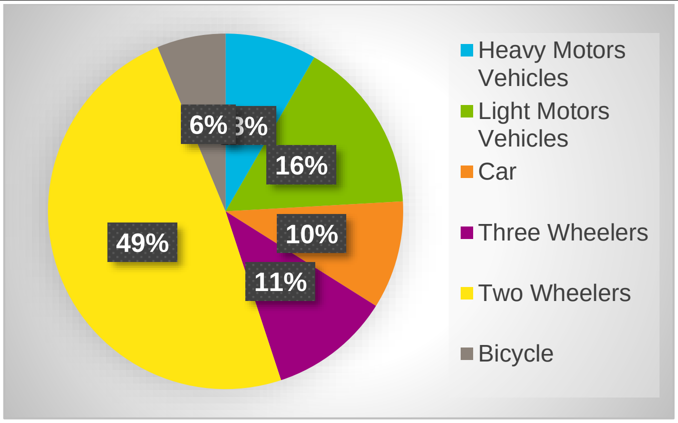
Peak hour traffic composition at Torani Gaon to Golaghat (SH3) Road (Holidays)



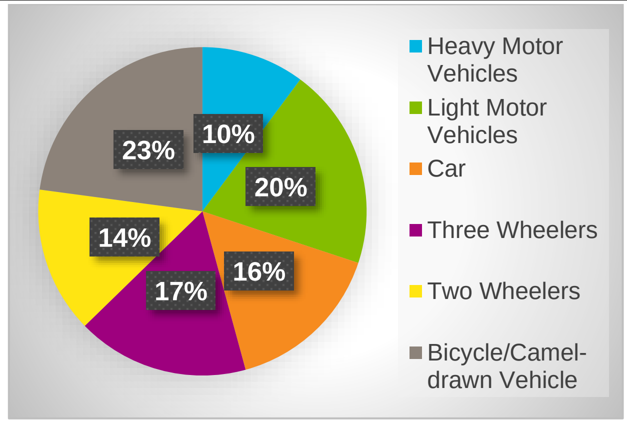
Peak hour traffic composition at Merapani to Nagaland Road (weekdays)



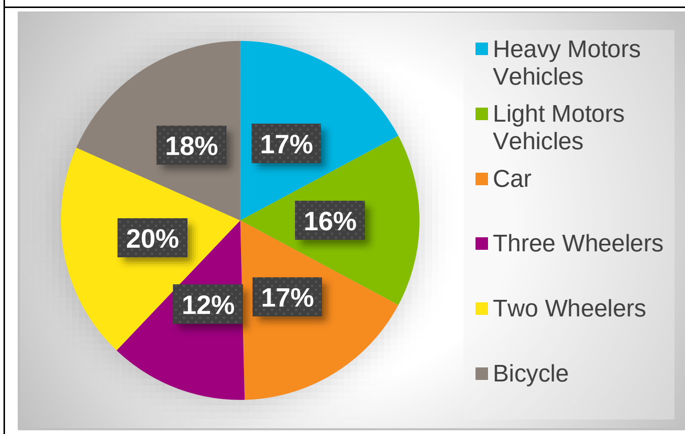
Peak hour traffic composition at Merapani to Nagaland Road (Holidays)



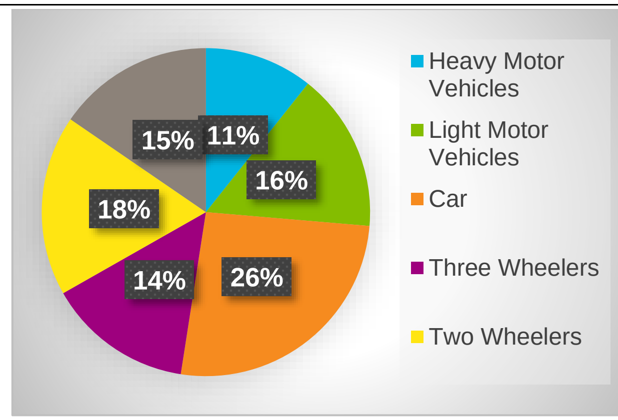
Peak hour traffic composition at MU Rd. to Sonaali Pathar (weekdays)



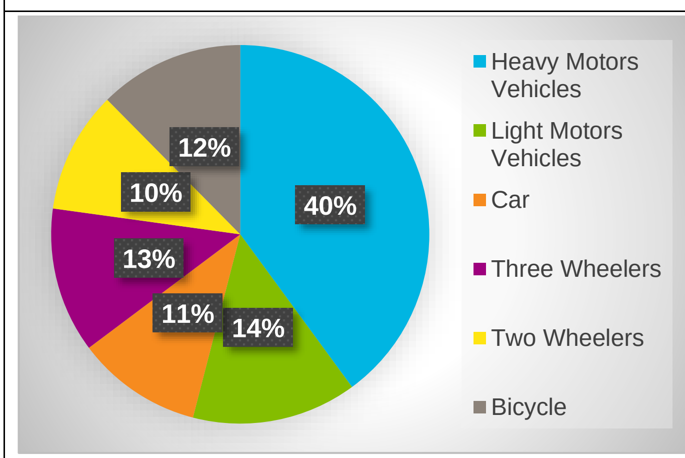
Peak hour traffic composition at MU Rd. to Sonaali Pathar (Holidays)



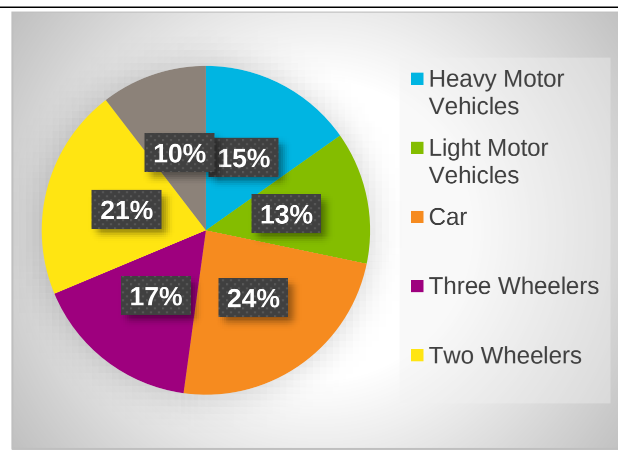
Peak hour traffic composition at Merapani Rd. to Sarupani Road (weekdays)



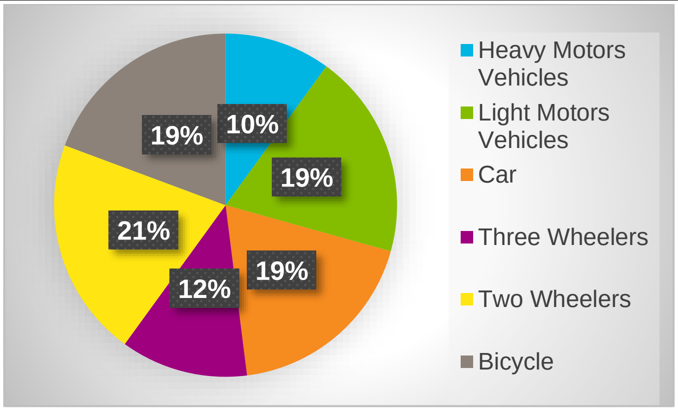
Peak hour traffic composition at Merapani Rd. to Sarupani Road (Holidays)



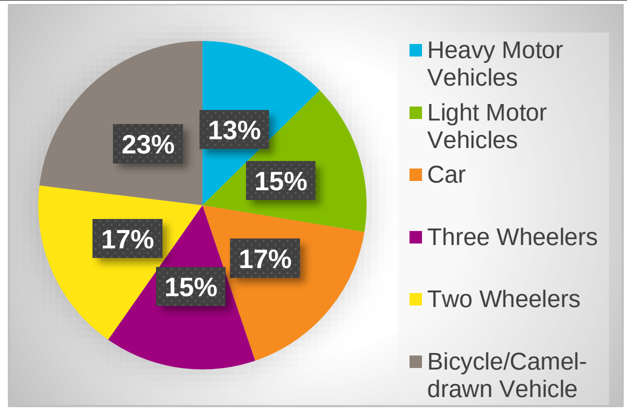
Peak hour traffic composition at Chungayan to Salukpathar (Naojan MV Road.) (weekdays)



Peak hour traffic composition at Chungayan to Salukpathar (Naojan MV Road.) (Holidays)



Peak hour traffic composition at Woroku to Uriamghat Road (weekdays)



Peak hour traffic composition at Woroku to Uriamghat Road (Holidays)

The peak hours at various intersections are given in Table 29. At 2 No. Nabajoyti to Godapani road the peak hour traffic composition was observed between 9:00 – 10:00 am during both weekdays and holidays. During weekdays at Torani Gaon to Golaghat road the peak hour traffic composition was observed at 8:00- 9:00 PM and on holidays at 11:00 -12 in the morning. On the other hand, Merapani to Ngaland road showed the peak hour traffic between 20:00-21:00 pm, and on holidays the peak hour traffic observed in the noon, between 13:00 – 14:00 hours. At MU road the peak hour traffic was recorded between 11:00- 12:00, and during holidays the peak hour traffic was observed between 10:00- 11:00 am. The peak hour traffic composition at Merapani to Sarupani road was observed between 9:00- 10:00 am, during weekdays and 11:00- 12:00 during holidays. At Chungajan to Salukpathar road the peak hour traffic composition was observed in the noon, between 15:00- 16:00 hours, during weekdays, and during holidays highest traffic composition was observed between 17:00- 18:00 hours. The peak hour traffic composition was observed at Workou to Uriamghat road was observed between 13:00-14:00 hours during weekdays, and in holidays peak hour traffic composition was observed between 10:00-11:00 am in the morning.

Table 29. Peak Hour Traffic Composition

SL No	Intersection	Weekdays	Holidays
1	2 No. Nabajoyti to Godapani road	9:00 – 10:00	9:00 – 10:00
2	Torani Gaon to Golaghat road	8:00- 9:00	11:00 -12
3	Merapani to Ngaland road	20:00-21:00	13:00 – 14:00
4	MU road	11:00- 12:00	10:00- 11:00
5	Merapani to Sarupani	9:00- 10:00	11:00- 12:00
6	Chungajan to Salukpathar	15:00- 16:00	17:00- 18:00
7	Workou to Uriamghat	13:00- 14:00	10:00-11:00

Source: Traffic survey,2019

Photographs of Traffic Survey

Photograph 1. Traffic Survey in Jorhat

Photograph 2. Traffic Survey in Golaghat

3.15 Ecological Environment

An Ecology and Biodiversity study of Block 1 (Forest), located in Golaghat and Jorhat districts of Assam, was conducted to recognise the possible impacts on biodiversity owing to drill development and exploratory well. The study was carried out in post-monsoon season during month of January 2020. A Total 8 transects, 30 quadrats and 6 aquatic sampling as well as primary productivity sampling locations were selected based on topography, land use, habitat and vegetation pattern. Faunal species were assessed by transect method by travelling a known distance (1 ± 0.05km) and observed faunal species along the length were noted. Primary data was collected through most of the diurnal period from early morning till late evening. Secondary data was collected from Divisional Forest Office of Jorhat and Golaghat and consultation with local people. Books like Trees and shrubs of India, the book of Indian Trees, Birds of the Indian Sub-continent, Indian Mammals- A field guide, Snakes of India, The Book of Indian reptiles and Amphibians and Freshwater Fish of Peninsular India were also consulted. Field identification has been based on professional experience, and following, standard field guides and identification keys were made use of. Fauna was checked for their IUCN status (International Union for Conservation of Nature, Red List Version 3.1) and their status in the Schedules of Wildlife Protection Act, 1972.

Methodology of the Study

Floral Survey

Primary data have been collected at ten sampling sites selected by applying the stratified systematic sampling method. Qualitative and quantitative data was collected at each sampling site, using the standard quadrat methodology. In each terrestrial ecology sampling locations three quadrat were laid i.e. 20m x 20m for trees, 5m x 5m for shrubs and 3m x 3m for herbs and total quadrat number was 30. Table 30 and Figure 45 presents details of the sampling sites, including location code, location coordinates, and habitat-profile of each site.

Table 30. Details of Terrestrial Ecology (TE) Sampling Sites

S.No.	Name of Location	Location	Nearest well/Block location	Type of Habitat
1	TE 1	26°22'5.04"N, 94°3'21.12"E	ELDA	Settlement
2	TE 2	26°21'43.65"N, 94°7'20.22"E	Within the block	Homestead Plantation
3	TE 3	26°18'28.27"N, 94°2'50.37"E	KSDC, KSDD	Agricultural land
4	TE 4	26°12'54.55"N, 94°1'45.45"E	DPDD, DPDH, DPDI, DPDJ, DPDK, DPDL	Forest Patch
5	TE 5	26°16'7.37"N, 94°0'29.97"E	Within the block	Settlement
6	TE 6	26°18'46.56"N, 94°5'38.40"E	Within the block	Homestead Plantation
7	TE 7	26°3'19.45"N, 93°55'0.73"E	NRDJ, NRDK	Dayang River Side
8	TE 8	26°6'36.31"N, 93°52'28.26"E	Within the block	Settlement
9	TE 9	26°2'42.13"N, 93°57'50.10"E	Within the block	Forest patch
10	TE 10	26°11'25.70"N, 93°59'15.49"E	DPDA	Agricultural land

Source: AECOM Primary Survey

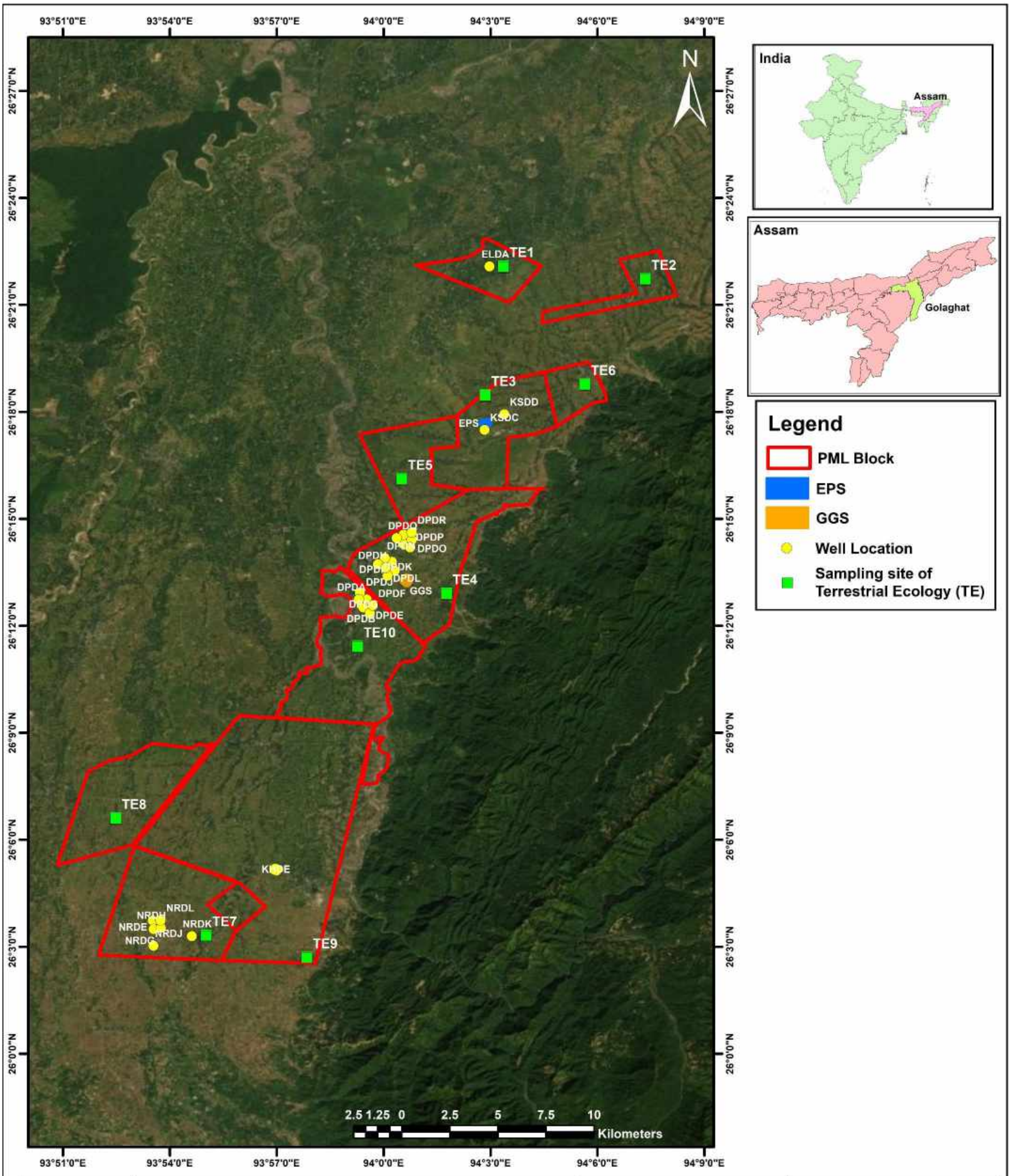


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				Title: Map showing the Sampling Location of Terrestrial Ecology	AECOM
	Date: 21/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3 Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.

Figure 46. Quadrate Sampling Locations

Faunal Survey

Faunal species were assessed by transect method by travelling a known distance and observed faunal species along the length were noted. Analysis was done through direct observation or visual encounter techniques. Also, Evaluation of faunal species was also done by using indirect method such as scats, pug marks, prey kills, calls, nests, feathers, skin molts and road-kills. Apart from line transects, vantage point surveys were also conducted along the village ponds for aquatic birds. Eight line transects were laid in the study area. GPS locations of transects laid is given in following Table 31 and Figure 47.

Table 31. Geographic Coordinates of the Transect Locations

Sr. No.	Transect	Start point	End point	Nearest Wells/ Habitat Type
1	TL1	26°4'24.62"N, 93°54'18.90"E	26°4'15.98"N, 93°54'53.21"E	NRDK, NRDJ; Agricultural and Settlement area
2	TL2	26° 7'21.22"N, 93°56'26.85"E	26°7'39.46"N, 93°56'53.75"E	Within the Block; Dayang River Side
3	TL3	26° 7'36.96"N, 93°51'31.42"E	26° 7'40.90"N, 93°52'7.43"E	Boundary of the Block, Agricultural area
4	TL4	26°11'49.37"N, 93°58'49.64"E	26°11'19.42"N, 93°58'55.73"E	DPDA, DPDB, DPDF, DPDG; Riverside patch forest
5	TL5	26°16'5.85"N, 94° 2'2.74"E	26°15'35.15"N, 94°1'57.68"E	DPDM, DPDN, DPDO, DPDP, DPDQ, DPDR; Agricultural and Settlement area
6	TL6	26°18'6.01"N, 94°4'20.07"E	26°17'58.45"N, 94°4'55.37"E	KSDC, KSDD; Homestead Plantation area
7	TL7	26°22'15.51"N, 94°1'48.77"E	26°21'43.79"N, 94°1'36.24"E	ELDA; Agricultural and Forest Patch area
8	TL8	26°21'32.62"N, 94°7'11.83"E	26°21'4.90"N, 94°7'35.06"E	Within the Block; Settlement and Homestead plantation area

Source: AECOM Primary Survey

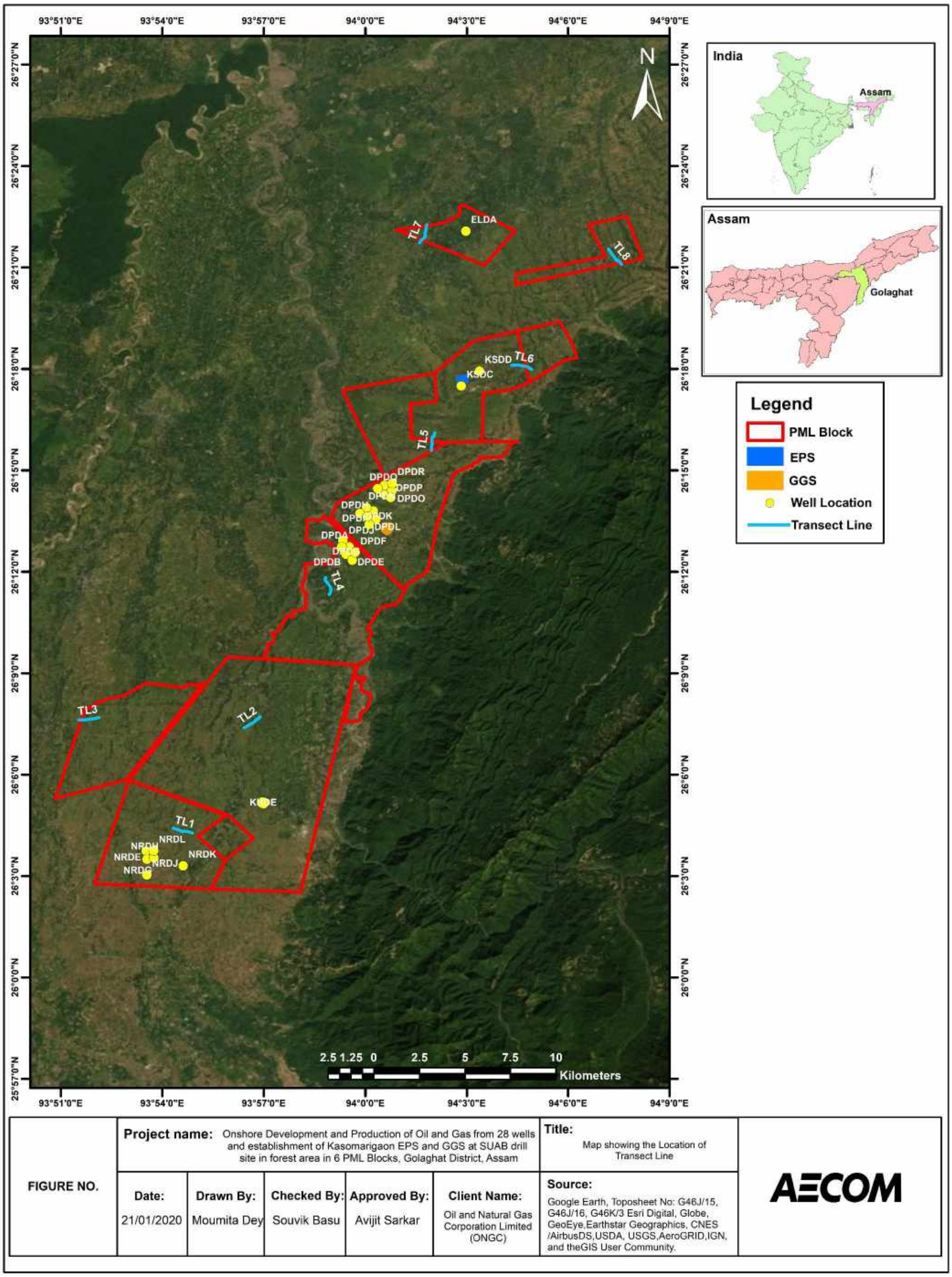


Figure 47. Line Transect location map

Phyto-sociological Analysis

Relative Frequency, density and dominance were calculated following Mishra (1968) and dos Santos et al. (2015). The formulae adopted are –

$$Relative\ Frequency = \frac{Number\ of\ quadrats\ in\ which\ species\ occured}{Total\ number\ of\ quadrats\ studied}\ x\ 100$$

$$Relative\ Density = \frac{Total\ number\ of\ individual\ s\ of\ the\ species}{Sum\ of\ all\ individual\ s\ of\ all\ species}\ x\ 100$$

$$Relative\ dominance = \frac{Dominance\ of\ given\ species}{Total\ dominance\ of\ all\ species}\ x\ 100$$

Important value index (IVI) is used to determine the overall importance of each species in the community structure. It is used to identify the dominance of any given species in the study area which helps in getting an overall importance of any given species in the community by statistical analysis. It can be calculated by summing the values of relative frequency, relative density and relative dominance. The IVI of the individual species has been calculated as the following formula

IVI=Relative frequency + Relative density + Relative dominance

The rationale behind the number of transect and quadrats laid was to ensure thorough and proportionate coverage of all the habitat types observed in the study area.
General diversity of an area was calculated using the Shannon–Wiener diversity index. Besides, Shannon–Wiener diversity index Simpson's dominance index, Pielou's evenness index, and Margalef's richness index were also calculated by using PAST version 3.07. Shannon–Wiener diversity index and Simpson's dominance index both were based on the proportional species abundance in the studied area. However, Shannon–Wiener diversity index was more sensitive to rare species, whereas Simpson's dominance index gave more importance to common species. Pielou's evenness index reflects homogeneity among the species. Margalef's richness index considered both abundance and species richness.

Desktop review and Secondary Data Collection

A desktop review has been carried to identify the forest area, land use pattern, Vegetation type etc. information regarding sensitive ecological habitat such as Biosphere Reserve, National Park, Wild life Sanctuary , Game reserve, Conservation reserve also collected from sources such as Forest Working Plan of Jorhat and Golaghat, different Scientific report published in peer reviewed journals, Government reports. To identify the different classification of different forest types, report from Forest Survey Of India (SoFR, 2017) was consulted Stakeholder consultation with forest Department and local villagers was also carried out to gather the relevant information during field survey.

Terrestrial Ecology

Flora of the Study Area

The floristic baseline was carried out after considering the different habitats present in the study area. Forest types are also identified as per the Champion and Seth Classification, 1967. Forest working Plans of Golaghat and Jorhat District are also consulted during identification of Forest types.

Forest Types

The Study area falls within the Jorhat and Golaghat district of Assam. Both the districts receive heavy rain fall in the monsoon season and moderate to light rainfall for rest the year. This type of rainfall helps to development of forest area. In Golaghat District, 18.91% of the Geographic area comes under forest cover whereas in Jorhat District, 19.65 % of geographic area falls in the forest area (SoFR. 2019). The Major forest types which are observed in the study area are Tropical Wet Evergreen forest, Alluvial Semi-Evergreen forest and Moist Mixed Deciduous Forest.

Floristic Species Recorded

A consolidated list of flora species observed in the study area, prepared on the basis of primary survey has been provided in following Table 28. Orchids such as *Cymbidium aloipholium, Dendrobium aphyllum, Rhynchostylis rhetusa, Aerides rosea, Aerides odorata, Bulbophyllum sp, Papilionanth teres, Dendrobium densiflirum* and *Papilionanthe teres* were observed in the study area.

Trees

The study area comprises of 53 tree species belonging to 28 families and depicted in Table 29. Diversity of species belonging to Fabaceae family was found to be higher, followed by *Moraceae, Arecaceae, Myrtaceae* and *Lamiaceae*. Most common species were *Moringa oleifera, Borassus flabellifer, Euclyptus sp., Polyalthia longifolia* , and *Acacia auriculoformis.*

Among trees *Borassus flabellifer* (22.15), *Euclyptus* sp. (17.99), *Acacia auriculoformis* (14.44) are the dominant species observed in the study area (Table 30).

The floral diversity was found to be medium to high as Shannon's index value varied from 2.48-2.89. Whereas Simpson's indices value varied very less (0.91-0.94), that means no single specie was dominant in that project sites. Margalef's richness index varied from 4.5-5.59, that means species richness varied with the change of habitat. Whereas Pielou's evenness index was varied very less (0.84-0.94), that means in project sites all species were evenly distributed. Quadrat wise value of all diversity indices are given in following Table 33.

Table 32. List of tree species observed in the study area

S.No.	Botanical Name	Common Name/ Local Name	Family	IUCN 3.1
1	*Acacia auriculoformis*	Moj	Fabaceae	Not Assessed
2	*Aegle marmelos*	Bel	Rutaceae	Not Assessed
3	*Albizia odoratissima*	Siris	Fabaceae	Not Assessed
4	*Albizia procera*	Kalo Siris	Fabaceae	Not Assessed
5	*Alianthus grandii*	Borpat	Simaroubaceae	Not Assessed
6	*Alibiiza lebbeck*	Kothiya-koroi	Fabaceae	Not Assessed
7	*Alistonia scholaris*	Satiana	Apocynaceae	Not Assessed
8	*Annona squamosa*	Aata	Annonaceae	Not Assessed
9	*Anthocephalus sinensis*	Kadam	Rubiaceae	Not Assessed
10	*Areca catachu*	Tambol	Arecaceae	Not Assessed
11	*Artocarpus intergifolia*	Kathal	Moraceae	Not Assessed
12	*Azadirachta indica*	Mahaneem	Meliaceae	Not Assessed
13	*Bauhinia variegata*	Kanchan	Fabaceae	Not Assessed
14	*Bombax ceiba*	Simalu	Malvaceae	Not Assessed
15	*Borassus flabellifer*	Tal	Arecaceae	Not Assessed
16	*Caeslpinia pulcherima*	Krishnasura	Fabaceae	Not Assessed
17	*Cassia fistula*	Shonaru	Caesalpiniaceae	Not Assessed
18	*Cayea arborea*	Kum	Lamiaceae	Not Assessed
19	*Ceiba pentendra*	Swet Simul	Bombacaceae	Not Assessed
20	*Cocoos nucifera*	Narikal	Palmae	Least Concern
21	*Dalbergia sissoo*	Sisu	Fabaceae	Not Assessed
22	*Delonix regia*	Radhasura	Fabaceae	Not Assessed
23	*Dillenia indica*	Outenga	Dilleniaceae	Least Concern
24	*Erythrina variegata*	Modar	Fabaceae	Not Assessed
25	*Euclyptus sp.*	--	Myrtaceae	Not Assessed
26	*Ficus bengalensis*	Bat	Moraceae	Not Assessed
27	*Ficus hispida*	Ingthum	Moraceae	Not Assessed
28	*Gmelina arborea*	Gameri	Lamiaceae	Not Assessed
29	*Litchi chinensis*	Lichi	Sapindaceae	Not Assessed

S.No.	Botanical Name	Common Name/ Local Name	Family	IUCN 3.1
30	*Mangifera indica*	Aam	Anacardiaceae	Data Deficient
31	*Melia azedarch*	Ghoraneem	Meliaceae	Not Assessed
32	*Mesua ferrea*	Nahar	Calophyllaceae	Not Assessed
33	*Michelia champaca*	Titachopa	Magnoliaceae	Not Assessed
34	*Moringa oleifera*	Sajina	Moringaceae	Not Assessed
35	*Mimusops elengi*	Bokul	Sapotaceae	Not Assessed
36	*Phoenix sylvestris*	Khejur	Arecaceae	Not Assessed
37	*Pterospermum acerifolium*	Kanak champa	Sterculiaceae	Not Assessed
38	*Phyllanthus embilica*	Amla	Phyllanthaceae	Not Assessed
39	*Plumaria acutiafolia*	Katgolap	Apocynaceae	Not Assessed
40	*Polyalthia longifolia*	Debadaru	Annonaceae	Not Assessed
41	*Pongamia pinnata*	Karach	Fabaceae	Not Assessed
42	*Psidium gujava*	Madhuriam	Myrtaceae	Not Assessed
43	*Punica grantum*	Dalim	Punicaceae	Not Assessed
44	*Sesbania grandiflora*	Bakphul	Fabaceae	Not Assessed
45	*Syzygium cumini*	Kalajam	Myrtaceae	Not Assessed
46	*Saraca indica*	Asoka	Fabaceae	Not Assessed
47	*Tectona grandis*	Segun	Lamiaceae	Not Assessed
48	*Terminalia arjuna*	Arjun	Combretaceae	Not Assessed
49	*Tamarindus indica*	Tetuli	Fabaceae	Not Assessed
50	*Tetrameles nudiflora*	Bhelu	Tetramelaceae	Not Assessed
51	*Terminalia chebula*	Silikha	Combretaceae	Not Assessed
52	*Trewa nudiflora*	Barkhetri	Euphorbiaceae	Not Assessed
53	*Zizyphus jujuba*	Bagari	Rhamnaceae	Not Assessed

Table 33. List of trees with IVI Index

S.No.	Botanical Name	Relative Dominance	Relative Frequency	Relative Abundance	IVI
1	*Acacia auriculoformis*	4.60	3.75	6.09	14.44
2	*Aegle marmelos*	1.67	2.50	1.22	5.40
3	*Albizia odoratissima*	3.35	3.13	8.33	14.81
4	*Albizia procera*	2.51	3.75	2.28	8.54

S.No.	Botanical Name	Relative Dominance	Relative Frequency	Relative Abundance	IVI
5	*Alianthus grandii*	1.26	1.25	1.52	4.03
6	*Alibiiza lebbeck*	1.26	1.25	2.50	5.00
7	*Alistonia scholaris*	1.67	1.88	2.10	5.65
8	*Annona squamosa*	1.67	2.50	0.73	4.90
9	*Anthocephalus sinensis*	1.67	1.88	0.62	4.17
10	*Areca catachu*	1.67	2.50	1.10	5.27
11	*Artocarpus intergifolia*	2.09	3.13	3.91	9.12
12	*Azadirachta indica*	2.93	3.13	2.40	8.45
13	*Bauhinia variegata*	0.84	1.25	0.25	2.34
14	*Bombax ceiba*	1.67	2.50	1.68	5.86
15	*Borassus flabellifer*	7.11	4.38	10.66	22.15
16	*Caeslpinia pulcherima*	2.51	3.13	5.50	11.13
17	*Cassia fistula*	0.84	1.25	1.39	3.47
18	*Cayea arborea*	0.42	0.63	0.33	1.38
19	*Ceiba pentendra*	1.67	1.88	4.25	7.79
20	*Cocoos nucifera*	3.77	3.75	4.98	12.50
21	*Dalbergia sissoo*	2.51	2.50	1.48	6.49
22	*Delonix regia*	0.84	1.25	1.17	3.26
23	*Dillenia indica*	1.26	1.88	0.52	3.65
24	*Erythrina variegata*	0.84	0.63	0.70	2.16
25	*Euclyptus sp.*	7.53	3.75	6.71	17.99
26	*Ficus bengalensis*	0.84	1.25	2.15	4.24
27	*Ficus hispida*	0.42	0.63	0.52	1.56
28	*Gmelina arborea*	1.26	1.88	0.62	3.75
29	*Litchi chinensis*	0.42	0.63	0.13	1.18
30	*Mangifera indica*	3.35	2.50	5.94	11.79
31	*Melia azedarch*	0.84	1.25	0.36	2.45
32	*Mesua ferrea*	0.42	0.63	0.15	1.19
33	*Michelia champaca*	0.42	0.63	0.10	1.14
34	*Moringa oleifera*	7.95	0.63	2.00	10.57
35	*Mimusops elengi*	0.42	0.63	0.27	1.31

S.No.	Botanical Name	Relative Dominance	Relative Frequency	Relative Abundance	IVI
36	*Phoenix sylvestris*	2.09	2.50	1.28	5.87
37	*Pterospermum acerifolium*	0.84	1.25	0.28	2.36
38	*Phyllanthus embilica*	0.42	0.63	0.19	1.24
39	*Plumaria acutiafolia*	4.60	4.38	0.58	9.55
40	*Polyalthia longifolia*	5.44	3.75	1.26	10.45
41	*Pongamia pinnata*	0.42	0.63	0.29	1.33
42	*Psidium gujava*	0.42	0.63	0.10	1.14
43	*Punica grantum*	1.26	1.88	0.29	3.42
44	*Sesbania grandiflora*	0.84	1.25	0.21	2.30
45	*Syzygium cumini*	0.42	0.63	0.21	1.26
46	*Saraca indica*	0.84	1.25	0.14	2.23
47	*Tectona grandis*	1.26	1.88	1.78	4.91
48	*Terminalia arjuna*	2.09	2.50	3.60	8.20
49	*Tamarindus indica*	0.84	1.25	0.56	2.65
50	*Tetrameles nudiflora*	0.84	1.25	1.83	3.92
51	*Terminalia chebula*	0.42	0.63	0.24	1.28
52	*Trewa nudiflora*	0.84	1.25	0.82	2.90
53	*Zizyphus jujuba*	1.67	2.50	1.68	5.86

Table 34. Quadrat wise Diversity indices of Trees

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
TE 1	14	2.58	0.92	0.94	4.50
TE 2	18	2.74	0.92	0.86	5.22
TE 3	13	2.48	0.91	0.92	4.15
TE 4	20	2.89	0.94	0.90	5.59
TE 5	16	2.60	0.91	0.84	4.60
TE 6	19	2.79	0.93	0.85	5.40
TE 7	15	2.63	0.92	0.92	4.53

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
TE 8	16	2.69	0.93	0.92	4.78
TE 9	18	2.81	0.93	0.92	5.35
TE 10	16	2.64	0.92	0.87	4.72

Shrubs

There are 34 species of shrubs were observed in the study area and listed in Table 32. Shrubs family belonging to Poaceae was found to be higher, followed by Lamiaceae. Species such as *Calotropis procera, Hyptis suaveolens, Phlogacanthus tubiflorus, Solanum spirale were* commonly observed in the study area. Among Shrub, *Calotropis procera* (11.27) and *Hyptis suaveolens* (9.15) are the dominant species. The floral diversity was found to be medium to high as Shannon's index value varied from 2.97-2.43. Whereas Simpson's indices value varied very less (0.84-0.91), that means no single specie was dominant in that project sites. Pielou's evenness index was varied very less (0.87-0.95), that means in project sites all species were evenly distributed. Whereas, Margalef's richness index varied from 2.65-4.06, that means species richness varied with the change of habitat. Whereas Quadrat wise value of all indices are given in following Table 36.

Table 35. List of Shrubs Species observed in Study area

S.no	Botanical name	Common Name/ Local Name	Family	IUCN Status	Relative Dominance	Relative Frequency
1	*Abutilon indicum*	Jopa bondha	Malvaceae	Not assessed	1.41	1.87
2	*Adhatoda zeylanica*	Jok-an-kelok	Acanthaceae	Not assessed	4.93	5.61
3	*Antidesmus acidum*	Ingchum	Phyllanthaceae	Not assessed	2.11	1.87
4	*Bambusa arundinacea*	Jaati Bans	Poaceae	Not assessed	3.52	2.80
5	*Bambusa teres*	Bans	Poaceae	Not assessed	3.52	1.87
6	*Bambusa vulgaris*	Bans	Poaceae	Not assessed	3.52	2.80

S.no	Botanical name	Common Name/ Local Name	Family	IUCN Status	Relative Dominance	Relative Frequency
7	*Bambusa tulda*	Bans,Mitinga	Poaceae	Not assessed	1.41	1.87
8	*Bambusa balcooa*	Bans, barak (barua)	Poaceae	Not assessed	2.11	3.74
9	*Bambusa offinis*	Bans, Kanak-kai	Poaceae	Not assessed	1.41	2.80
10	*Bambusa nana*	Bans	Poaceae	Not assessed	2.82	2.80
11	*Calamus rotang*	Pri	Arecaceae	Not assessed	1.41	1.87
12	*Calotropis procera*	Akanda	Apocynaceae	Not assessed	11.27	8.41
13	*Clerodendrum indicum*	Bapnem-ai	Lamiaceae	Not assessed	0.70	1.87
14	*Clerodendrum serratum*	Phelang-riho	Lamiaceae	Not assessed	2.11	2.80
15	*Dendrocalamus giganteus*	Worra	Poaceae	Not assessed	1.41	1.87
16	*Hibiscus rosa-sinensis*	Jaba	Malvaceae	Not assessed	2.82	2.80
17	*Hibiscus vitifolius*	Bon-kapas	Malvaceae	Not assessed	0.70	0.93
18	*Hyptis suaveolens*	Bunotulshi	Lamiaceae	Not assessed	9.15	5.61
19	*Ixora coccinea*	Rangan	Rubiaceae	Not assessed	1.41	1.87
20	*Jatropha curcus*	Bongali Era	Euphorbiaceae	Not assessed	2.11	2.80
21	*Lantana camera*	Lantana	Verbenaceae	Not assessed	1.41	1.87
22	*Murraya koenigii*	Thengsakso	Rutaceae	Not assessed	1.41	1.87
23	*Nerium indicum*	Karabi	Apocynaceae	Not assessed	2.82	2.80

S.no	Botanical name	Common Name/ Local Name	Family	IUCN Status	Relative Dominance	Relative Frequency
24	*Nyethenthes arbortristis*	Sewali	Oleaceae	Not assessed	0.70	0.93
25	*Olax acuminate*	Hanboka	Olacaceae	Not assessed	2.82	2.80
26	*Paederia foetida*	Rekang	Rubiaceae	Not assessed	1.41	1.87
27	*Persicaria microcephala*	Delap	Polygonaceae	Not assessed	2.11	1.87
28	*Phlogacanthus tubiflorus*	Jok-anke-et	Acanthaceae	Not assessed	6.34	6.54
29	*Ricinus communis*	Rehri	Euphorbiaceae	Not assessed	4.93	3.74
30	*Solanum spirale*	Jok-ho	Solanaceae	Not assessed	5.63	5.61
31	*Solanum torvum*	Theso-rongman	Solanaceae	Not assessed	3.52	3.74
32	*Thevetia peruviana*	Kolkey	Apocynaceae	Not assessed	1.41	1.87
33	*Vitex negundo*	Malbar nut	Lamiaceae	Not assessed	0.70	0.93
34	*Xanthium stromarium*	Gokru	Asteraceae	Not assessed	4.93	4.67

Table 36. Quadrat wise Diversity indices of Shrubs

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
TE 1	9	2.14	0.88	0.95	3.03
TE 2	12	2.34	0.89	0.87	3.88
TE 3	8	1.97	0.84	0.90	2.92
TE 4	12	2.43	0.91	0.94	3.97

TE 5	10	2.21	0.88	0.91	3.51
TE 6	11	2.30	0.89	0.91	3.69
TE 7	11	2.34	0.90	0.95	3.79
TE 8	10	2.25	0.89	0.94	3.51
TE 9	12	2.43	0.91	0.95	4.06
TE 10	8	1.97	0.85	0.90	2.65

Herbs

There are 24 species of herbs were observed in the study area and depicted in Table 34. Herbs family belonging to Araceae was found to be higher, followed by Amaranthaceae. Species such as *Alternanthera sessilis, Chenopodium album, Oxalis corniculate* were commonly observed in the study area. Among herbs, *Alternanthera sessilis* (10.11) showed higher diversity followed by, *Chenopodium album* (8.43) and *Oxalis corniculate* (7.3) were the dominant species observed in the study area. The Shannon's index value of herbs varied from 1.59-1.98. Whereas Simpson's indices value varied very less (0.75-0.85), that means no single specie was dominant in that project sites. Pielou's evenness index was varied (0.82-0.96), that means in project sites all species distribution were varied distributed. Whereas, Margalef's richness index varied from 1.73-2.12, that means species richness varied with the change of habitat very less. Quadrat wise value of all indices are given in following Table 38.

Table 37. List of Herbs Species observed in Study area

S.no	Botanical name	Family	Common Name/ Local Name	IUCN Status	Relative Dominance	Relative Frequency
1	*Alocasia macrorrhiza*	Araceae	Henchala	Not assessed	6.18	7.46
2	*Abutilon indicum*	Malvaceae	Potari	Not assessed	5.06	4.48
3	*Alternanthera sessilis*	Amaranthaceae	Raeaba	Not assessed	10.11	7.46
4	*Achyranthes aspera*	Amaranthaceae	Bonsoth	Not assessed	5.06	4.48
5	*Amorphophalus bulbifer*	Araceae	Hen saluki	Not assessed	6.18	2.99
6	*Arisaema tortuosum*	Araceae	Chamua	Not assessed	3.93	1.49
7	*Beta vulgaris*	Amaranthaceae	Belgali dido	Not assessed	5.06	4.48

S.no	Botanical name	Family	Common Name/ Local Name	IUCN Status	Relative Dominance	Relative Frequency
8	*Cassia tora*	Caesalpinioideae	Bapduli	Not assessed	2.25	4.48
9	*Chenopodium album*	Chenopodiaceae	Churu	Not assessed	8.43	8.96
10	*Commelina benghalensis*	Commelinaceae	Kurveng	Not assessed	3.37	5.97
11	*Curcuma amada*	Zingiberaceae	Tharmit tharve	Not assessed	0.56	1.49
12	*Drymaria cordata*	Caryophyllaceae	Kur-vengso	Not assessed	2.25	4.48
13	*Datura metal*	Solanaceae	Dutura	Not assessed	1.12	2.99
14	*Ensete superbum*	Musaceae	Lobong	Not assessed	2.81	2.99
15	*Homalomena aromatic*	Araceae	Ok hi atehang	Not assessed	4.49	4.48
16	*Hydrocotyle sibthorpoides*	Araliaceae	Chong amok	Not assessed	1.69	1.49
17	*Leucas aspera*	Lamiaceae	Chanrong aan	Not assessed	2.25	1.49
18	*Oxalis corniculata*	Oxalidaceae	Vothung mekbop	Not assessed	7.30	8.96
19	*Physalia peruviana*	Solanaceae	Thebong-kang	Not assessed	5.06	2.99
20	*Portulaca oleracea*	Portulacaceae	Chitu	Not assessed	2.25	2.99
21	*Portulaca quadrifida*	Portulacaceae	Vothung mekvoke-er	Not assessed	1.69	1.49
22	*Solanum nigrum*	Solanaceae	Pharchingki	Not assessed	3.93	2.99
23	*Tagetes erecta*	Asteraceae	Mir kadomphui	Not assessed	5.06	5.97
24	*Tephrosia hamiltonii*	Fabaceae	Bono nil	Not assessed	3.93	2.99

Table 38. Quadrat wise Diversity indices of Herbs

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
TE 1	6	1.60	0.77	0.83	1.80
TE 2	7	1.76	0.80	0.83	2.12
TE 3	6	1.75	0.82	0.96	1.85
TE 4	8	1.92	0.83	0.86	2.42
TE 5	6	1.64	0.79	0.86	1.73
TE 6	7	1.76	0.80	0.83	2.12
TE 7	7	1.85	0.83	0.91	2.04
TE 8	6	1.59	0.75	0.82	1.77
TE 9	8	1.98	0.85	0.90	2.23
TE 10	7	1.75	0.80	0.82	2.08

The list of climbers is depicted in Table 39 and cultivated agricultural species in Table 40.

Table 39. List of Climbers Species observed in Study area

S.no	Botanical name	Family	Common Name/ Local Name	IUCN Status
1	*Argyreia nervosa*	Convolvulaceae	Ghav bel	Not assessed
2	*Abrus precatorius*	Fabaceae	Latumoni	Not assessed
3	*Bauhinia vahlii*	Fabaceae	Sonbel	Not assessed
4	*Byttneria aspera*	Amaranthaceae	Teconibarua lata	Not assessed
5	*Calamus tenuis*	Areceae	Jati-bet	Not assessed
6	*Cissus quadrangularis*	Vitaceae	Repich ingthun	Not assessed
7	*Combretum roxburghii*	Combretaceae	Lota chali	Not assessed
8	*Connarus paniculatus*	Connaraceae	Mokai lata	Not assessed

S.no	Botanical name	Family	Common Name/ Local Name	IUCN Status
9	*Cucurbita maxima*	Cucurbitaceae	Ranga	Not assessed
10	*Dalbergia pinnata*	Fabaceae	Dat bijli	Not assessed
11	*Deeringia amaranthoides*	Amaranthaceae	Hanthai	Not assessed
12	*Dioscorea esculenta*	Dioscoreaceae	Ruipheng selu	Not assessed
13	*Dioscorea pentaphylla*	Dioscoreaceae	Ruipheng	Not assessed
14	*Dioscorea puber*	Dioscoreaceae	Rui-chilong	Not assessed
15	*Ipomea aquatica*	Convolvuaceae	Kalmou	Not assessed
16	*Ipomes batatas*	Convolvuaceae	Ruidok	Not assessed
17	*Clitorea tenata*	Fabaceae	Aparajita	Not assessed
18	*Cuscut reflexa*	Convolvulaceae	Akashilata	Not assessed
19	*Millettia auriculata*	Fabaceae	Agarbel	Not assessed
20	*Mikania scandens*	Asteraceae	Nag	Not assessed
21	*Paederia foetida*	Rubiaceae	Bhedai lata	Not assessed
22	*Piper longum*	Piperaceae	Pipli	Not assessed
23	*Smilax perfoliata*	Smilacaceae	Bagh-achora-lata	Not assessed
24	*Tinospora cordifolia*	Menispermaceae	Hoguni-lot	Not assessed

Table 40. List of most cultivated agricultural Species observed in Study area

S.no	Botanical name	Family	Common Name/ Local Name
1	Aquilaria malaccensis	Thymelaeaceae	Kasighas
2	Areca catechu	Arecaceae	Betel Nut palm
3	Brassica oleracea	Brassicaceae	Cabbage
4	Brassica oleracea var. botrytis	Brassicaceae	Cauliflower
5	Capsicum annum	Solanaceae	Chilli
6	Camelia sinensis	Theaceae	Tea
7	Coriandrum sativum	Apiaceae	Coriander
8	Cumin cyminum	Apiaceae	Cumin
9	Lens culinaris	Fabaceae	Lentil/Daal

S.no	Botanical name	Family	Common Name/ Local Name
10	Musa acuminata	Musaceae	Banana
11	Musa balbisiana	Musaceae	Banana
12	Oryza sativa	Poaceae	Rice /Paddy
13	Pisum sativum	Fabaceae	Pea
14	Piper longum	Piperaceae	Long Pepper
15	Piper betel	Piperaceae	Paan leaf
16	Saccharum officinarum	Poaceae	Sugarcane
17	Sesamum indicum	Pedaliaceae	Til
18	Solanum tuberosum	Solanaceae	Potato
19	Solanum melongena	Solanaceae	Eggplant
20	Vigna radiata	Fabaceae	Mug
21	Zingiber officinale	Zingiberaceae	Ginger

Fauna of the Study Area

The faunal baseline of the study area is based on the species having recorded ranges that include the study area, supported by the primary faunal data recorded during field visit. The following sub-sections provide details of the faunal species reported from or recorded in the study area.

Mammals

Among Mammals, 12 mammalian species were observed in the study area during field visit. The IUCN status of this species is Least concern (LC) and as per Wild life protection Act (WPA), 1972, this species is enlisted in Schedule II and V. The list of mammalian species which is observed in the study area is given in Table 41.

Table 41. Mammalian Species observed in the Study Area

Sr. No.	Scientific Name	Common Name	IUCN Status	WPA 1972 Schedule
1	*Mus booduga*	Little Indian field mouse	LC	Sch. IV
2	*Mus musculus*	House mouse	LC	Sch. IV
3	*Suncus murinus*	Asian House Shrew	LC	Not Evaluated
4	*Bandicota bengalensis*	Lesser bandicoot rat	LC	Sch. IV
5	*Bandicota indica*	Large Bandicoot Rat	LC	Sch. IV
6	*Rattus norvegicus*	Brown Rat	LC	Sch. IV

Sr. No.	Scientific Name	Common Name	IUCN Status	WPA 1972 Schedule
7	*Rattus rattus*	Common House Rat	LC	Sch. IV
8	*Funambulus palmarum*	Indian palm squirrel	LC	Sch. IV
9	*Macaca mulatta*	Rhesus Macaque	LC	Sch. II
10	*Pteropus giganteus*	Indian Flying Fox	LC	Sch. V
11	*Pipistrellus coromandra*	Little Indian Bat	LC	Sch. IV
12	*Herpestes javanicus*	Small Indian Mongoose	LC	Sch. II

** LC- Least Concern, Schedule – Sch.*

Avifauna

50 avian species have been observed in the study area. All bird's species which were observed during the study were Least Concern according to IUCN red data Book and Schedule IV according to Wildlife Protection Act (WPA, 1972). No other globally threatened avian species has been observed in the study area Maximum diversity of birds belonging to order Passeriformes were found in the study area. Detailed checklist of birds observed in the study area is given in Table 42.

Table 42. List of Avifauna observed in the Study Area

S. No.	Scientific Name	Common Name	Order	IUCN Status	Schedule as per WPA, 1972
1	*Accipiter Badius*	Shikra	Accipitriformes	LC	Not Evaluated
2	*Acridotheres fuscus*	Jungle Myna	Passeriformes	LC	Sch.IV
3	*Acridotheres ginginianus*	Bank Myna	Passeriformes	LC	Sch.IV
4	*Acridotheres tristis*	Common Myna	Passeriformes	LC	Sch.IV
5	*Aegithina tiphia*	Common Iora	Passeriformes	LC	Sch.IV
6	*Actitis hypoleucos*	Common Sandpiper	Charadriiformes	LC	Sch.IV
7	*Aethopyga siparaja*	Crimson Sunbird	Passeriformes	LC	Sch.IV

S. No.	Scientific Name	Common Name	Order	IUCN Status	Schedule as per WPA, 1972
8	*Alcedo meninting*	Common Kingfisher	Coraciiformes	LC	Sch.IV
9	*Amaurornis phoenicurus*	White-breasted waterhen	Gruiformes	LC	Not Evaluated
10	*Anastomus oscitans*	Asian Openbill	Ciconiiformes	LC	Sch.IV
11	*Anthus rufulus*	Paddyfield Pipit	Passeriformes	LC	Sch.IV
12	*Ardeola grayii*	Indian Pond heron	Pelecaniformes	LC	Sch.IV
13	*Bubulcus ibis*	Cattle Egret	Pelecaniformes	LC	Sch.IV
14	*Casmerodius albus*	Great Egret	Pelecaniformes	LC	Sch.IV
15	*Ceryle rudis*	Pied Kingisher	Coraciiformes	LC	Sch.IV
16	*Cinnyris asiaticus*	Purple Sunbird	Passeriformes	LC	Sch.IV
17	*Columba livia*	Common Pigeon	Columbiformes	LC	Not Evaluated
18	*Copsychus saularis*	Oriental Magpie Robin	Passeriformes	LC	Not Evaluated
19	*Coracias benghalensis*	Indian Roller	Coraciiformes	LC	Sch.IV
20	*Corvus levaillantii*	Eastern Jungle Crow	Passeriformes	Not Evaluated	Sch.IV
21	*Corvus splendens*	House Crow	Passeriformes	LC	Sch.IV
22	*Cypsiurus balasiensis*	Asian Palm Swift	Caprimulgiformes	LC	Sch.IV
23	*Dendrocitta vagabunda*	Rufous Treepie	Passeriformes	LC	Sch.IV
24	*Dendrocygna javanica*	Lesser whistling - Duck	Anseriformes	LC	Sch.IV
25	*Dicrurus hottetottus*	Spangled Drongo	Passeriformes	LC	Sch.IV

S. No.	Scientific Name	Common Name	Order	IUCN Status	Schedule as per WPA, 1972
27	*Dicrurus macrocercus*	Black Drongo	Passeriformes	LC	Sch.IV
28	*Eudynamys Scolopaceus*	Asian Koel	Cuculiformes	LC	Sch.IV
29	*Gracupica contra*	Asian Pied Starling	Passeriformes	LC	Sch.IV
30	*Halcyon smyrnensis*	White throated Kingfisher	Coraciiformes	LC	Sch.IV
31	*Hierococcyx varius*	Common Hawk Cuckoo	Cuculiformes	LC	Sch.IV
32	*Hirundo rustica*	Barn Swallow	Passeriformes	LC	Sch.IV
33	*lanius schach*	Long tailed Shrike	Passeriformes	LC	Not Evaluated
34	*Leptoptilos javanicus*	Lesser Adjutant	Ciconiiformes	VU	Not Evaluated
35	*Lonchura malacca*	Chestnut Munia	Passeriformes	LC	Sch.IV
36	*Motacilla flava*	Yellow Wagtail	Passeriformes	LC	Not Evaluated
37	*Nycticorax nycticorax*	Black Crowned Night heron	Pelecaniformes	LC	Sch.IV
38	*Oriolus Xanthornus*	Black Hooded oriole	Passeriformes	LC	Sch.IV
39	*Orthotomus sutorius*	Common Tailorbird	Passeriformes	LC	Not Evaluated
40	*Parus major*	Great Tit	Passeriformes	LC	Sch.IV
41	*Passer montanus*	Eurasian Tree Sparrow	Passeriformes	LC	Not Evaluated
42	*Pelargopsis capensis*	Stork Billed Kingfisher	Coraciiformes	LC	Sch.IV
43	*Ploceus philippinus*	Baya Weaver	Passeriformes	LC	Sch.IV
44	*Prinia inornata*	Plain Prinia	Passeriformes	LC	Not Evaluated

S. No.	Scientific Name	Common Name	Order	IUCN Status	Schedule as per WPA, 1972
45	*Pycnonotus cafer*	Red Vented Bulbul	Passeriformes	LC	Sch.IV
46	*Pycnonotus jocosus*	Red-whiskered Bulbul	Passeriformes	LC	Sch.IV
47	*Stigmatopelia Chinensis*	Spotted Dove	Columbiformes	LC	Sch.IV
48	*Treron phoenicopterus*	Yellow footed green pigeon	Columbiformes	LC	Sch.IV
49	*Tringa ochropus*	Green Sandpiper	Charadriiformes	LC	Sch.IV
50	*Vanellus indicus*	Red-wattled lapwing	Charadriiformes	LC	Not Evaluated

* *LC- Least Concern, Schedule – Sch.*

Reptiles

Six reptilian species have been observed in the study area. All reptiles which were observed during the study were Least Concern according to IUCN red data Book and Except Xenochrophis piscator rest five species were not evaluated according to Wildlife Protection Act (WPA, 1972). Xenochrophis piscator is under Schedule II. Detailed checklist of reptiles which were observed in the study area is given in Table 43.

Table 43. List of Reptiles observed in the Study Area

Sr. No.	Scientific Name	Common Name	IUCN Status	WPA 1972 Schedule
1	*Eutropis carinata*	Common Skink	LC	Not Evaluated
2	*Hemidactylus frenatus*	Common house gecko	LC	Not Evaluated
3	*Hemidactylus flaviviridis*	House Lizard	LC	Not Evaluated
4	*Gekko gecko*	Tokay Gecko	LC	Not Evaluated
5	*Calotes versicolor*	Oriental garden lizard	LC	Not Evaluated
6	*Xenochrophis piscator*	Checkered keelback	LC	Sch.IV

* *LC- Least Concern, Schedule – Sch.*

Amphibia

Six amphibian species have been observed in the study area. All amphibians which were observed during the study were Least Concern according to IUCN red data Book and Except Hoplobatrachus tigerinus rest five species were not evaluated according to Wildlife Protection Act (WPA, 1972). Hoplobatrachus tigerinus is under Schedule IV. Detailed checklist of amphibians which were observed in the study area is given in Table 44.

Table 44. List of Amphibians observed in the Study Area

Sr. No.	Scientific Name	Common Name	IUCN Status	WPA 1972 Schedule
1	*Duttaphrynus melanostictus*	Asian common toad	LC	Not Evaluated
2	*Hoplobatrachus tigerinus*	Asian bullfrog	LC	Sch. IV
3	*Microhyla berdmorei*	Large pygmy frog	LC	Not Evaluated
4	*Uperodon globulosus*	Balloon frog	LC	Not Evaluated
5	*Polypedates leucomystax*	Common tree frog	LC	Not Evaluated
6	*Euphlyctis hexadactylus*	Green Pond Frog	LC	Not Evaluated

* *LC- Least Concern, Schedule – Sch.*

Eco-Sensitive areas

As per the legal documents all the blocks under forest PML areas are located in Dayang Reserve Forest, Rengma Reserve Forest and Nambor South Reserve Forest area. However, at the time of field visit it was observed that total forest land was diverted into agricultural field and settlement area. Few small forest patches were observed besides Dayang and Rengma river side. Apart from that the Nearest protected area is Nambor Wildlife sanctuary which is located at a distance 10.52 km from the nearest block boundary in west direction.

Aquatic Ecology

In an aquatic ecosystem, the environment is water, and all the system's plants and animals live either in or on that water. Aquatic ecosystems include wetlands, rivers, lakes, and coastal estuaries. Rengma river, Dayang River and Sisupani River, apart from several ponds, wetlands and paddy fields is the major river in the area providing a huge aquatic habitat in the block. Total six locations were selected in the study area for plankton diversity studies, GPS coordinates of locations selected for phytoplankton and zooplankton sampling are given in Table 45 and Figure 48.

Table 45. Aquatic Ecology (AE) Sampling locations

S.No.	Name of Location	Location	Nearest well	Type of Habitat
1	AE1	26° 4'4.93"N, 93°55'34.57"E	NRDK, NRDJ	Rengma River, Sonalinagar No. 2
2	AE2	26°9'48.84"N, 93°59'29.46"E	Within the Block	Dayang River, Panbari
3	AE3	26°14'18.02"N, 93°59'59.70"E	DPDM, DPDN, DPDO, DPDP, DPDQ, DPDR	Sisupani River, onapur
4	AE4	26°21'44.23"N, 94° 2'54.08"E	ELDA	Pond, Ghiladhari
5	AE5	26°21'0.27"N, 94° 6'52.45"E	Within the Block	Pond, Tarani Borkathoni
6	AE6	26° 8'3.78"N, 93°56'59.87"E	Within the Block	Rengma River, Kamalpur

Source: AECOM Primary Survey

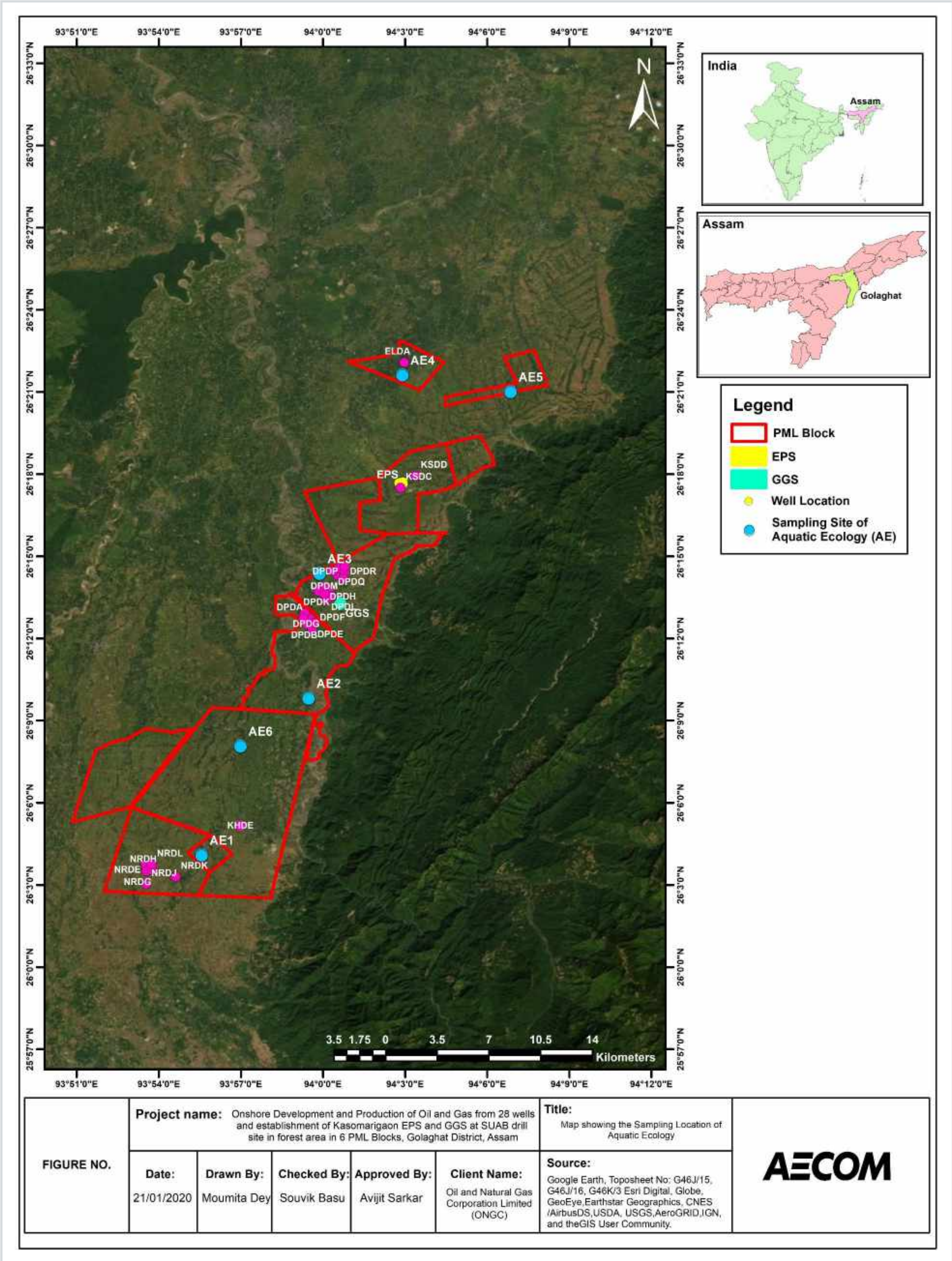


Figure 48. Aquatic ecology sampling locations

Aquatic Survey Methodology

For phytoplankton analysis one litre of water sample has been collected from each collecting point, and 10% Lugols' Iodine solution mixed instantly on the spot in 100:1 ratio. All collections have been done before 10 am in the morning. Sampling bottles have been kept for about 6hrs and then, the 10-mL precipitation has been collected from the amber bottle. The identification and quantitative analysis of phytoplankton samples have been done by using Leica microscope.

For qualitative and quantitative analysis of zooplankton, the samples have been collected by filtering 50L of water using No. 25 bolting silk cloth plankton-net (with 64μm aperture size and allowing nearly 33% open area). Sample volumes of 100 ml has been maintained for all sample bottles. Zooplankton have been estimated by Lackey – Drop Method (1938). From decanted sample subsamples of 0.2 ml each has been taken in a microscopic grooved slide and then covered by square cover glass of known area. Ten such counts have been averaged and the organisms present in a litre of water.

Phytoplankton

The species distribution of the phytoplankton as found after sampling at six sites are summarized in Table 46 while the Site wise different diversity indices are given in Table 47. Six Phytoplankton class were identified from the six sampling points. The highest phytoplankton was observed under Bacillariophyceae class followed by Chlorophyceae. From the analysis of the water samples it was observed that from AE4 and AE5 sites, which were pisciculture ponds, maximum number of phytoplankton present. Also, Shannon diversity index, Simpson dominance and Margalef index was high in that sites. However, in AE1 phytoplankton were more evenly distributed than others.

Table 46. Distribution of Phytoplankton (individual L^{-1}) in Aquatic Ecology (AE) Sampling Sites

Sl No	Class	Name of Phytoplankton	AE1	AE2	AE3	AE4	AE5	AE6
1	Bacillariophyceae	*Frustulia* sp.	0	0	2	4	3	0
2		*Stauroneis* sp.	1	0	0	0	0	2
3		*Gyrosigma* sp.	2	3	0	0	0	1
4		*Navicula* sp.	0	0	1	3	3	0
5		*Pinnularia* sp.	0	0	0	4	7	0
6		*Diatoma* sp.	2	1	2	3	4	1
7		*Cymbella* sp.	0	0	0	0	0	2
8		*Gomphonema* sp.	0	2	0	0	0	0
9		*Fragilaria* sp.	0	0	3	0	0	1
10		*Synedra* sp.	0	0	0	2	4	1
11	Chlorophyceae	*Hydrodictyon* sp.	1	0	0	0	0	2
12		*Eudorina* sp.	0	0	0	2	3	0
13		*Microspora* sp.	0	0	0	1	1	0

Sl No	Class	Name of Phytoplankton	AE1	AE2	AE3	AE4	AE5	AE6
14		*Chlamydomonas* sp.	0	0	0	3	2	0
15		*Draparnaldiopsis* sp.	2	2	0	0	2	1
16		*Closterium* sp.	0	0	0	2	1	0
17		*Desmidium* sp.	0	0	0	1	1	0
18		*Volvox* sp.	1	0	1	2	1	2
19		*Spirogyra* sp.	2	1	1	3	2	1
20	Cyaenophyceae	*Anabaena* sp.	0	0	0	3	4	0
21		*Oscillatoria* sp.	2	0	2	0	0	1
22		*Aphanizomenon* sp.	0	1	0	0	0	0
23		*Rivularia* sp.	1	2	0	0	0	1
24		*Spirulina* sp.	0	0	0	6	4	1
25	Phaeophyceae	*Ectocarpus* sp.	0	0	0	2	1	0
26	Euglenidae	*Euglena* sp.	0	1	1	2	4	2
27		*Phacus* sp.	0	0	0	2	1	0
28	Myxophyceae	*Anabaena* sp.	1	0	0	0	2	2
29		*Oscillatoria* sp.	1	0	0	2	0	0
30		*Lyngbya* sp.	0	0	0	0	0	1
31		*Nostoc* sp.	0	0	0	2	1	0

Source: AECOM Primary Survey

Table 47. Aquatic Ecology (AE) Sampling Site wise Diversity indices of Phytoplankton

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
AE1	11	2.34	0.90	0.94	3.61
AE2	8	1.99	0.85	0.92	2.73
AE3	8	1.99	0.85	0.92	2.73
AE4	19	2.86	0.94	0.91	4.63
AE5	20	2.82	0.93	0.84	4.83
AE6	16	2.71	0.93	0.94	4.85

Source: AECOM Primary Survey

Zooplankton

The species distribution of the zooplankton as found after sampling at six sites are summarized in Table 48 while the Site wise different diversity indices are given in Table 49. Total 36 genera of zooplankton under five zooplankton groups were identified from the six sampling points. Copepodswere the dominated species followed by rotifers. Like phytoplankton, it was observed that from AE4 and AE5 sites, which were pisciculture ponds, maximum number of zooplankton present. Same as phytoplankton the Shannon diversity index, Simpson dominance and Margalef index was high in AE4 and AE4. Actually, in ponds water was in stagnant condition and nutrient was higher than flowing river, and its favored the growth of the plankton.

Table 48. Distribution of Zooplankton (individual L^{-1}) in Aquatic Ecology (AE) Sampling Sites

Sl No	Class	Name of Phytoplankton	AE1	AE2	AE3	AE4	AE5	AE6
1	Copepoda	*Nauplii* sp.	0	0	0	2	1	0
2		*Cyclops* sp.	2	1	0	1	2	0
3		*Diaptomus* sp.	0	0	0	2	1	0
4		*Tropocyclops* sp.	2	1	1	1	3	0
5		*Heliodiaptomus* sp.	0	0	0	1	1	0
6		*Mesocyclops* sp.	0	0	2	2	1	1
7	Cladocera	*Alona* sp.	0	0	0	2	0	1
8		*Moina* sp.	0	1	0	2	3	0
9		*Bosmina* sp.	0	0	0	1	1	0
10		*Bosminopsis* sp.	0	0	0	1	2	0
11		*Ceriodaphnia* sp.	0	0	0	1	1	0
12		*Celsinotum* sp.	0	0	2	0	0	0
13		*Daphnia* sp.	2	1	2	2	1	2
14		*Euryalona* sp.	0	0	0	0	0	2
15		*Karualona* sp.	0	1	0	0	0	2
16		*Kurzia* sp.	0	0	0	1	0	0
17		*Macrothrix* sp.	0	0	0	1	2	0
18		*Leydigia* sp.	2	0	0	0	0	1
19	Rotifera	*Monostyla* sp.	0	0	0	2	1	0
20		*Filina* sp.	0	0	0	1	0	0
21		*Lepadella* sp.	0	0	0	0	2	0
22		Asplanchna sp.	0	0	1	3	1	0
23		Brachionus sp.	1	2	0	2	1	2
24		*Keratella* sp.	0	0	0	1	0	0
25		*Plationus* sp.	0	0	0	0	1	0
26		*Lecane* sp.	0	0	0	0	1	0
27		*Euchlanis* sp.	0	0	0	1	0	0
28		*Colurella* sp.	0	0	0	1	0	0

Sl No	Class	Name of Phytoplankton	AE1	AE2	AE3	AE4	AE5	AE6
29		*Mytilina* sp.	0	0	0	0	2	0
30		*Polyarthra* sp.	1	0	0	0	1	1
31		*Testudinella* sp.	0	0	0	1	0	0
32		*Trichocerca* sp.	0	0	0	0	2	0
33	Ostracoda	*Cypris* sp.	1	1	2	2	1	2
34	Protozoa	*Arcella* sp.	0	0	0	1	0	0
35		*Centropyxis* sp.	0	0	0	1	0	0
36		*Difflugia* sp.	0	0	0	0	2	0

Source: AECOM Primary Survey

Table 49. Aquatic Ecology (AE) Sampling Site wise Diversity indices of Zooplankton

Name of Location	No. of Taxa	Shannon–Wiener diversity index	Simpson's dominance index	Pielou's evenness index	Margalef's richness index
AE1	7	1.89	0.84	0.95	2.50
AE2	7	1.91	0.84	0.96	2.89
AE3	6	1.75	0.82	0.96	2.17
AE4	25	3.15	0.95	0.93	6.70
AE5	23	3.05	0.95	0.92	6.24
AE6	9	2.14	0.88	0.95	3.03

Source: AECOM Primary Survey

Primary Productivity

Primary productivity is a term used to describe the rate at which plants and other photosynthetic organisms produce organic compounds in an ecosystem. There are two aspects of primary productivity:

Gross productivity is the entire photosynthetic production of organic compounds in an ecosystem.

Net productivity is the organic materials that remain after photosynthetic organisms in the ecosystem have used some of these compounds for their cellular energy needs (cellular respiration).

Primary productivity will be calculated using Winkler's light and dark bottle method. The technique developed by Gaarder and Gran uses variations in the concentration of oxygen under different experimental conditions to infer gross primary production. At all six sites initial dissolve oxygen (DO) was measured and one pair of water filled light and dark bottles were immersed in water for one hours. After that dissolve oxygen (DO) of the dark bottles and light bottles are measured. The photosynthetic quotient (PQ), which is the ratio of moles of oxygen released to moles of C fixed, was taken as 1.2. The primary productivity depicted in Table 50 and the results shown that the primary productivity of river water (AE1, AE2, AE3, AE6) was very low, however, in pond water (AE4, AE5) the primary productivity was high due to high phytoplankton assemblages. Depending upon the NPP results, as per Wetzel, 2001 the AE4 and AE5 is medium productive Oligotrophic lake. Primary productivity of sampling sites is given in Table 50.

Table 50. Primary Productivity of Different sites

Sr. No.	Study Sites	Net Primary Productivity (NPP; mg C m^{-3} d^{-1})	Gross Primary Productivity (GPP; mg C m^{-3} d^{-1})
1	AE1	8.65	18.25
2	AE2	6.72	14.5
3	AE3	4.5	10.75
4	AE4	30.15	52.5
5	AE5	35.5	65.25
6	AE6	9.7	19.25

Photographs

Plankton Sampling from Dayang River

Plankton Sampling from Rengma River

Primary Productivity Estimation by Dark & Light Bottle Method

Dissolve Oxygen Estimation by Aquamerck Kit

3.16 Socioeconomic Environment

Socio-economic impact assessment is the systematic analysis conducted during the EIA study for evaluation of the social and economic impacts of the proposed project under consideration. The impacts will include direct and indirect, positive and negative consequences on the lives of the project affected persons. The assessment facilitates an understanding of the needs, demands, preferences, capacities and constraints of the people in the vicinity of the project operation area. It is undertaken primarily to enhance the understanding of other relevant factors such as social organizations and networks, livelihood patterns, social infrastructure etc. The assessment attempts to predict and evaluate future impacts of the proposed project upon people, their physical and psychological health and well-being, their economic facilities, cultural heritage, lifestyle and other value system and help in prioritizing ONGC's commitment towards the CER initiatives. Inputs from the social assessment into the design phase facilitated in:

- Tracking potential adverse effects over different time frames and different activities.
- Reviewing options to eliminate such negative impacts through design changes or mitigate them through specific social protection or mitigation measures.

- Reviewing options to extend or enhance benefits for the population in near proximity of the project area.

Area of Influence

Study area or area of influence was selected by identify the villages of each blocks, where a chance of impact is possible due to any hazards happened in the well pad. These villages are primarily selected based on reconnaissance surveys, census data information, topo sheet maps, understanding of the project and professional judgment. The villages falling under each ML area, for which socio-economic baseline assessment has been undertaken have been mentioned in table 51.

Villages under PML

Table 51. PML Wise village list

Nambor ML

Village	Tehsil	District
Nikhikhe	Sarupathar	Golaghat
Amguri No. 1	Sarupathar	Golaghat
Aao Basti	Sarupathar	Golaghat
Amguri No. 2	Sarupathar	Golaghat
Kuki Basti	Sarupathar	Golaghat
Ming Mang No. 2	Sarupathar	Golaghat
Khehoi	Sarupathar	Golaghat
Danodar No. 2	Sarupathar	Golaghat
Panjan No. 2	Sarupathar	Golaghat
Ratanpur	Sarupathar	Golaghat
Janata Pathar	Sarupathar	Golaghat
Damodar No. 2	Sarupathar	Golaghat
Sonali Pathar	Sarupathar	Golaghat
Sankarpur	Sarupathar	Golaghat
Sonali Nagar No. 2	Sarupathar	Golaghat
Thaigirguri	Sarupathar	Golaghat
Doyalpur	Sarupathar	Golaghat
Morajan No.1	Sarupathar	Golaghat
Khoraghat Extn. ML		
Village	**Tehsil**	**District**
Ranipukhuri	Sarupathar	Golaghat
Haripur	Sarupathar	Golaghat
Jitapara	Sarupathar	Golaghat
Lakhi Pathar	Sarupathar	Golaghat
Owabari	Sarupathar	Golaghat
Gelajan	Sarupathar	Golaghat

Sankarpur	Sarupathar	Golaghat
Krishnapur	Sarupathar	Golaghat
Kempur	Sarupathar	Golaghat
Chetiagaon No. 2	Sarupathar	Golaghat
Chetiagaon No. 1	Sarupathar	Golaghat
DA- Kawalipathar No. 1	Sarupathar	Golaghat
Jordolong No. 1	Sarupathar	Golaghat
Jordolong No. 2	Sarupathar	Golaghat
Jahajibosti	Sarupathar	Golaghat
Gholapani	Sarupathar	Golaghat
Jurpukhuri	Sarupathar	Golaghat
Dimorujan	Sarupathar	Golaghat
Bordondi No. 2	Sarupathar	Golaghat
Goroibil	Sarupathar	Golaghat
Dhonpur No. 2	Sarupathar	Golaghat
Haldhibari	Sarupathar	Golaghat
Lachitgaon No. 1	Sarupathar	Golaghat
Bilgaon	Sarupathar	Golaghat
Tamulpur	Sarupathar	Golaghat
Lotapur	Sarupathar	Golaghat
Panbari	Sarupathar	Golaghat
Bidyapur	Sarupathar	Golaghat
Janakpur	Sarupathar	Golaghat
Hatidubi	Sarupathar	Golaghat
Madhupur No. 2	Sarupathar	Golaghat
Kamalpur	Sarupathar	Golaghat
Lakhinagar No. 1	Sarupathar	Golaghat
Indrapur	Sarupathar	Golaghat
Barijan	Sarupathar	Golaghat
Chetonapur	Sarupathar	Golaghat
Ajharguri No. 1	Sarupathar	Golaghat
Kathonipur	Sarupathar	Golaghat
Kochomari	Sarupathar	Golaghat
Rana Nagar	Sarupathar	Golaghat
Golaghat PML		
Village	**Tehsil**	**District**
Naojan Gaon	Sarupathar	Golaghat
Sungajan Block No. 5	Sarupathar	Golaghat
Bosapathar No. 1	Sarupathar	Golaghat
Sungajan Block No. 2	Sarupathar	Golaghat

Sungajan Block No. 3	Sarupathar	Golaghat
Betoni Jan	Sarupathar	Golaghat
No. 1 Parghat	Sarupathar	Golaghat
Sarupathar gaon	Sarupathar	Golaghat
Chukia Pathar	Sarupathar	Golaghat
Pachim Panbari	Golaghat	Golaghat
Santipur No. 2	Golaghat	Golaghat
Pathori Miching Gaon	Golaghat	Golaghat
Sialmari	Golaghat	Golaghat
Padum Pathar	Golaghat	Golaghat
Kalyanpur No. 2	Golaghat	Golaghat
Bijoypur Sissupani	Golaghat	Golaghat
Tanajan Miching	Golaghat	Golaghat
Odali Pothar	Golaghat	Golaghat
Doimuguri	Golaghat	Golaghat
Kasomari gaon Additional PML		
Village	**Tehsil**	**District**
Samukjan No. 2	Golaghat	Golaghat
Doyalpur Bagan	Golaghat	Golaghat
Milonpur	Golaghat	Golaghat
Samukjan	Golaghat	Golaghat
Mikirbosti	Golaghat	Golaghat
Pathortoli No. 1	Golaghat	Golaghat
Golekpur	Golaghat	Golaghat
Dineshpur	Golaghat	Golaghat
Pawali Pothar	Golaghat	Golaghat
Terenga Pothar	Golaghat	Golaghat
Cheleng Pothar Sapekhati	Golaghat	Golaghat
Janata Pothar	Golaghat	Golaghat
Chaodang Pothar	Golaghat	Golaghat
Jeypur Veleuguri	Golaghat	Golaghat
Chalang Pothar	Golaghat	Golaghat
Adarsha No. 1	Golaghat	Golaghat
Tarani TG	Golaghat	Golaghat
Singphura	Golaghat	Golaghat

Kasomarigaon PML		
Village	**Tehsil**	**District**
Madhupur	Golaghat	Golaghat
Teteliguri	Golaghat	Golaghat

Dighalpani Kadamguri	Golaghat	Golaghat
Anantapur	Golaghat	Golaghat
Milonpur Dighalpani	Golaghat	Golaghat
Sibangpara	Golaghat	Golaghat
Batiporia Gaon	Golaghat	Golaghat
Nalani Pothar	Golaghat	Golaghat
Jaroni No. 2	Golaghat	Golaghat
Athgaon	Golaghat	Golaghat
Kulajan No. 2	Golaghat	Golaghat
Puli Bagan	Golaghat	Golaghat
Bhakat Gaon	Golaghat	Golaghat
Titabor Tangia	Golaghat	Golaghat
Banua Tangia	Golaghat	Golaghat
Torani No. 1	Golaghat	Golaghat
East Lakhibari PML		
Village	**Tehsil**	**District**
Ghiladhari	Golaghat	Golaghat
Merapani	Golaghat	Golaghat
Matikhula	Jorhat	Titabor

Methodology for Socio-economic Study

The socio-economic assessment was primarily based on the analysis of the secondary data obtained from the census survey 2011 and Community consultations. Following tools have been used for gathering information and validating secondary data after considering nature of project operation and understanding the demographic characteristic of the area.

Secondary Data Analysis

To evaluate socio-economic environment in the study area, secondary information from the 2011 Census handbook has been referred to and details pertaining to habitations in the study area have been extracted and assessed. Apart from that district level secondary information has also been collected for district statistical hand book, Year 2011.

Stakeholder Consultation

At the beginning of the EIA process, the AECOM team conducted a preliminary identification of probable stakeholders. An inventory of potential stakeholders, including local groups and individuals, local institutions like panchayats which may be directly or indirectly affected by the project or with interest in the development activities of the region was made at preliminary.

Consultations with community are a continuous process that was carried in the EIA process and would be continued during the construction and operation phases of the project. Issues like land and resource damage, social disturbance, severance and increased congestion, noise and air pollution, employment opportunities, need for development of basic infrastructure, safe drinking water, sanitation facilities in the villages located in 2.5 km periphery have been discussed during the consultations so that they can be adequately addressed through the environment management plans. The consultations also helped in developing preliminary understanding of the requirement of social development initiatives, which are required in the project village and may be undertaken as part of the ONGC's CER activity.

Socio-Economic Profile of Nambor PML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 17 villages are present in the Nambor PML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Morajan No. 1, with a population size of 1006, followed by Sonalinagar No. 2, with a population size of 826. The least population size was observed in the village of Damodar No. 2, with a population size of 24. The average size of household was reported to be 4.95, in the villages situated in Nambor PML. The maximum household size was observed in Amguri No. 2 (5.80). The average sex ratio was found to be 1010, in the villages of Nambor PML. The highest sex ratio was found in Aao Basti (1102).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 30.10 percent of the total population in the villages present in Nambor PML. The highest ST population was observed in Sonalipathar No. 1& 2, with a ST population size of 274. Amguri No. 2 and Nikhikhe village has no ST population present, as per Census 2011. Average SC population in Nambor PML is accounted to be 0.47 percent. The highest SC population was observed to be in the village, Morajan No. 1, with a SC population of 50.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Kuki Basti (86.74%), followed by Amguri No. 1 (79.75%). The least literacy was found in the village MingMang No. 2 (62.67%). The average literacy of villages in Nambor PML was observed to be 72.63%, which is almost similar with the Assam state literacy rate (72.19%), but lower than the district literacy of Jorhat (82.15%) and Golaghat

(77.43%). The average male literacy was observed as 79.83%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of both the district Jorhat (87.63%) and Golaghat (83.56%). The highest male literate population was found in Morajan No. 1 (344). Average female literacy of villages present in Nambor PML was accounted as 65.07%, which is lower than the state female literacy of 66.27%, but also lower than the female literacy of Jorhat (76.45%) and Golaghat (71.09%). Maximum female literate population was also observed in Morajan Village (260).

Economic Condition of the study area of villages in Nambor PML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in Nambor PML was ranged between 25.70 to 61.54 percent. Maximum working population was found in the village of Damodar No. 2 (61.54%). The average percentage of main working population was observed as 63.73%, of the total working population, whereas the average percentage of marginal working population was observed as 36.27. Most of the working population is engaged in Cultivation, which is accounted as 65.47 percent of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 59.08 percent of the total population, the maximum non working population percentage was observed in the village Ming mang No. 2 (74.30%).

Basic Amenities and Infrastructure

Drinking water facilities

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in 7 villages, whereas tap water supply present in only in 3 villages. Rest of the villages are depends upon covered or uncovered well in the influenced area.

Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

Medical Facilities

No Primary health center or Community health centre is present in the study area villages, only 1 Sub Primary health centre is present in Morajan No. 1. People of this area has to visit the Golaghat for any medical emergency.

Educational Facilities

As per Census 2011, villages present in Nambor PML has educational facilities. Government primary school is present in nine villages, whereas government middle school is present in only one village: Amguri No. 1, but no secondary school is present in the villages of Nambor PML, but nine villages within the radius of 10 km of Nambor PML has the facility of Government secondary school. Government college is not present in the villages of Nambor PML.

Transport and Communication

There are some village road present in NamborPML, which leads to NH 39, for any kind of transport and communication.

Power supply, post and Tele communication

Power supply is present in most of the villages in Nambor PMl. As a telecommunication system most of the people has the facility of mobile phone. No post office is present in the closest vicinity.

Community Consultation

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Nambor PML. Proceedings of the community consultations are provided in Annexure 3.10.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility.
- There is no health care facility nearby.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Some villagers are benefited y ONGC’s CSR programme, during the previous drilling activity.

Socio-Economic Profile of East Lakhibari PML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 3 villages are present in the East Lakhibari PML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Giladhari, with a population size of 4661, followed by Merapani, with a population size of 3518. The least population size was observed in the village of Matikhula Gaon, with a population size of 696. The average size of household was reported to be 4.84, in the villages situated in East Lakhibari PML. The maximum household size was observed in Merapani (4.91). The average sex ratio was found to be 924, in the villages of East Lakhibari PML. The highest sex ratio was found in Giladhari (994).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 6.85 percent of the total population in the villages present in East Lakhibari PML. The highest ST population was observed in Merapani, with a ST population size of 136. Average SC population in East Lakhibari PML is accounted to be 1.15 percent. The highest SC population was also observed to be in the village, Merapani, with a SC population of 158.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Merapani (88.07%), followed by Matikhula Gaon (85.08%). The least literacy was found in the village Giladhari (62.27%). The average literacy of villages in East Lakhibari PML was observed to be 78.64%, which is higher than the Assam state literacy rate (72.19%), but lower than the district literacy of Jorhat (82.15%) and higher than Golaghat (77.43%). The average male literacy was observed as 84.87%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of the district Jorhat (87.63%) and higher than Golaghat (83.56%). The highest male literate population was found in Merapani (1546). Average female literacy of villages present in East Lakhibari PML was accounted as 72.16%, which is higher than the state female literacy of 66.27%, but also lower than the female literacy of Jorhat (76.45%) and higher than Golaghat (71.09%). Maximum female literate population was also observed in Merapani Village (1200).

Economic Condition of the study area of villages in East Lakhibari PML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in East Lakhibari PML was ranged between 47.13 to 59.48 percent. Maximum working population was found in the village of Matikhula Gaon (59.48%). The average percentage of main working population was observed as 69.99%, of the total working population, whereas the average percentage of marginal working population was observed as 30.01. Most of the working population is engaged in Cultivation and other work category (service, business etc.), which is accounted as 42.87 and 43.16 percent respectively of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 48.07 percent of the total population, the maximum non working population percentage was observed in the village Merapani (52.87%).

Basic Amenities and Infrastructure

<u>Drinking water facilities</u>

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in all the three villages, whereas tap water supply present in in 3 villages. Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

<u>Medical Facilities</u>

Merapani village has only the facility of both Community Health Centre and Primary Heath Centre.

<u>Educational Facilities</u>

As per Census 2011, villages present in East Lakhibari PML has educational facilities. Government primary school is present in all the three villages, whereas government middle school and secondary schools are also present in all three villages. Merapani has also a facility of degree college.

<u>Transport and Communication</u>

There are some village road present in East Lakhibari PML, NH 34 is the only road passing through this block.

<u>Power supply, post and Tele communication</u>

Power supply is present in most of the villages in East Lakhibari PML. As a telecommunication system most of the people has the facility of mobile phone. Post office is present in Merapani village.

<u>Community Consultation</u>

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Nambor PML. Proceedings of the community consultations are provided in Annexure XXX.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility, in the inner side of the villages.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Some villagers are benefited y ONGC's CSR programme, during the previous drilling activity.
- People are lacking public transportation.

Socio-Economic Profile of Golaghat ML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 19 villages are present in the Golaghat ML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Naojan Gaon, with a population size of 2406, followed by Sarupathar Gaon, with a population size of 2327. The least population size was observed in the village of No. 1 Parghat, with a population size of 141. The average size of household was reported to be 5.03, in the villages situated in Golaghat ML. The maximum household size was observed in Pathori Miching Gaon (6.72). The average sex ratio was found to be 963, in the villages of Golaghat ML. The highest sex ratio was found in Kalyanpur No. 2 (1149).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 39.83 percent of the total population in the villages present in Golaghat ML. The highest ST population was observed in Tanjan Miching, with a ST population size of 294. Average SC population in Golaghat ML is accounted to be 0.87 percent. The highest SC population was observed to be in the village, Naojan Gaon, with a SC population of 131.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Kalyanpur No. 2 (91.89%), followed by Sungajan Block No. 3 (88.30%). The least literacy was found in the village Pachim Panbari (58.41%). The average literacy of villages in Golaghat ML was observed to be 77.06%, which is higher than Assam state literacy rate (72.19%), but lower than the district literacy of Jorhat (82.15%) and Golaghat (77.43%). The average male literacy was observed as 84.31%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of the district Jorhat (87.63%) and higher than Golaghat (83.56%). The highest male literate population was found in Naojan Gaon (925). Average female literacy of villages present in Golaghat ML was accounted as 69.23%, which is higher than the state female literacy of 66.27%, but lower than the female literacy of Jorhat (76.45%) and Golaghat (71.09%). Maximum female literate population was also observed in Naojan Gaon (804).

Economic Condition of the study area of villages in Golaghat ML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in Golaghat ML was ranged between 26.45 to 70.58 percent. Maximum working population was found in the village of Bosapathar No. 1 (70.58%). The average percentage of main working population was observed as 65.22%, of the total working population, whereas the average percentage of marginal working population was observed as 34.78. Most of the working population is engaged in Cultivation, which is accounted as 61.03 percent of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 51.54 percent of the total population, the maximum non working population percentage was observed in the village Sungajan Block No. 3 (73.55%).

Basic Amenities and Infrastructure

Drinking water facilities

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in 13 villages, whereas tap water supply present in only in 5 villages. Rest of the villages are depends upon covered or uncovered well in the influenced area.

Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

Medical Facilities

No Primary health center or Community health centre is present in the study area villages, only 1 Sub Primary health centre is present in Sarupathar gaon. People of this area has to visit the Golaghat for any medical emergency.

Educational Facilities

As per Census 2011, villages present in Golaghat ML has educational facilities. Government primary school is present in 13 villages, whereas government middle school is present in only in 5 villages. but only 1 village, Chukia Pathar has the facility of secondary school is present in the villages of Golaghat ML. Government college is not present in the villages of Golaghat ML.

Transport and Communication

There are some village road present in Golaghat ML, which leads to NH 39 or Golaghat road, for any kind of transport and communication.

Power supply, post and Tele communication

Power supply is present in most of the villages in Golaghat ML. As a telecommunication system most of the people has the facility of mobile phone. No post office is present in the closest vicinity.

Community Consultation

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Nambor PML. Proceedings of the community consultations are provided in Annexure XXX.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility.
- Villagers are expecting more educational institutions in the villages.
- There is no health care facility nearby.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Some villagers are benefited y ONGC's CSR programme, during the previous drilling activity.

Socio-Economic Profile of Kasomarigaon Additional PML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 19 villages are present in the Kasomarigaon Add. PML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Chalang Pathar, with a population size of 1522, followed by Chowdang Pathar, with a population size of 1449. The least population size was observed in the village of Mikir Bosti, with a population size of 41. The average size of household was reported to be 5.08, in the villages situated in Kasomarigaon Add. PML. The maximum household size was observed in Mikirbosti (5.86). The average sex ratio was found to be 973, in the villages of Kasomarigaon Add. PML. The highest sex ratio was found in Pathrtoli No. 1 (1103).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 30.30 percent of the total population in the villages present in Kasomarigaon Add. PML. The highest ST population was observed in Chaodang Pothar, with a ST population size of 1086. Average SC population in Kasomarigaon Add. PML is accounted to be 10.33 percent. The highest SC population was observed to be in the village, Samukjan, with a SC population of 423.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Chaodang Pothar (85.18%), followed by Tarani T.G. (84.08%). The least literacy was found in the village Mikir Bosti (48.39%). The average literacy of villages in Kasomarigaon Add. PML was observed to be 75.15%, which is higher than Assam state literacy rate (72.19%), but lower than the district literacy of Jorhat (82.15%) and Golaghat (77.43%). The average male literacy was observed as 82.45%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of the district Jorhat (87.63%) and Golaghat (83.56%). The highest male literate population was found in Chaodang Pothar (605). Average female literacy of villages present in Kasomarigaon Add. PML was accounted as 67.61%, which is higher than the state female literacy of 66.27%, but lower than the female literacy of Jorhat (76.45%) and Golaghat (71.09%). Maximum female literate population was also observed in Chaodang Pothar (510).

Economic Condition of the study area of villages in Kasomarigaon Add. PML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in Kasomarigaon Add. PML was ranged between 32.98 to 79.88 percent. Maximum working population was found in the village of Samukjan (79.88%). The average percentage of main working population was observed as 65.62%, of the total working population, whereas the average percentage of marginal working population was observed as 34.38. Most of the working population is engaged in Cultivation, which is accounted as 62.33 percent of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 48.20 percent of the total population, the maximum non working population percentage was observed in the village Samukjan No. 2 (67.02%).

Basic Amenities and Infrastructure

Drinking water facilities

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in 14 villages, whereas tap water supply present in only in 2 villages. Rest of the villages are depends upon covered or uncovered well in the influenced area.

Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

Medical Facilities

No Primary health center or Community health centre is present in the study area villages, only 4 Sub Primary health centres is present in the villages of Kasomarigaon Add. PML. People of this area has to visit the Golaghat for any medical emergency.

Educational Facilities

As per Census 2011, villages present in Kasomarigaon Add. PML has educational facilities. Government primary school is present in 14 villages, whereas government middle school is present in only in 3 villages. but no secondary school and degree college is present in the villages of Kasomarigaon Add. PML.

Transport and Communication

There are some village road present in Kasomarigaon Add. PML, which leads to Wokha-Merapani road, for any kind of transport and communication.

Power supply, post and Tele communication

Power supply is present in most of the villages in Kasomarigaon Add. PML. As a telecommunication system most of the people has the facility of mobile phone. No post office is present in the closest vicinity.

Community Consultation

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Nambor PML.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility.
- Villagers are expecting more educational institutions in the villages.
- There is no health care facility nearby.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Some villagers are benefited by ONGC’s CSR programme, during the previous drilling activity.

Socio-Economic Profile of Kasomarigan PML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 16 villages are present in the Kasomarigaon PML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Nalani Pothar, with a population size of 1343, followed by Torani No. 1, with a population size of 1300. The least population size was observed in the village of Milonpur Dighalpani, with a population size of 55. The average size of household was reported to be 4.73, in the villages situated in Kasomarigaon PML. The maximum household size was observed in Naloni Pothar (5.35). The average sex ratio was found to be 970, in the villages of Kasomarigaon PML. The highest sex ratio was found in Sibangpara (1043).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 27.92 percent of the total population in the villages present in Kasomarigaon PML. The highest ST population was observed in Naloni Pothar, with a ST population size of 631. Average SC population in Kasomarigaon PML is accounted to be 13.22 percent. The highest SC population was observed to be in the village, Bhakat Gaon, with a SC population of 535.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Bhakat Gaon (96.06%), followed by Athgaon (90.13%). The least literacy was found in the village Milonpur Dighalpur (65.96%). The average literacy of villages in Kasomarigaon PML was observed to be 80.49%, which is higher than the Assam state literacy rate (72.19%), but lower than the district literacy of Jorhat (82.15%) and higher than Golaghat (77.43%). The average male literacy was observed as 87.14%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of both the district Jorhat (87.63%) and higher than Golaghat (83.56%). The highest male literate population was found in Naloni Pothar (538). Average female literacy of villages present in Kasomarigaon PML was accounted as 73.67%, which is higher than the state female literacy of 66.27%, but also lower than the female literacy of Jorhat (76.45%) and higher than Golaghat (71.09%). Maximum female literate population was also observed in Torani No.1 (481).

Economic Condition of the study area of villages in Kasomarigaon PML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in Kasomarigaon PML was ranged between 43.09 to 73.13 percent. Maximum working population was found in the village of Jaroni No. 2 (73.13%). The average percentage of main working population was observed as 50.27%, of the total working population, whereas the average percentage of marginal working population was observed as 49.73%. Most of the working population is engaged in Cultivation, which is accounted as 63.22 percent of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 41.62 percent of the total population, the maximum non working population percentage was observed in the village Banua Tangia (56.91%).

Basic Amenities and Infrastructure

Drinking water facilities

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in 12 villages, whereas tap water supply present in only in 4 villages. Rest of the villages depend upon covered or uncovered well in the influenced area.

Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

Medical Facilities

Only 1 primary health centre is present in the village Athgaon, and two Sub primary health centre is present in the villages of Kasomarigaon PML. No community health centre is present in the villages of Kasomarigaon PML.

Educational Facilities

As per Census 2011, villages present in Kasomarigaon PML has educational facilities. Government primary school is present in eleven villages, whereas government middle school is present in four villages, but only one secondary school is present in Jaroni village. Government college is not present in the villages of Kasomarigaon PML.

Transport and Communication

There are some village road present in Kasomarigaon PML, which leads to Wokha Merapani road, for any kind of transport and communication.

Power supply, post and Tele communication

Power supply is present in most of the villages in Kasomarigaon PMI. As a telecommunication system most of the people has the facility of mobile phone. No post office is present in the closest vicinity.

Community Consultation

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Kasomarigaon PML. Proceedings of the community consultations are provided in Annexure 3.10.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility.
- There is no health care facility nearby.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Secondary schools and colleges needs to be developed in the villages.
- Some villagers are benefited by ONGC’s CSR programme, during the previous drilling activity.

Socio-Economic Profile of Khoraghat Extension ML

Demographic profile

Demographic details are details related to statistical and dynamic aspects of a population. Data related to households, population, sex ratio, caste, literacy rate was obtained from Census, 2011 that is conducted every 10 year since 1872. Total 39 villages are present in the Khoraghat Extension ML.

Population and Household size

As per the Census 2011, maximum population was observed in the village Bidyapur, with a population size of 2197, followed by Madhupur No. 2, with a population size of 2087. The least population size was observed in the village of Jitapara, with a population size of 74. The average size of household was reported to be 4.96, in the villages situated in Khoraghat Extension ML. The maximum household size was observed in Jordolong No. 2 (6.34). The average sex ratio was found to be 961, in the villages of Khoraghat Extension ML. The highest sex ratio was found in Jurpukhuri (1203).

SC and ST population

The Scheduled Castes and Scheduled Tribes are officially designated groups of people who are historically disadvantaged in India. The terms were derived in the Constitution of India and the groups are designated in one or other of the categories.

According to Census 2011, the average ST population is 33.69 percent of the total population in the villages present in Khoraghat Extension ML. The highest ST population was observed in Chetonapur, with a ST population size of 306. Average SC population in Khoraghat Extension ML is accounted to be 0.91 percent. The highest SC population was observed to be in the village, Chetiagaon No. 1, with a SC population of 76.

As per the social consultation in the project site, it has been found that Rava, Kochari, Dimsa are the main ST communities present in the villages, and Mali, Patni, Sutradhar are main SC communities present in the villages.

Literacy Rate

Literacy, as defined in Census data, is the ability to read and write with understanding in any language and literacy rate is a key indicator of the level of education prevalent amongst the sample population. It is also considered as one of the key factors of socioeconomic progress. All children of age below 7 years are treated as illiterate. People who are blind and could read in Braille are also treated as literates.

According to Census 2011, maximum literacy rate was found in Owabari (87.57%), followed by Jitapara (85.82%). The least literacy was found in the village Madhupur No. 2 (48.94%). The average literacy of villages in Khoraghat Extension ML was observed to be 71.24%, which is lower than the Assam state literacy rate (72.19%), and also lower than the district literacy of Jorhat (82.15%) and Golaghat (77.43%). The average male literacy was observed as 80.15%, which is higher than the state male literacy rate of Assam (77.85%), but lower than the male literacy of both the district Jorhat (87.63%) and Golaghat (83.56%). The highest male literate population was found in Bidyapur (650). Average female literacy of villages present in Khoraghat Extension ML was accounted as 61.90%, which is lower than the state female literacy of 66.27%, but also lower than the female literacy of Jorhat (76.45%) and Golaghat (71.09%). Maximum female literate population was also observed in Bidyapur (484).

Economic Condition of the study area of villages in Khoraghat Extension ML

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region.

The working population of the villages present in Khoraghat Extension ML was ranged between 20.79 to 92 percent. Maximum working population was found in the village of Jitapara (92%). The average percentage of main working population was observed as 58.43%, of the total working population, whereas the average percentage of marginal working population was observed as 41.53%. Most of the working population is engaged in Cultivation, which is accounted as 72.33 percent of the total working population.

Major population in the study area villages either are workers in nearby Tea Estates or involved in agricultural crop cultivation as a source of their livelihood. Apart from the tea estates, the study area mainly comprises of monocropped land with paddy being the major agricultural produce. Apart from paddy cultivation, inhabitants of study area villages are also involved in tea cultivation in their homestead land.

The population who are not engaged in any type of work, is regarded as non working population, which is accounted as 51.03 percent of the total population, the maximum non working population percentage was observed in the village Jordolong No. 1 (79.21%).

Basic Amenities and Infrastructure

Drinking water facilities

The Census data reveals that drinking water facility exits in all the villages. There are different types of drinking water facility available in study area. The Tube wells are present in 16 villages, whereas tap water supply present in only in 8 villages. Rest of the villages are depends upon covered or uncovered well in the influenced area.

Other than drinking water people also depends on the above mention facility for their daily activity. Villagers reside near river also use river water for their domestic purpose.

Medical Facilities

Only 1 primary health centre is present in Kochomari village, and two numbers of primary health sub centre is present in the villages of Khoraghat Extension ML, no community health centre is present in the area.

Educational Facilities

As per Census 2011, villages present in Khoraghat Extension ML has educational facilities. Government primary school is present in 19 villages, whereas government middle school is present in only four villages, but no secondary school is present in the villages of Khoraghat Extension ML. Government college is not present in the villages of Khoraghat Extension ML.

Transport and Communication

There are some village road present in Khoraghat Extension ML, Golaghat road is 10 km away from the PML boundary, for any kind of transport and communication.

Power supply, post and Tele communication

Power supply is present in most of the villages in Khoraghat Extension ML. As a telecommunication system most of the people has the facility of mobile phone. No post office is present in the closest vicinity.

Community Consultation

Public consultation was carried out with the objective of finding out about people's views and opinion on issues relating to the project, its operations and also to the peripheral development. In this backdrop, extensive public consultations were conducted during the socio-economic assessment as part of EIA study. Suggestions were also received from participants on managing of project functions so that it does not have any adverse impacts on the community living in the area adjoining the project, better targeting community development programs, ensuring community involvement and cooperation in the operation of the project. The feedback from the continued consultation will facilitate the project in developing strategies to address these issues in consensus with the communities residing around the project. Community consultations in this project are mainly carried out the village located in 1km periphery of proposed development well location within Nambor PML. Proceedings of the community consultations are provided in Annexure 3.10.

Key points of Stakeholder Consultation

Consultation with several group of stake holders, reveal the socio-economic issues, of the targeted villages:

- Most of the villagers facing a problem of drinking water facility.
- There is no health care facility nearby.
- Road condition is not well maintained.
- Most of the villagers has a facility of pucca toilet, but some population are habituated in open defecation.
- Some villagers are benefited by ONGC's CSR programme, during the previous drilling activity.

Photographs of Social consultation in the study Area

Consultation with villagers

Consultation with village women

Consultation with high school teacher

4. Environmental Impact assessment.

The impact assessment of a project systematically identifies, characterizes and assesses the potential impacts arising out of the project and ranks them through a semi quantitative system so that it can be effectively addressed by Environmental management plans. Potential environmental impacts may arise out of various sequential activities, to be included as a part of proposed project exploratory and development drilling, GGS, EPS and Laying of pipelines.

4.1 Impact assessment methodology

An environmental impact assessment identification matrix has been developed with the objective to present an overview of the possible interaction between project aspects and components of the environment, which could be affected. The matrix structure mainly considers the physical, biological and socio-economic components of the environment, on X axis and activities of the proposed project in Y axis. Aspects (based on the phases of projects like predrilling, drilling, development, decommissions and potential accidental events) and impacts on environmental components that have been taken into consideration were in line with standard Environmental Management System. Environment and socio- economic components were identified based on reviewing of applicable legislation and baseline condition of the environment., site reconnaissance visits, discussion with stakeholders and the professional judgement. The general methodology used for environmental impact assessment is presented in Figure 49, with consultation in every phase.

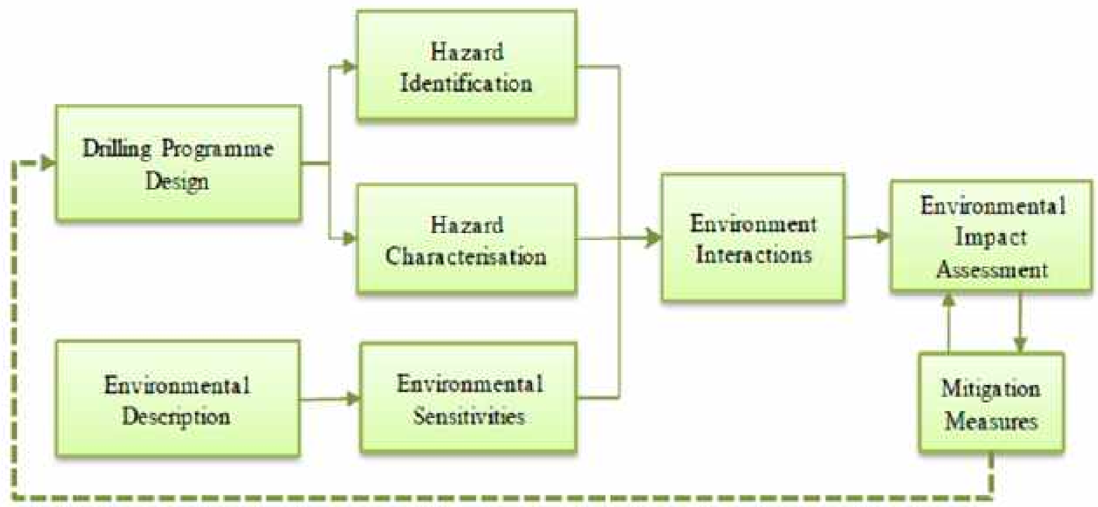


Figure 49. Methodology for Environmental Impact Assessment

Potential environmental and socio- economic impacts that may result from any of the identified projects aspects has been identified in a matrix based on the activity component interaction and has subsequently been used to develop an impact evaluation matrix that list evaluation scores based on significance criteria.

Impact Criteria and Ranking

After identification of all project environmental aspects for the different activities of the proposed project, the level of impact that may result from each of the activity component interaction has been assessed based on subjective criteria. For this, three key elements have been taken into consideration based on standard environmental assessment methodologies:

- Severity of the Impact: Degree of damage that may be caused to the environmental components concerned.
- Extent of Impact: Geographical spread of impact around project location and corridors of activities.
- Duration of Impact: Time for which impact lasts taking project lifecycle into account.

These elements have been ranked in three levels viz. 1 (low), 2 (moderate) and 3 (high) based on the following criteria provided in Table 52:

Table 52. Impact Prediction Criteria

Impacts elements	Criteria	Ranking
Severity	1. Regional impact resulting in long term and/ or medium damage to the natural environment. 2. Major impact on community and occupational health (e.g. serious injury, loss of life) on account of accidental events viz. well blowouts and related operational activities. 3. Adverse national media attention. 4. Permanent Loss of land/livelihood	3
	5. Local scale impact resulting in short term change and / or damage to the natural environment. 6. Temporary loss of land, livelihood source of affected communities. 7. Local scale impact on terrestrial habitat, endangered species, drainage pattern and community resources. 8. Moderate impact on occupation and community health & well being (e.g. noise, light, odour, dust, injuries to individuals). 9. Complaints from the public, authorities and possible local media attention.	2

Impacts elements	Criteria	Ranking
	10. Limited local scale impact causing temporary loss of some species etc. 11. Limited impact on human health and well-being (e.g. occasional dust, odour, light, and traffic noise). 12. Public Perception/Concern	1
Extent	13. Regional scale impact and including impacts to physical, biological and socio-economic environment of the exploratory block.	3
	14. Largely local level impact limited to immediate vicinity of the exploratory well site.	2
	15. Impact not discernible on a local scale.	1
Duration	16. The impact is likely to occur during the entire project life cycle and Beyond.	3
	17. The impact is likely to occur in some phases of project life under normal operating conditions.	2
	18. The impact is very unlikely to occur at any time during project life cycle but may occur in exceptional circumstances.	1

A positive or beneficial impact that may result from this project has not been ranked and has been depicted in the form of ++.

Impact significance

The significance of the impact has been selected based on a multiplicative factor of three element rankings. Table 53 presents impact significance in a scale of low, medium and high, and will be used for delineation of preventive actions, if any, and management plans for mitigation of impacts. Impact significance has been determined considering measures which have been factored in the design and planning phase of the project. Legal issues have been taken into account, wherever appropriate in the criterion sets, to aid in ONGC's effort to comply with all relevant legislation and project HSE requirements. Additionally, the results of quantitative impact prediction exercise, wherever undertaken, have also been fed into the process.

Table 53. Criteria Based Significance of Impacts

Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Impact Significance (Ax B x C)	
1	1	1	1	Low
1	1	2	2	
1	2	1	2	
1	1	2	2	
1	2	2	4	
2	1	2	4	
3	1	2	6	Medium
1	3	2	6	
2	2	2	8	
3	2	2	12	
2	3	2	12	
2	2	3	12	
3	3	2	18	High
3	2	3	18	
2	3	3	18	
3	3	3	27	
Beneficial Impact			++	

To assist in determining and presenting significance of an impact, an impact evaluation matrix (Table 53) has been developed based on the one developed for the impact identification exercise. In addition to ranked weights, significance of impacts has been depicted using colour codes for easy understanding. In case an environmental component be impacted by more than one project activity, higher impact significance ranking has been taken as the significance ranking for subject receptor. Impacts that have been determined to be having high significance ranking of “>12” are considered significant and hence require examination in terms of preventive actions and/or additional mitigation to reduce level of the potential impact. Recommended additional mitigation measures and management plans are presented in Chapter 6. A second evaluation matrix presents significance of impacts after considering that proposed mitigation measures will be implemented. The identified impacts are further discussed in detail in the following section with discussion focusing on impacts of higher significance. This is followed by a point wise outline of mitigation measures recommended.

Table 54. Impact Identification Matrix

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
A. Pre-Drilling Activities for wells and GGS																													
Site selection and land acquisition				x	x														x			x							
Site clearance and top soil removal	x	x	x			x	x					x	x	X									x	x			+	x	
Well site & access road construction	x	x	x	x	x		x																x				+	x	x
Sourcing & transportation of borrow material etc	x	x	x	x		x	x					x	x							x	x		x				+	x	x
Storage and handling of construction debris	x	x																										x	
Transportation of drilling rig and ancillaries		x	x	x												x					x		x					x	x
Operation of DG set		x	x																										
Workforce engagement & accommodation at construction site																				x					x		+		
Consumption of water for construction &											x											x							

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
domestic use for labourer																													
Generation of domestic solid waste & disposal	x					x					x						X												x
Generation of waste water & discharge from construction activity & labour camp									x		x							x											x
Surface run-off from construction site						x	x		x		x						x					x							
B. Exploratory/Development well Drilling & Testing																													
Physical Presence of drill site	x												x																
Operation of DG sets and machinery		x	x										x															x	x
Operation of drilling rig			x											x									x					x	
Storage and disposal of drill cuttings and mud	x					x			x x		x																		
Generation of process waste water & discharge									x								x												

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Surface run-off from drill site						x					x						x												
Generation of domestic waste water & discharge						x					x						x												
Generation of Municipal waste & disposal	x					x					x																		
Workforce engagement & accommodation at drill site																				x		x			x		+		x
Flaring during production testing and process upset		x	x																									x	x
Accidental events – blow out		x				x			x		x	x		x			x											x	x
Accidental events-spillage of chemical & oil						x			x		x																		
C. Early Production																													
Flaring of Gas		x	x															x											
DG Set of Emission		x																											
Produced Water						x	x	x	x																				
D. Operation of GGS																													

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Physical Presence of GGS	x																												
Operation of DG sets and machinery		x	x																									x	x
Generation of waste & disposal						x			x															x				x	x
Souring of Water																													
flaring		x	x																										
Accidental events – blow out		x				x			x		x	x	x	x			x											x	x
Accidental events-spillage of chemical & oil						x			x		x																	x	x
E. Laying of Pipeline																													
Site selection and land acquisition					x														x			x							
Site clearance and top soil removal	x	x	x			x	x					x	x	x									x	x			+	x	
Trenching	x	x	x	x		x	x																				+	x	x

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Sourcing & transportation of burrow material etc		x	x	x		x	x					x	x							x	x						+	x	x
Storage and handling of construction debris	x	x																										x	
Transfer of pipes to construction site		x	x	x																	x		x					x	x
Operation of DG set	x	x	x																										
Workforce engagement & accommodation at construction site																				x		x			x		+		x
Consumption of water for construction & domestic use for labourer										x												x							
Generation of domestic solid waste & disposal	x					x			x		x						x												x
Generation of waste water & discharge									x		x																		x

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
from construction activity & labour camp																													
Surface run-off from construction site						x	x		x		x						x					x							
F. Decommissioning and Reinstatement																													
Dismantling of rig and associated facilities		x	x																									x	X
Transportation of drilling rig and ancillaries		x	x	x																									X
Removal of well site construction materials & disposal		x	x				x																						

4.2 Impact Assessment

This section describes the impacts of the project activities, (both exploratory and development drilling, along with GGS) on the prior environmental receptors that might be get affected adversely by the project. It will put an emphasize on probable impacts on the environmental and socioeconomic components during various phases of the project life cycle. Rankings for every activity component interaction is based on the criterion set earlier and resulting environmental significance with necessary justification that has been recorded below for every set of impacts and the same has been represented in evaluation matrices. In another context, it is important to remember that operations related to exploratory and development well drilling, testing and completion activities also include positive socioeconomic impacts in terms of increase in local business opportunities and on a larger perspective, by providing potential energy security at a national level.

Visual Impacts and Aesthetics

<u>Development wells</u>

The forest PML is an operating oil field, which has a number of development and exploratory wells, as well as existing well locations are also present. In this Block, awareness about drilling activity for exploration/development of oil persists amongst local people. Visual impacts on local people are envisaged during the construction as well as operation phases of the project.

In case of drilling, site preparation 2.25 Ha land would be cleared for the construction of drill site. This operation would be limited where the drilling would be operated from the existing drill site. During site construction activity, dust will be generated due to the transportation of construction material, machinery and personnel, irregular dumping of construction waste, domestic waste from labour camp. These may cause visual and aesthetic impacts. Such impacts are likely to be experienced by communities residing in or traversing through villages located in the vicinity of the drilling well. However, considering the temporary nature of site preparatory activities and implementation of necessary mitigation measures by the proponent with respect to the siting of well locations (borrow areas, use of existing infrastructure etc.), the impact will be of low significance. The development well pads are present for long term and hence the duration of visual impact will be for a long term. The drilling waste and process waste water is likely to be temporarily stored in impervious pits, visual impact in this regard is not envisaged.

Visual impact arising from operation of drilling rig and presence of base camp will not be considered significant given the temporary nature of the exploratory/development activities (about 45-60 days to few years) and provided the well is indicative of any commercial hydrocarbon reserve. The DG sets will be housed in acoustic enclosure, but the size of the DG set in the enclosure along with its stack that is continuously emitting is not aesthetically or visually pleasing.

The construction of drill pad, drilling of development wells and decommissioning will involve a continuous day and night process, hence the high power, lighting (halogen) at night will be a source of visual discomfort to the residents of nearby settlements. Other than that light generated from flaring events might also be visually discomforting at night.

However, flaring is likely to be of intermittent in nature, and occur only during process upset and production testing.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	2
Impact Significance = 4 (Low)					

Mitigation Measure

- All the construction activities shall be restricted within the designated site.
- Dust nuisance from construction site shall be suppressed through periodical water sprinkling over the unpaved surfaces and at disturbance areas;
- On completion of work all temporary structures, surplus materials and wastes will be completely removed;
- Construction wastes and municipal solid waste temporarily stored at the sites will be transported to the designated disposal site/facility at regular intervals;
- Adequate measure would be taken to orient the halogens at the construction facility. Excess lighting should not be used.
- After decommissioning of rig and associated facilities, drill sites will be restored to its previous state, at possible extent – drill platform will be removed, pits & garland drains will be filled up, construction material will be buried in the pit in the demarcated sterile zone;
- Restoration of the top soil removed during Site preparation and the Site will be rehabilitated by laying of top soil.

GGS and EPS

Visual impacts arising during construction phase will be temporary while the impacts during the operational phase will be permanent as GGS and EPS along with pipe lines would comprise permanent structures compared to development wells. The visual impacts associated with the development wells will also be applicable for the construction of GGS and Pipeline. Apart from that the following visual impairments are expected. Since this area is devoid of Industries except for tea processing units, hence the construction of GGS and EPS will add a physical feature that will be uncommon feature in the majorly agricultural landscape.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	2
Impact Significance = 4 (Low)					

The impact significance will be low as the visual impact will be highest during the construction phase and would decrease in the operation phase.

Mitigation Measure

- Pipeline once laid will be covered with burrowed soil and leveled as per the height of surrounding land.
- Plantation to improve aesthetic views would be done around the wall of the GGS to blend with the surroundings.

Impacts on Air Quality

Exploratory and Development wells

Operation of vehicles and construction machinery

Exhaust emissions from operation of construction machinery is likely to contribute air pollution load (PM_{10}, $PM_{2.5}$, NO_2 and SO_2 etc.) in the ambient air near well site facilities. However, considering localized nature of impacts, temporary (short and long term) nature of construction and drilling activities along with necessary mitigation measures that is likely to be adopted by the proponent, the impact is of low significance.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

Construction material transport, storage and handling

During the construction phase activity, it is assumed that approximately 100 tones of sand, stones and cement would be required for approach road construction/strengthen of approach road and site preparation activities for each well site. Therefore, fugitive emission is anticipated from transportation, storage and handling of construction materials, and this kind of fugitive emission is likely to be governed by micro meteorological conditions, such as wind speed and direction, so the transport road condition has to be considered as the drilling activity is likely to take place in dry season and majority of the roads are unpaved village roads or in degraded condition. Such impacts would be considered as medium, considering severity and extent of impact, however the duration of construction activities, rig mobilization and decommissioning activities is temporary and limited movement of project vehicles will take place according to the adopted mitigation measure, hence the significance of impact would be considered to be low.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**1**
Impact Significance = 4 (Low)					

Operation of Diesel Generators (DG) sets

The proposed projects would involve the operation of four diesel driven 750 KV generators for drilling of each exploratory/development well along with two (2) additional Emergency DG Sets. Additionally, two (2) (1 working and 1 standby) DG sets of 750 KV generator will be required to meet power demand of camp and other emergency requirements. The operation of DG sets will therefore result in the emissions of air pollutants viz. PM, NO_2, CO and HC thereby affecting the ambient air quality. The dispersion of these air pollutants may affect the receptors viz. village settlements located in near vicinity of the well site only under exceptional combination of meteorological conditions. However, considering the temporary nature of drilling phase, wet and humid conditions prevalent in the exploratory block region and provision of adequate DG set stack height for effective dispersion of air pollutants, no significant impact to this regard is envisaged. Additionally, the proponent also plans to adopt and implement necessary mitigation measures as discussed in the subsequent section to effectively address potential air quality impacts from DG set operation.

Potential Impact and Mitigation Measures on Air Quality

Prediction of impacts on air environment has been carried out employing mathematical model based on a steady state Gaussian plume dispersion model designed for multiple point sources for short term. In the present case, AERMOD dispersion model based on steady state gaussian plume dispersion, designed for multiple point sources for short term and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from point sources.

Model Input Data

Emission from DG set

The power requirements for the development is met by using diesel generator sets. Six(4 W+2 Standby) generators of each 750 kVA are installed at the site. The DG sets are primary contributor to air pollution at the development site. The pollutants emitted by a DG set consists of Particulate Matter (PM), Sulphur-di-oxide (SO2) and Nitrogen Oxides (NOx). Combustion of fuel in a DG set typically happens at high temperatures resulting in generation of considerable amounts of NOx. The SO2 concentration in emissions is dependent on the Sulphur content in fuel burnt and particulate matter consists of unburnt Carbon particles. As the fuel used is low sulphur HSD, lesser amount of SOx emissions is envisaged. For the particular drilling site during development, there will be 4 operating DG sets, as detailed in Table 55.

Table 55. Details of DG set

Location	DG set capacity	Operation	Standby
Drilling Site	750	4	2

Source: Pre-feasibility report of ONGC

The emission characteristics considered for the modelling exercise from DG generator sets are given in the Table 56.

Table 56: Input Parameters Considered for Dispersion Modelling

Emission sources	Stack height (m)	Stack dia. (m)	Stack gas temp. (K)	Stack gas velocity (m/s)	Emission Rate (g/s)		
					NO_2	SO_2	PM10
750 KVA DG*	7.7	0.5	973.0	8.7	1.53	0.004	0.05
750 KVA DG*	7.7	0.5	973.0	8.7	1.53	0.004	0.05
750 KVA DG*	7.7	0.5	973.0	8.7	1.53	0.004	0.05
750 KVA DG*	7.7	0.5	973.0	8.7	1.53	0.004	0.05

Source: DG book

Comments on Predicted Concentrations

A perusal of Table-56 reveals that the maximum incremental 24-hourly ground level concentrations for PM, SO_2, NOx likely to be encountered due to DG sets are 0.49 µg/m^3, 0.045 µg/m^3, 14.0 µg/m^3 occurring at a distance of 0.5 km in WNW direction. The predictions indicate that the PM, SO_2 and NOx concentrations are likely to be well within the prescribed limit for residential and rural zone.

Resultant Concentrations after Implementation of the Project

The maximum incremental GLCs due to the proposed project for PM, SO2 and NOx are superimposed on the maximum baseline PM, SO2 and NOx concentrations recorded during the study to arrive at the likely resultant concentrations after commissioning of the proposed project. The cumulative concentrations (baseline + incremental) after implementation of the project are tabulated below in Table-57.

Table 57: Resultant Consideration for SO_2, NO_2 and PM 10

Pollutant Maximum	Distance	AAQ Highest Concentration Recorded During the Study (µg/m^3)	Incremental 24hourlyConcentration due to Drilling (µg/m^3)	Resultant Concentration (µg/m^3)	AAQ Standard (CPCB)
SO_2	0-2km	10.5	0.045	10.55	80
	2-5km	10.5	0.02	10.52	80
	5-10KM	10.5	0.015	10.52	80

Pollutant Maximum	Distance	AAQ Highest Concentration Recorded During the Study ($\mu g/m^3$)	Incremental 24hourlyConcentration due to Drilling ($\mu g/m^3$)	Resultant Concentration ($\mu g/m^3$)	AAQ Standard (CPCB)
NO_2	0-2km	20.5	14.0	34.50	80
	2-5km	20.5	8.0	28.50	80
	5-10KM	20.5	6.0	26.50	80
PM_{10}	0-2km	79.0	0.49	79.49	100
	2-5km	79.0	0.35	79.35	100
	5-10KM	79.0	0.21	79.21	100

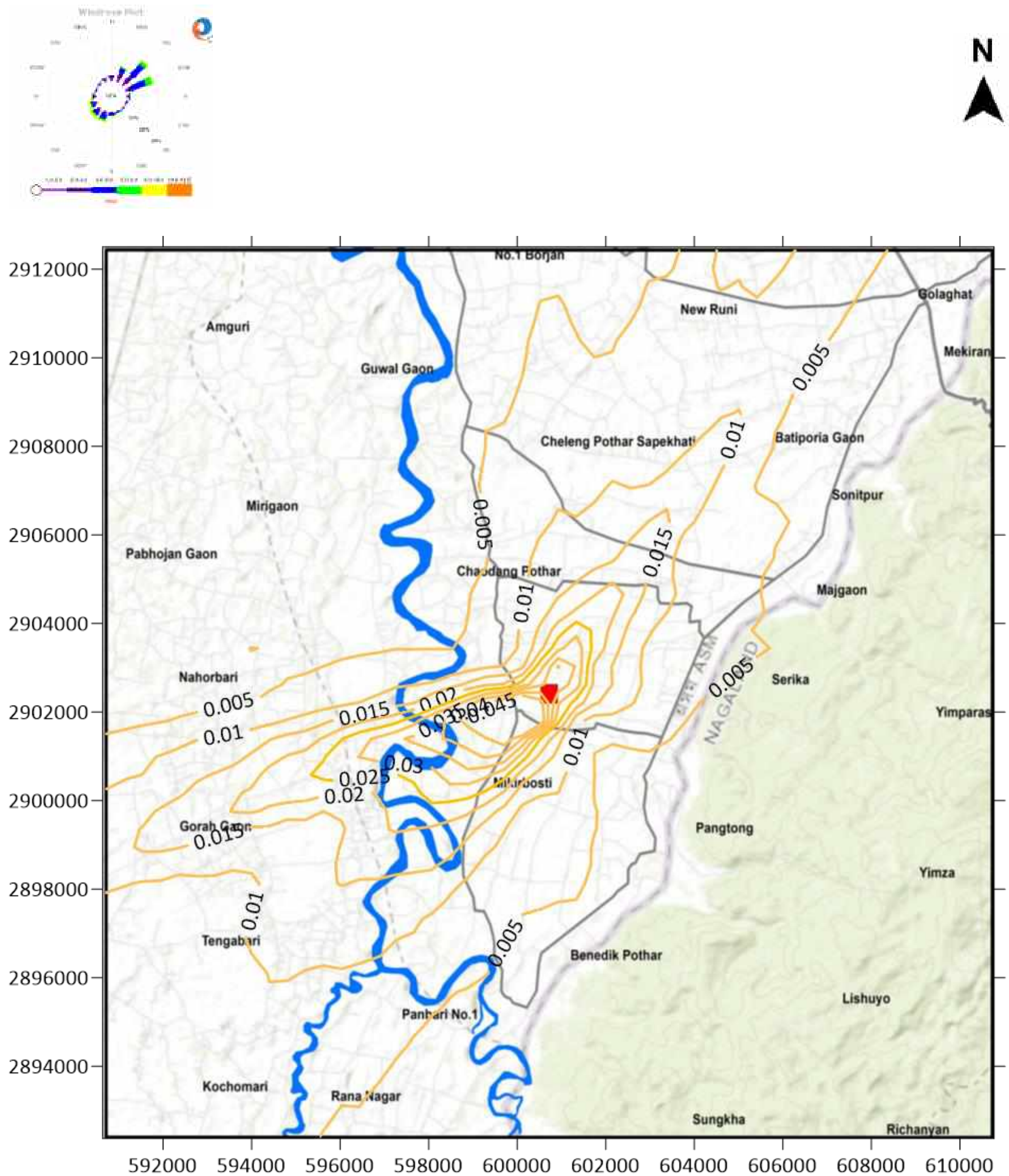


Figure 50. 24 HOURLY GLCs OF SO2

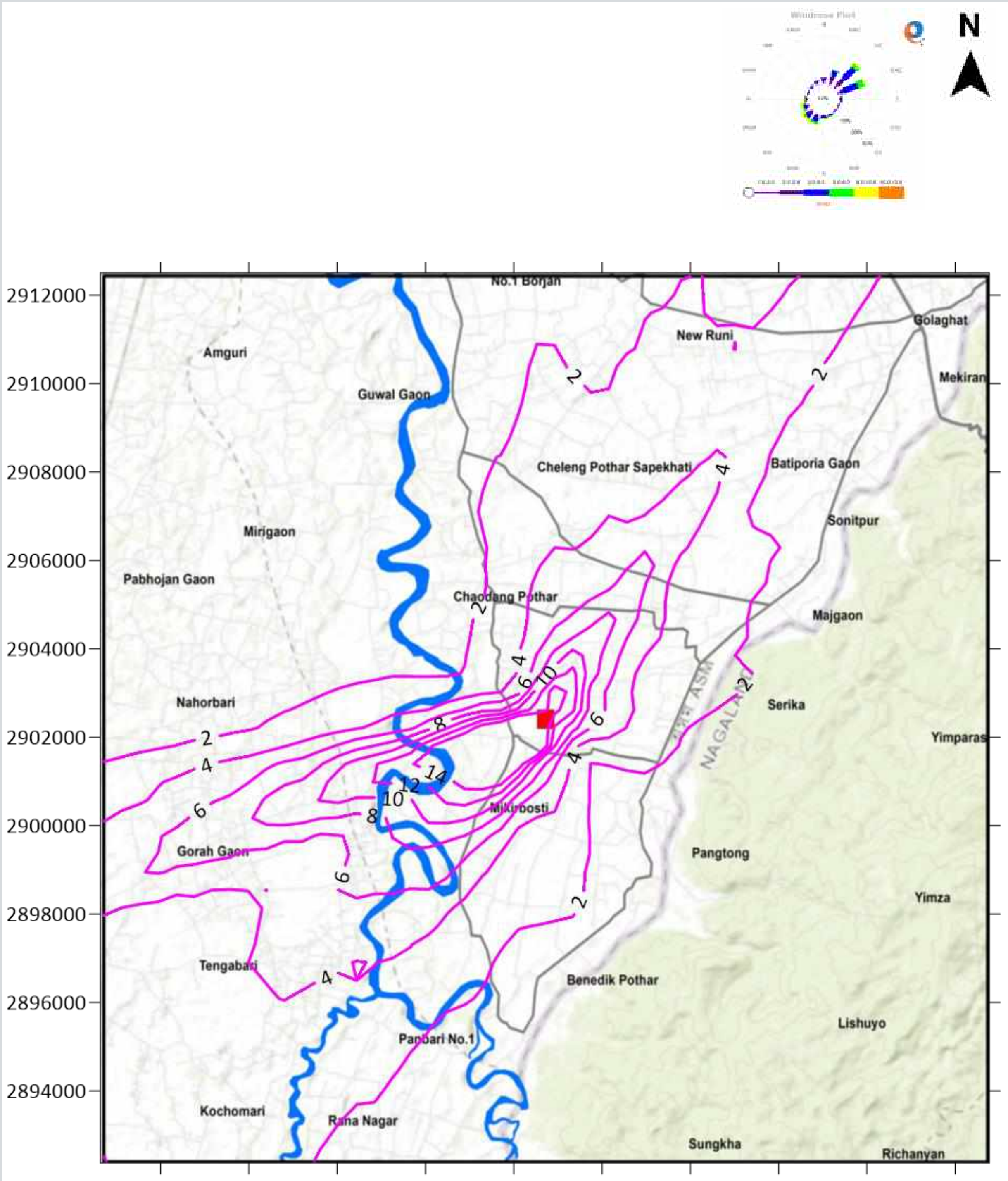


Figure 51. 24 HOURLY GLCs OF NO2

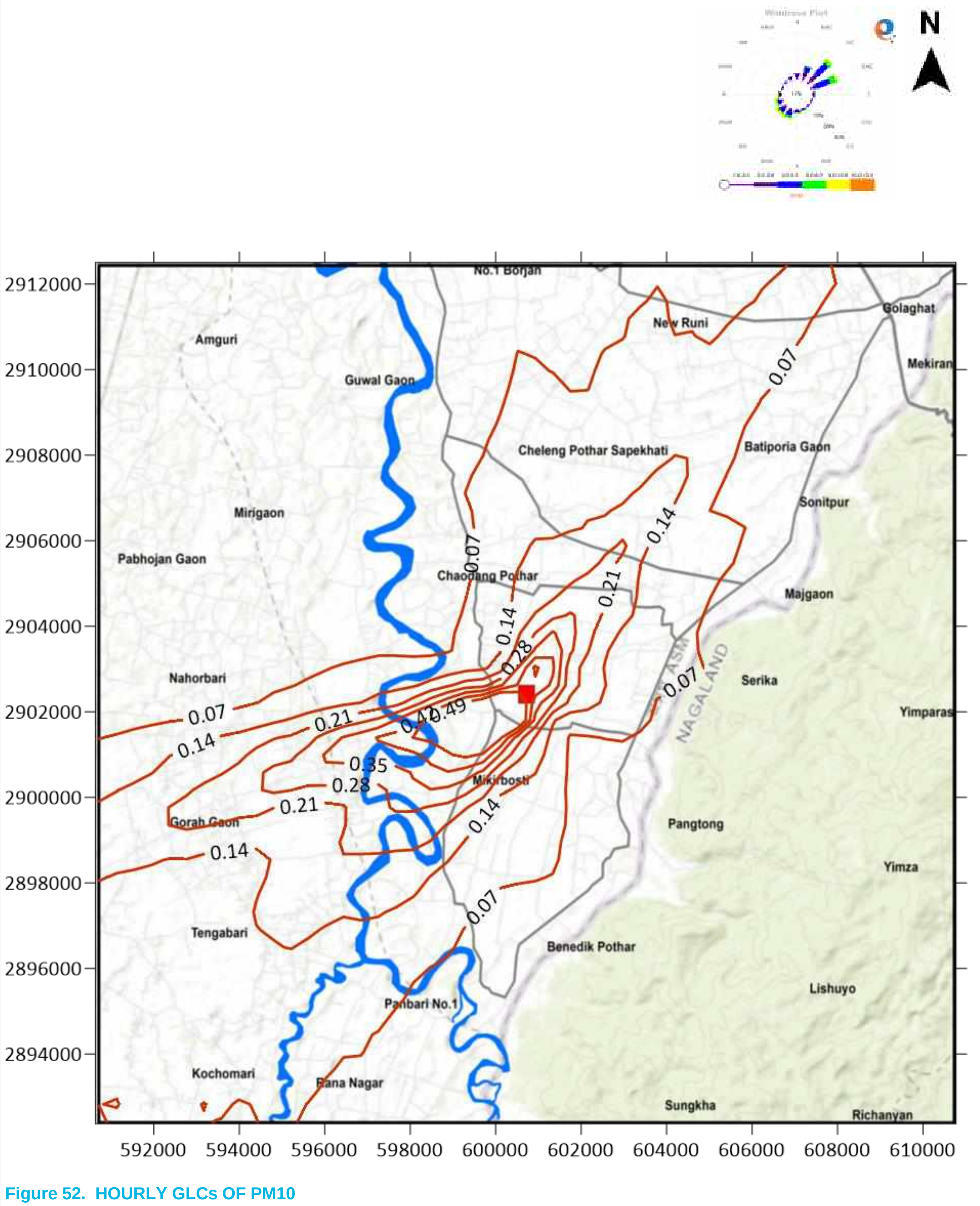


Figure 52. HOURLY GLCs OF PM10

Mitigation Measures:

Measures proposed to mitigate the effects of air emissions are as follows:

- The exhaust of the DG sets will be at sufficient height to allow dispersions of the pollutants and periodical maintenance of DG sets so that emissions will be under limits and the stack height shall comply with CPCB norms for stack height. .
- Low Sulphur diesel to reduce emissions of pollutant SO_2.
- Most of the equipment, machinery and vehicles have inbuilt pollution control devices.
- The storage and handling of top soils and materials will be carefully managed to minimize the windblown material and dust.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	2
Impact Significance = 4 (Low)					

Mitigation Measure

- All the vehicles should be PUC certified.
- All vehicles used for transportation of loose and friable materials will not be loaded over the freeboard limit and will be covered.
- Water spraying will be done on the access roads to control re-entrained dust during dry season;
- Equipment, machinery and vehicles having inbuilt pollution control devices would be considered as a measure for prevention of air pollution at source.
- Engines and exhaust systems of all vehicles and equipment used for the project would be maintained so that exhaust emissions are low and do not breach statutory limits set for that vehicle/equipment type.
- DG set with appropriate stack height will be utilized.
- Providing Personnel Protective Equipment (PPEs) like mask to workers at site.

GGS, EPS and Pipeline

During construction phase of GGS, EPS and laying of pipeline, it is evident to produce fugitive dust emission. All the issues pertaining to air pollution that have been dealt in above section for development well also stand relevant for GGS and EPS. Activity related to air pollution during the operation phase is rare for pipeline and GGS.

Mitigation Measure

The mitigation measures for fugitive dust emission and DG set operation have been same with DG sets. The only measure will be erection of stack for flaring of gases in GGS and EPS.

Impacts on Noise quality

Development wells

Potential impact on noise quality is anticipated from vehicular movement, operation of construction machineries during well site construction and access road strengthening and operation of drilling rig.

Operation of Construction machinery/equipment

Operation of heavy machinery/equipment and vehicular movement during site preparatory and road strengthening/construction activities may result in the generation of increased noise levels. The noise related disturbance is likely to be experienced by communities residing in proximity of the construction site and along material transportation routes. The environmental setting of well sites reveals that settlements are close to the proposed well site and site access road. Considering the construction phase activities to be of temporary (short and long term) nature with limited daily movement of project vehicles (3-4 nos. vehicle for transportation of personnel and 8-10 nos. for material transport) and adequate mitigation measures viz. equipment maintenance, noise barrier etc. to be implemented by the project proponent, impact is considered to be of medium significance.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 8 (Medium)					

Operation of drilling rig

Operational phase noise impacts are anticipated from operation of drilling rig and ancillary equipment viz. shale shakers, mud pumps and diesel generators. Studies indicated that noise generated from operation of drilling rig generally varies in the range of 88-103 dB(A). Other contributors of high noise level at the well site include shale shakers, mud pumps and diesel generators. The average equivalent noise levels of drilling rig and ancillary equipment is estimated to 96 dBA. Further, considering drilling to be a continuous operation, noise generated from aforesaid equipment has the potential to cause discomfort to the local communities residing in proximity (within 500m) of the rig facility. Occupational health and safety impacts viz. Noise Induced Hearing Loss (NIHL) is also anticipated on personnel working close to such noise generating equipment. However, considering short duration of drilling period (approx 45-60 days) and necessary noise prevention and control measures viz. use of acoustic barriers, provisions for proper PPEs, regular preventive maintenance of equipment etc. to be implemented by the-proponent medium significant impact to this regard is envisaged.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 (Medium)					

Noise level prediction

Driller rotors and the power generators and pumps would be the main sources of noise pollution during the drilling activity. Noise due to vehicular movement would be intermittent but would also add to the background noise levels. The well site during excavation phase of the site preparation where heavy earth moving machinery would be in operation, noise level of the vehicle would not be more than the 90 dB (A). Typically, the noise generating sources for the onshore drilling activity are provided below (in the immediate vicinity):

- Diesel generator -: 75 dB(A)
- Pumps at the Rig: 85 to 90 dB(A)
- Mud pumps: 73.3-80.5 dB(A)
- Control Room & Quarters: 50 to 60 dB(A)
- Drilling: 85-90 dB(A)
- Flaring: 86.0 dB(A)

For the proposed project only 4 units of 650KW DG sets would be operate during drilling phase.

Mathematical model for sound wave propagation during operation phase

For an approximate estimation of dispersion of noise in the ambient from the source point, a standard mathematical model for sound wave propagation is used. The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its interaction with objects in the transmission path. For hemispherical sound wave propagation through homogenous loss free medium, one can estimate noise levels at various locations, due to different sources using model based on first principles, as per the following equation:

$Lp_2 = Lp_1 - 20\log(r_2/r_1)$ ……………… (1)

Where Lp2 and Lp1 are Sound Pressure Levels (SPLs) at points located at distances r2 and r1 from the source.

The combined effect of all the sources then can be determined at various locations by the following equation.

$Lp\,(total) = 10 \times LOG_{10}\, \Sigma\, [10^{(LPi/10)}]$ ………………. (2)

Where LP total is the combined sound pressure level, for all the noise generating equipment, and for the proposed project, the combined noise level is calculated as 90.23 dB. This combined noise level would be measured at distance of 50m, 100m, 200m and 500 m, and tabulated in table 58.

Table 58. Noise Prediction level at different distance

Distance(m)	Predicted noise levels	Predicted noise levels at day time in residential area	Predicted noise levels at night time in residential areas
50	65.79	55	45
100	59.77	55	45
200	53.75	55	45
500	45.79	55	45

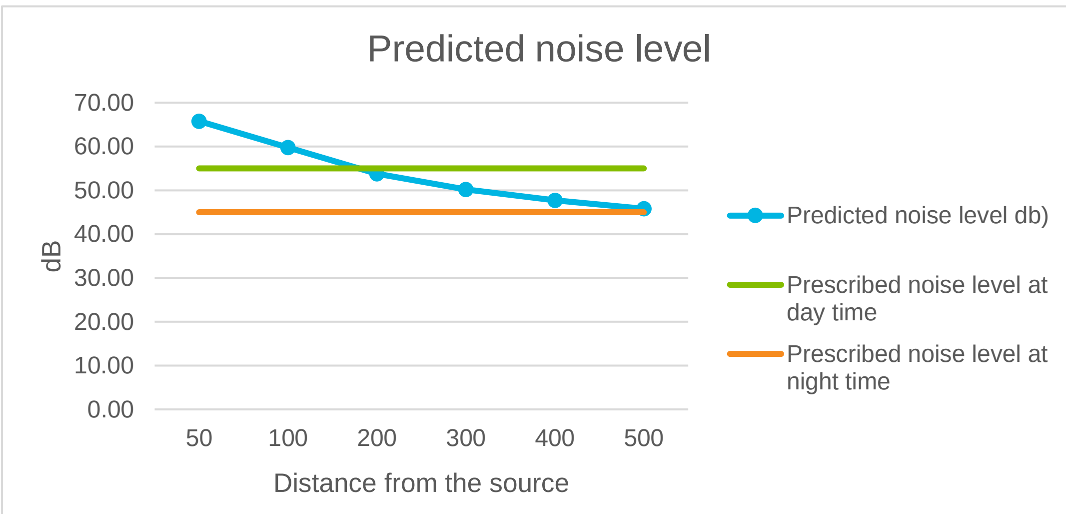


Figure 53. Predicted noise levels at different distance

<u>Mitigation Measure</u>

Typical mitigation measures for noise pollution includes the following:

- Installation of sufficient engineering control on equipment and machinery (like mufflers & noise enclosures for DG sets and PC pumps) to reduce noise and vibration, emission levels at source, carrying out proper maintenance and subjecting them to rigid noise and vibration control procedures.
- Proper placement of noise generating equipment to take advantage of distance and shielding.
- Providing appropriate PPEs like ear plugs/muffs to the workers, working at site.
- Implementation of preventive maintenance of vehicles and machines to reduce noise levels.

<u>GGS, EPS and Pipeline</u>

The construction of GGS, EPS and pipeline would involve the noisy activities through the scale of noise would be far lower compared to the drilling activity in case of exploratory/development wells. The major source of noise during construction of GGS would be during concretization that would involve site clearance, top soil removal, site access road construction and DG set operation. The movement of vehicles for transportation of construction material, site

equipment and transportation of waste material would be another source of noise generation. For pipeline laying, apart from the manual trenching, the other major source of noise would be handling of pipelines. Activity related to noise pollution during the operation phase is rare for pipeline. As mitigation measures will be employed and the activities will be of short duration, hence the impact significance expected to be low.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	2
Impact Significance = 2 (Low)					

Potential impact for transport and road traffic

The drill site access roads (i.e. PWD road, village road) are not located on busy vehicular route. The traffic survey data shows that the total vehicles plying in and around the block are low. The two wheelers are the maximum type of vehicles followed by Light Vehicles and high vehicles. Movement of heavy vehicles is estimated to be about 60 truck/trailer load (from Jorhat to the Block) is anticipated during both site construction and decommissioning phases. During drilling phase 5-6 medium to small vehicles will be used for transportation of personnel to the drill sites. Transportation of vehicles during various projects phases particularly during site construction and decommissioning is likely to cause disturbance to the villages in the access routes. Most of the access road to the proposed or existing well site is in poor condition and narrow compared to the space required for the movement of the trailors. Hence, roads need to be widened and strengthened before the commencement of the project. With respect to increase in traffic movement the impact is considered to be of medium significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 (Medium)					

Potential impact on Land use

Development wells

Approximately, 29.162 Ha of forest land is required for the whole project. Two reserve forests eg. Dayang and Nambor Reserve forest is involved in the proposed project land. Dayang reserve forest has lost its natural vegetation and turned in to agriculture land by the local people. Among all six PML present in forest block, wells present in Kasomarigaon PML, East Lakhibari PML, Khoraghat Extn- 1 and Nambor PML would be drilled from existing site, where no additional land would not be required. For the rest of the PMLs ONGC has applied for the forest clearance to Golaghat DFO.

ONGC would have to take the land for short/long term lease from local panchayat. In short /long term lease, land will be converted from forest land to industrial land. After the completion of the lease period the land will be reinstated and converted to agricultural land before handing over to the panchayat. Additionally, necessary measures will be adopted by ONGC through provision of adequate compensation against loss of standing crops and reinstatement of well site in accordance to defined post closure plan and regulatory requirements. Hence the impact is considered to be of low due to temporary nature (short and long term) of development but of low significance due to subsurface laying of pipeline.

Severity of Impact	1	Extent of Impact	1	Duration of Impact	2
Impact Significance = 2 (Low)					

Mitigation Measure

Provide adequate compensation to landowners against loss of standing crops in accordance to regulatory requirements viz. Petroleum & Mineral Pipelines (PMP) Act, Land Acquisition Act, 1894 (amended in 1984) and Scheduled Tribes and Other Traditional Forest Dwellers Right, 2006.

Impact on Soil Quality

Development wells

Potential impact on soil quality is anticipated in the form of increase in soil erosion and loss of soil fertility resulting site clearance and top soil stripping due to well site preparation. Accidental spillage resulting from storage and handling of mud chemicals is potential soil abuser. Soil quality impacts so identified have been assessed and evaluated in the section below.

Site clearance and top soil removal

Most of the land of forest PMLs are used for agricultural purpose. Stripping of top soil likely to affect the soil fertility of the well sites. Since the wells of Kasomarigaon PML, East Lakhibari area and Nambor PML would be drilled from existing location, additional land would not be required for construction, hence site clearance and top soil removal would not be involved here. However, the wells present in Dayang reserve forest, is presently used for cultivation. It is estimated that about 3825 m^3 of top soil will be removed per well site having an area of 2.25 ha considering 15 cm top soil. The impact is considered to be temporary as the proper restoration of site will be undertaken by the proponent in case the exploratory wells are not indicative of any commercially exploitable hydrocarbon reserves. Necessary surface run-off control measures will be adopted by the proponent during construction phase to prevent contamination of adjoining lands from discharge of surface run-off characterized by increased sediment load. The top soil will be stored in mound form and preserved in a manner so that its fertility is maintained. The impact is therefore considered to be of low significance.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

<u>The mitigation measure proposed for top soil preservation are as follows:</u>

- The top soil will be stored in mound form.
- The height of the mound should not be more than 2m.
- The slope angle should not be more than 30˚.
- A jute mat or a tarpauline sheet will be over layered on the mound to contain the erosion of top soil.
- A garland drain will be constructed around the mound to contain the runoff of top soil.

<u>Storage and disposal of drill cuttings and drilling mud</u>

It is estimated that nearly about 225 m^3 of drill cuttings and 1200 m^3/day of drilling mud is likely to be generated from each well during exploratory and development drilling operation. Improper storage and disposal of process waste on open soil or unlined areas may lead to the contamination of soil onsite and abutting land if not properly managed. The project design takes into account construction of a HDPE lined impervious pits for temporary storage of drill cuttings and drilling fluid respectively and their disposal in accordance with “CPCB Oil & Extraction Industry Standard – Guidelines for Disposal of Solid Wastes” in their planning stage. Hence, no significant impact in this regard is envisaged. Further with ONGC committing to the use of water-based mud, the drill cuttings and waste drilling mud generated are likely to be non-hazardous in nature and is not anticipated to pose any potential threat to the soil environment. The waste cuttings will be tested and accordingly disposed by ONGC. The impact is therefore considered to be of low significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	1
Impact Significance = 4 (Low)					

Storage and handling of fuels and chemicals

Contamination of soil could occur from the project activities if certain operations like storage of chemicals and fuels, spent oil and lubricants are not managed efficiently. Storage of chemicals and fuels spent lubricants on unpaved surfaces also have potential for contamination of soil. However, considering that appropriate spill prevention and control measures will be implemented by the ONGC, hence the impact is not considered to be of significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	1
Impact Significance = 4 (Low)					

Mitigation measure

The following mitigation measures are proposed for reducing impact on soil quality:

- Restricted project activities during monsoon.
- Carrying out adequate restoration of soil.
- Implementing adequate sediment control measures to prevent discharge of untreated surface run-off characterized by increased sediment load to adjoining agricultural land.
- Ensuring proper storage of drill cutting and chemicals to prevent any potential contamination from spillage.
- Implementing appropriate spill prevention and control measures.

GGS, EPS and Pipeline

Site clearance and top soil removal

The construction of the GGS and EPS will result in long term diversion of forest land that is presently being cultivated by other forest dwellers. Hence, instead of simply storing it in mound forms the top soil removed will be used at the periphery of the GGS and EPS for greenbelt development. The impact significance is medium as the top soil that was utilized for cultivation will be used for greenbelt plantation, an alteration of fertility.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	1
Impact Significance = 4 (Low)					

The soil dug during trenching will be reused for concealing after laying the pipelines. Care will be taken to restore the location of the concealed pipelines to its earlier state. The process will be completed within a very short period of time.

Impact on Topography and Drainage

Development wells

During development phase of wells Potential impact on drainage and topography viz. alteration of drainage pattern, water logging etc. are anticipated during well site preparation, widening/strengthening of access roads and restoration of existing well facilities. The impact details have been discussed below:

Site preparation and Road Construction/ strengthing

Potential impact on drainage is primarily assumed in the form of disruption of natural drainage pattern during site preparation and approach road construction. The site prepared will be raised to a height determined after studying the height attained by the maximum flood level of past ten-twenty years. This may lead to alteration of onsite micro-drainage pattern leading to potential problems of water logging in the agricultural land and settlements near the drill site. This problem is likely to be further intensified due to heavy rainfall experienced by Golaghat and Jorhat district throughout the year.

The infrastructure in major portion of the PMLs is characterized by metalled and unmetalled rural roads which are adversely affected during intense rainfall received by the districts. Effect of rainfall on unpaved rural roads is more pronounced than the paved ones and sometimes could lead to complete isolation of few villages from the other parts of the district. Site approach roads to be constructed for drill site varies to 100 to 150m only. However, widening and strengthening of existing roads will be required for effective transportation of drilling rig and heavy equipment to the well site especially, since Giladhari river flows along the blocks. Widening/ new construction of roads could therefore result in the alteration of drainage along water crossings and may lead to water-logging of adjacent lands and settlements if not properly managed. However, considering that the provisions of cross drainage structures viz. culverts etc. and road embankments and stream crossings are present, and they will be further strengthened by ONGC if required to ensure an uninterrupted drainage flow, the impact is considered to be of medium significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 (Low)					

Well site restoration

Site restoration will be initiated for well sites, if not indicative of any commercially exploitable hydrocarbon reserves. Unplanned restoration may lead to the long-term disruption in natural drainage pattern and water logging in neighbouring agricultural land abutting the site. The land has to be restored taking into consideration the originally existing contours and pre-dominant slope. The impact is considered to be of low significance as onsite drainage will be taken care of during site restoration.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

Mitigation Measure

- Levelling and grading operations will be undertaken with minimal disturbance to the existing contour, thereby maintaining the general slope of site;
- Disruption/alteration of micro-watershed drainage pattern will be minimized to the extent possible.
- Loss of micro-watershed drainage, if any, is to be compensated through provision of alternate drainage.

GGS, EPS and Pipeline

Site preparation and Road Construction/ strengthing

The site prepared will be raised to a height determined after studying the height attained by the maximum flood level of past ten-twenty years. A storm water drain will be built at the periphery of the GGS and EPS to contain the site drainage during excessive rain. The storm water drain will be lead into the channel of Ghiladhari, after silt and oil and grease trapping. The road to the GGS will be the same that would be built for drill site. The construction of pipeline would be built across of varying land use and land cover. A suitable depth of land will be excavated beneath the waterbodies, both rural and State highways and homestead plantations so that the landcover is undisturbed. As mitigation measures will be employed and the activities will be of short duration, hence the impact significance will be low.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

Impact on surface water quality

Development wells

Ill impact on surface water quality of natural drainage channels and community water bodies near the well locations, may arise from discharge of contaminated surface run off, sewage and process waste water generated during different phase of the project.

Surface run off discharge

As discussed earlier, site clearance and stripping of top soil during site construction would result in an increase in soil erosion, which in turn increase the sediment load in the surface run off during monsoon. Also, surface run off from drilling waste, hazardous waste (waste oil, used oil etc) and chemical storage areas on open soil is likely to be contaminated leading to the pollution of receiving water bodies like natural drainage channels, pond etc. This situation is likely to be more pronounced considering rainfall records of Golaghat and Jorhat districts. However, considering the provision of onsite drainage system and sediment control measures to be implemented by the proponent in compliance with the S No. 72 A.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, the impact is considered to be of low significance.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

Discharge of drilling wash water

Approximately 9 m^3/day of drilling wash eater is likely to be generated during drilling operation. The drilling wash water so generated may be characterized by presence of oil and greases, barites and heavy metal which on discharge to near by natural drainage channels or rivers may lead to possible surface water contamination. However, ONGC has considered to use water based mud, for the proposed project, temporarily storage of drilling waste in HDPE lined pit and subsequent treatment to ensure conformance with CPCB MINAS standards for Onshore oil and gas drilling and extraction and guidelines provided by MoEF&CC under the Hazardous wastes (Management, Handling and Transboundary movement) Rules, 2008, the impact is considered to be low significance.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**1**
Impact Significance = 4 (Low)					

Mitigation measure

Following mitigation measures will be implemented for water pollution control:

- Proper treatment of all wastewater and produced water discharges will be made to ensure that they comply with criteria set by the regulatory body (MoEF&CC and SPCB).
- Drainage and sediment control systems at the well site will be efficiently designed
- Construction activities viz. stripping, excavation etc during monsoon season will be restricted to the extent possible.
- All chemical and fuel storage areas, process areas will have proper bunds so that contaminated run-off cannot escape into the storm-water drainage system.
- An oil-water separator will be provided at the storm water drainage outlet, to prevent discharge of contaminated run-off.

GGS, EPS and Pipeline

Surface run off and discharge:

It is estimated that the concretization of the GGS and EPS would take a very short period of time. This would reduce the probability of surface wash-out of silty material if there is no rain within the construction period. Further the surface run off, from the site after it is concretized will be collected in a storm water drain that will have requisite silt trap and oil trap. The filtered water of the storm water drain will further be discharged to the nearest channel of Ghiladhari river in compliance with the CPCB Inland Water Discharge Standards.

As the surface run off will hardly have any silt or oil and grease load that will impact the adjoining area or contaminate the natural drainage, the significance of impact will be low.

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 4 (Low)					

Pipeline

The surface level of the pipeline is always well compacted after filling with the subsoil and topsoil and shrubs eventually grow within a normal time frame. Hence, surface run-off is not a problem in the case of pipelines.

Impacts on Hydrogeology and Ground water quality

Potential impacts on groundwater resources that could arise as a result of the proposed drilling activities include the following:

Groundwater extraction

Water to meet domestic requirement of operational workforce, drilling mud preparation and flushing of blast holes will be sourced through vendors who possess relevant permission for water abstraction. If the vendor abstract water from nearby natural surface waterbody then there will no impact on the groundwater resource. But if the vendor sources it from the ground water then a different scenario arises. As reported by CGWB the average yield differs from 30 to 35m^3/hr for shallow to 200m^3/hr for deep tube wells in Golaghat district. The requirement per well is approximately 1m^3/hr and taking into account that drilling to be a temporary activity (approx. 45-60 days) impact on ground water resource is considered to be Low.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	1
Impact Significance = 2 (Low)					

The other impact on the groundwater resource will be due to the drilling activity. The drilling will be to a depth of 2200 – 3300 m. There are 2 to 6 prolific aquifer systems existing within the depth of 300m, as reported elsewhere. It is quite evident that there might be more aquifers beneath 300m as the north Eastern part of the Golaghat District where Kasomarigaon Block lies, has more potential for ground water resources compared to the other parts of the district.

Though, through the data logging service, the information about the drilling depth, where the drill will cut through the aquifer zone, would be acquired. Sometimes, during this activity an unquantified quantity of water does flow out as the rig cuts across the aquifer zone before cementing and casing is done. Since the cementing and casing is done within few hours the impact significance will be low.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	1
Impact Significance = 4 (Low)					

Storage of drill cuttings and waste drilling mud

Possibility of contamination of subsurface and unconfined aquifers may exist if the casing and cementing of the well is not carried out properly leading to infiltration or seeping of drilling chemicals or mud into porous aquifer region. The same is also valid for disposal of drilling waste and mud in an open/unpaved pit. However, the toxicity test of the drill cuttings of nearby wells of Assam Arakan-Assam Basin has shown the absence of any hazardous chemicals. Hence, the impact is considered to be of low significance.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	1
Impact Significance = 2 (Low)					

Mitigation Measure

- Proper engineering controls will be used for drilling and cementing operations.
- Water based, non hazardous type of drilling mud will be utilized for drilling operation.
- Drill cuttings & mud will be stored in HDPE lined pits

GGS, EPS and pipeline

Impact on groundwater due to the construction of and operation in pipeline is not envisaged. The water present in oil emulsion will be sent as crude oil via the pipeline to the proposed GGS and EPS. Hence, the impact of produced water on groundwater quality will not occur.

Impact on Biological Environment

Potential impact on Ecological environment i.e. impacts on existing terrestrial and aquatic floral and faunal diversity is envisaged particularly during Site preparation phase and operation phase.

The potential impacts on terrestrial Ecology in Site preparation and operational phase is given below:

Source of Impact:

The Potential Impacts on the existing floral and faunal diversity may arise due to following activities:

- Vegetation Clearance.
- Illumination from Site.
- Generation of Noise

Impact Assessment:

Vegetation Clearance

It is proposed to carryout drilling of development and exploratory wells in Forest PML areas, which is primarily located on forest land but converted into agricultural fields and settlement area. During primary survey, it has been observed that removal of ground vegetation is required for site preparation.

The vegetation observed in the study area is common to these climatological conditions and no endangered floral species is observed in the study area. Further the distribution of vegetation is scattered in nature. Clearance of vegetation for site preparation would not require cutting of any mature trees. It is observed that approximately 9 ha land is required for each drill site and clearance of only shrubs and herbs are required. Therefore, the scale of Impact can be considered as low, extent of impact would be limited within site. The clearance of vegetation would initiate the change in land use. So, overall impacts would be low.

Generation of Noise and Illumination from site

It is anticipated that noise would be generated particularly during the construction/site preparation period and various operational activities from the drilling site. It is expected to get attenuated to baseline level of noise within 200-300 m from the proposed drilling locations. During the field visit and as confirmed by the Forest Department of Government of Assam, the nearest WLS i.e. Nambor Wildlife Sanctuary is located 10.52 km of the block boundary. Therefore, no activity is planned inside the Wildlife Sanctuary area. However, the blocks are located with the Dayang Reserve Forest, Rengma Reserve Forest and Nambor South Reserve Forest. But, at the time of field visit it was observed that total forest land was diverted into agricultural field and settlement area. Few small forest patches were observed during field survey but all well locations are outside the small patches. Thus, the potential impacts on existing wildlife due to generation of noise can be considered as low.

The drill site would be illuminated during both construction and operational phase as drilling would be conducted continuously for 24 hrs and thus may cause significant disturbance to local faunal population particularly avifauna.

Severity of Impact	**2**	**Extent of Impact**	**1**	**Duration of Impact**	**2**
Impact Significance = 4 i.e. Low					

Mitigation Measures

A range of measures would be adopted during construction and drilling phase to mitigate the potential impacts of terrestrial ecology and biodiversity which are described below:

- The working area would always be kept minimum.
- For felling of trees prior approval from concerned department would be obtained;
- Appropriate shading of lights would be ensured to prevent unwanted scattering.
- Plantation of local trees would be undertaken;
- Fencing would be done on the camp site to avoid any unfortunate encounter with faunal species.

The potential impacts on Aquatic Ecology in Site preparation and operational phase is given below.

During Monsoon, due to the surface run off from drilling waste (cuttings and drilling mud), hazardous waste (waste oil, used oil etc) and chemical storage areas may lead to the pollution of receiving water bodies and rivers unless precautionary measures are adopted. Some well location is located nearby Dayang and Rengma river. However, provision of onsite drainage system, sediment control measures, provision of oil water separator would aid discharging of surface run off in compliance with the CPCB Inland Water Discharge Standards, the impact is considered would be of low significance.

Severity of Impact	**2**	**Extent of Impact**	**1**	**Duration of Impact**	**2**
Impact Significance = 4 i.e. Low					

Mitigation Measures

- Proper treatment of all wastewater and produced water and any water discharge from well site would comply with CPCB Discharge Standards for Oil and Gas Industries
- Waste mud would be stored in the HDPE lined pit
- Drainage and sediment control systems at the well site would be efficiently designed
- All chemical and fuel storage areas, process areas would have proper bunds so that contaminated run-off cannot escape into the storm-water drainage system.

Impact on Socio-economic environment

Development wells, GGS, EPS and Pipeline

Based on the nature and type of impacts, the assessment has been divided into broad categories namely (i) Adverse impacts and (ii) Positive impacts.

Adverse Impacts

- Loss of Livelihood

  The forest PML blocks mostly falls in the agricultural fields and forest land of Dayang and Nambor reserve forest. In case of Dayang reserve forest, the vegetation has been wiped out and the land is being cultivated by the settlers since 1974. Presently they have been surveyed by the Forest Departments to provide them ownership of land under Scheduled Tribes and Other Traditional Forest Dwellers Right, 2006. Hence ONGC has to compensate for the crop and pay lease

Severity of Impact	**1**	**Extent of Impact**	**2**	**Duration of Impact**	**3**
Impact Significance = 6 (Medium)					

  for the land to the settlers who cultivate these lands. Long term compensation will be awarded for the land leased for GGS and pipeline. The proposed project would not require any displacement of villagers. The impact on livelihood is considered to be of medium significance.

➢ Conflicts on Job Opportunity

Primary survey and public consultation showed that the local people willing to work in the ONGC projects. Involvement of outside workers in proposed activity may create a conflict with local people, as most of the villagers of the area are small scale cultivators, tea garden workers, daily labours, small businessman. Local people have a strong point on the fact that, major proportion of the workers should be from the surrounding villages. Considering this fact as a public opinion, the impact would be low.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**1**
Impact Significance = 4 (Low)					

➢ Disruption on Infrastructure

Road network in the PML area, are mainly weathered metalled roads and internal village roads, which are partly metalled or unmetalled road. Transportation of drilling rig and associated facilities to drill and decommissioning of rig and associated structure would increase the traffic movement. A sudden increase in vehicular fleet may damage road infrastructure, if not properly maintained.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 8 (Medium)					

➢ Dust and Noise Discomfort

Settlements, which are present in close proximity of well, may be affected by due to noise and dust generated from vehicular movement during site preparation, setting up of rig and associated facilities, decommissioning of rig and associated facilities. Further, during drilling operation, inhabitants residing close to drill sites (within 200 m) would get affected due to noise and emissions from DG sets and occasional flaring activity. Considering proximity of human settlement and short term activity with proper mitigation measures, impact would be of medium significance.

Severity of Impact	**2**	**Extent of Impact**	**2**	**Duration of Impact**	**2**
Impact Significance = 8 (Medium)					

➢ <u>Ecological productivity in Agricultural fields</u>

Impact on ecological productivity of the agricultural land, which would be leased for the exploratory drilling activity stands temporarily, during the lifecycle of the project. Reinstatement of ecological productivity will be dependent on successful restoration of soils, their structure, chemistry drainage characteristics and possibly other physical factors, such as micro-topography. This activity would provide a basis for successful recovery of ecological populations, whether allowed to occur naturally or aided by seeding and cultivation. However, considering necessary mitigation measures like top soil preservation, process water treatment, etc will be implemented by the proponent. During various project phases any impact in this regard is considered to be of low significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	1
Impact Significance = 4 (Low)					

➢ <u>Influx of Population</u>

Influx of population is anticipated in various stages of the project cycle particularly during exploratory drilling. The drill site would involve the operation of about 25 – 30 onsite workers. Hence there might be an impact on the local communities due to the sharing of common resources like space, drinking water, roads, etc. Interaction between workers with villagers of nearby areas might give rise to various issues like conflict of workers with the local population, nuisance caused by workers due to improper sanitation facilities, etc. However, taking into account that workforce is likely to be sourced from nearby villages and adequate sanitation facilities will be provided chances of such conflicts are negligible.

Severity of Impact	1	Extent of Impact	2	Duration of Impact	1
Impact Significance = 2 (Low)					

➢ <u>Cultural and Heritage site</u>

Impact on cultural environment may occur due to site preparation, operation of drilling rig and also, during vehicular movement with respect to the proposed exploration activities. There are no designated historical or cultural spots within the forest PML Block. Hence, no impact is envisaged on them.

➢ <u>Employment Opportunities</u>

Project will benefit people living in the neighboring villages by giving preference to them in relation to direct & indirect employment associated with the various project activities. Site preparation phase will involve certain number of laborers and there is a possibility that local people can be engaged for this purpose. Drilling process will involve a number of skilled and unskilled workers. There is a possibility that local people will be engaged for this purpose to the extent possible and hence improve existing employment scenario of the region. However, most jobs will comprise technical involvement. Hence villagers can possibly be employed only in certain non-technical or casual labour jobs and that too for a limited duration. It is proposed that first preference be given to people whose land is acquired and to their relations. Next preference will be given to the poorer people.

Impact Significance = ++++ (Positive)

Impact on Occupational Health and Safety

Occupational injuries and ill-health have huge socio-economic implications on individuals, their families and communities. They also have economic impacts in form of direct and indirect costs for society as a whole. Major occupational health risks encountered in proposed drilling activity include noise from drilling activity, operation of heavy vehicles and machinery, handing of chemicals. However, the proponent will adopt necessary control measures through implementation of mitigation measures and provision of proper PPEs to workers operating in aforesaid area to prevent and/or mitigate adverse health related impacts. Hence any possible occupational health impact from exposure to such fugitive dust is not likely to be of major significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 (Medium)					

- Community Health and safety

Community health and safety of inhabitants residing close to the drilling site stands to get affected from frequent heavy vehicular movement along village access roads and due to noise from drilling rig operations. Health and safety impact arising from technological emergencies viz. well blow outs, explosions will be dealt separately in the QRA section. Although the aforesaid activities are temporary in nature it may not adversely affect community health and safety and hence is considered to be of medium significance.

Severity of Impact	2	Extent of Impact	2	Duration of Impact	2
Impact Significance = 8 (Medium)					

Few mitigation measures should be adopted to protect the community are as follows

- All activities should be barricaded by proper fencing.
- Proper hoardings in English and Assamese language should be displayed during construction to prevent people from encroaching the fenced area or to make them aware of the danger associated with the construction.
- Pipes will be kept in level ground within proper barricade.

Table 59. Impact significance Matrix (With Mitigation)

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
A. Pre-Drilling Activities for wells, GGS and EPS																													
Site selection and land acquisition					M														M			L							
Site clearance and top soil removal	L	L	L			M						M		M									L	L			+	L	
Well site & access road construction	L	L	L	M			M																L				+	L	L
Sourcing & transportation of borrow material etc	L	L	L	M		L	L					M								M	M		L				+	L	L
Storage and handling of construction debris	L	L																										L	
Transportation of drilling rig and ancillaries		L	L	M																	M		L					L	L
Operation of DG set		L	L											M	M														

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment											
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Workforce engagement & accommodation at construction site																				M		L			M		+		L
Consumption of water for construction & domestic use for labourer										L												L							
Generation of domestic solid waste & disposal	L					L			L		L																		L
Generation of waste water & discharge from construction activity & labour camp									L		L																		L
Surface run-off from construction site						L			M		L											L							
B. **Development well Drilling & Testing**																													
Physical Presence of drill site	L													M	M														

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Operation of DG sets and machinery		L	M									L		L	L													M	M
Operation of drilling rig			M									L		L	L								M					M	
Storage and disposal of drill cuttings and mud	L					L			L		L																		
Generation of process waste water & discharge									M		L						M	M											
Surface run-off from drill site						L			L								M	M											
Generation of domestic waste water & discharge						L			L		L						M	M											
Generation of Municipal waste & disposal	L					L			L		L																		
Workforce engagement & accommodation at drill site																				M		L			M		+		M
Flaring during production testing and process upset		L	M									M		L	L													M	M

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment											
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Accidental events – blow out		L				M			M		M	M		L	L													M	M
Accidental events-spillage of chemical & oil						M			M		M						M	M											
C. **Early Production**																													
Flaring of Gas	L	M															L												M
DG Set of Emission	L																												M
Produced Water					L	L	M	M																					
D. **Operation of GGS**																													
Physical Presence of GGS	L				M																								
Operation of DG sets and machinery		M	L																									M	M
Generation of waste & disposal																													
Souring of Water																													
flaring		M																										M	M

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Accidental events – blow out		M				M			M		L	L						L	L									M	M
Accidental events-spillage of chemical & oil						M			M		L																		
E. Laying of Pipeline																													
Site selection and land acquisition					M														M			L					+	M	
Site clearance and top soil removal	L	L	L			M	L					L											M				+	M	M
Trenching	L	L	L	M			L																M				+	M	M
Sourcing & transportation of burrow material etc	L	L	L	M		L	L					L								M	M		M				+	M	M
Storage and handling of construction debris	L	L																										M	

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Transfer of pipes to construction site		L	L	M																	M		M					M	M
Operation of DG set	L	L	L																										
Workforce engagement & accommodation at construction site																				M		M					+		M
Consumption of water for construction & domestic use for labourer																						M							
Generation of domestic solid waste & disposal	L					L		L		L							L	L											M
Generation of waste water & discharge from construction activity & labour camp									L		L																		M

Environment / Activity	Physical Environment											Biological Environment							Socio-economic Environment										
	Aesthetics & Visuals	Air Quality	Noise Quality	Transport & Traffic	Land Use	Soil Quality	Local Drainage & Physiography	Surface Water Resources	Surface water quality	Ground Water Resources	Ground water quality	Flora & Floral Habitat	Wildlife Habitat	Fauna	Threatened & Endangered species	Migratory corridor & rout	Aquatic Habitat	Aquatic Flora & Fauna	Loss of Livelihood	Conflict on Job opportunity	Disruption of Infrastructure	Common Property Resources	Dust & Noise Discomfort	Loss of Agricultural Productivity	Influx of Population	Cultural & Heritage Site	Job & Economic Opportunity	Occupational Health & Safety	Community Health & Safety
Surface run-off from construction site						M	M		L		L						L	L				M							
E. **Decommissioning and Reinstatement**																													
Dismantling of rig and associated facilities		L	M																									M	M
Transportation of drilling rig and ancillaries		L	M	M																									M
Removal of well site construction materials & disposal		L	M	M																									M

5. Analysis of Alternatives

Analysis of alternatives is a requirement to the project proposal for developing an EIA report. During the scoping stage, alternatives to a proposal can be considered, either directly or by the reference to the key issues identified. A comparison of alternatives, with the present situation provides a better understanding to determine the best method of achieving the project objectives, with minimum environmental impacts or indicate the most cst effective option for the project. The consideration of alternatives is most useful when the EIA is undertaken early in the projects cycle. The type and range of alternatives open for consideration include:

- Site alternatives (e.g. advantage of proposed site, details of any other sites, if explored, etc)
- Input or supply alternatives (e.g. use of raw materials, sourcing, etc)
- Technology alternatives (e.g. feasibility of different technologies available and advantage of proposed technology, etc).

After detailed analysis of various factors, the most environment friendly, compatible and cost-effective alternative is selected, for the project activities. Reference may be made to available technologies, policy objectives, social attitudes, environmental and site constraints, projects economic etc.

This section provides an analysis of alternatives in relation to the conception and planning phase of the project. This includes the following:

5.1 No project Scenario

The no project scenario is such an analysis, where it would be seen, the reasonably expected condition in near future, if the proposed development drilling of hydrocarbons and production of hydrocarbon are not conducted in the area. In such a scenario, there would not be any pressure on use of local resources and infrastructure, and no negative impact on local ecology or load of pollution on the baseline environmental aspects, such as Air, water and noise levels. On the contrary, there would not be any positive or beneficial effect on socio economic status of the area, resulting from direct/indirect employment and economic benefits that such a project can provide.

With no project scenario, dependence of the Nation on import of crude oil and demand for foreign exchange would continue undesirably. Hence, the proposed project area is already invented by ONGC, in terms of exploration of hydrocarbons and seeing the positive effect on the local economy due to presence of some existing project, the proposed project would boost up the local economical standards and as well as it would also contribute in the self-dependency of hydrocarbon in the country.

5.2 Alternatives for project site

The PML is allocated by the Government of India under the revenue sharing contract (RSC). ONGC would be the operator for the PML. Drilling locations are proposed based on geoscientific information of the specific Block site available with MoPNG and alternate sites cannot be considered for the proposed project facilities due to the following reasons:

The location is within the existing RSC boundary of the Block. The surface locations of all wells have been tentatively selected considering the drilling configuration (reach to potential reservoirs).

5.3 Alternatives for well location

The proposed exploratory well site have been identified based on the study and interpretation of the stratigraphy and already available seismic data. Within the identified location the actual well drilling site would be selected based on the following factors:

- Located as far as possible from the nearest human habitation or sensitive receptors.
- Located at a safe distance from public road.
- Ensure natural drainage channels are avoided or drainage channels rerouted along the periphery to ensure unhindered flow of rain / flood water. Wherever necessary adequate erosion control measures would be provided.

5.4 Alternative Technology

Use of water Based Mud

Drilling mud plays a vital role in balancing formation pressure, lubricating and cooling bit on drilling processing. Due to its high cost and severe pollution to local environment, circulation utilization of drilling mud has been adopted by most of drilling companies. But, when pumped from downhole, the drilling mud carries massive solids that mainly consists of cuttings from crushed rocks and bentonite and barite added for better performance. What's more, the solids-removal effect will exert a direct influence on mud property and drilling safety. According the contribution to drilling mud, the solids can be classified as useful and unuseful particles which mainly contains drilling cuttings. Excessive massive solids will increase pressure more than formation pressure, and drilling mud will permeate into strata while fine particles will enter into oil channel which results in blockage causing damage of oil reservoir. The main component/ solvent of drilling fluid are water, oil or synthetic and accordingly they are called as oil-based, water-based, and synthetic-based muds (OBMs, WBMs, and SBMs).

In the proposed project ONGC has decided to use WBM or Water based mud for drilling activity, as their standard practice. Water-based drilling mud most commonly consists of bentonite clay (gel) with additives such as barium sulfate (barite), calcium carbonate (chalk) or hematite. WBM is cost effective and less harmful to the environment on comparison with SBM and OBM. WBM are also good for curing mud losses by pumping coarse bridging materials (called lost circulation material), mud losses often are cured. It is believed that the main mechanism is that in water-wet formations, filtrate losses occur, leaving dense particles in the mud in the fracture.

The only disadvantage with water-based drilling fluids is that they are reactive to clays and lead to time-dependent borehole problems. The hole size often increases with time in shales.

5.5 Conclusion

This proposed project is of national importance as it has potential to achieve enhanced fuel security and save on FOREX reserve expenditure. The proposed project would have positive benefits in terms of revenue generation to state and central government as well as increase in job opportunities of primary and secondary types.

Site selection would be carried out taking into consideration the nearest habitation, proximity to any sensitive receptor and natural drainage. In addition, ONGC would ensure that the final site selection is made after due consideration to all environmental conditions as mentioned earlier. Also, use of alternate technology to avoid sensitive locations would be made to the extent possible. Consideration of these alternatives with strict compliance to the Environment Management and Monitoring Plans suggested in the next chapter would ensure minimal adverse impact on the Environment.

6. Environmental monitoring Programme

An environmental monitoring plan provides a convenient mechanism to address the adverse environmental impacts of a project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works. An environmental monitoring programme is essential as it provides useful information and helps to:

- Assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures;
- Define the responsibilities of the project proponents, contractors and environmental monitors and provides means of effectively communicating environmental issues among them;
- Define monitoring mechanism and identify monitoring parameters;
- Evaluate the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggest improvements in management plan, if required;
- Identify training requirement at various levels.

An environmental monitoring program is suggested to monitor environmental parameters during survey, drilling and Post Drilling Phase of the project. The monitoring plan is given in Table 60, Table 61 and Table 62 below. This environment monitoring plan is designed for ten years.

Table 60. Recommended Environmental monitoring protocol- Pre-Drilling Phase

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Ambient Air Quality	Drilling site	PM 10, PM 2.5, NO_X, SO_X, VoCs and HC.	Once prior to drilling
Surface Water Quality (if available)	Water bodies within the radius of 1 km from the Drilling Site	pH, Total Suspended Solids, Total Dissolved Solids, BOD, COD, O&G, heavy metals (Zinc, lead, iron, nickel, cadmium and chromium)	Once prior to drilling
Noise Levels	Drilling site	For Background Noise Levels (using Noise meters)	Once prior to drilling
Physical Infrastructure	Drilling site	• Lining of effluent pits with HDPE sheets. • Oil & Grease traps on outlets; storm water runoff points. • Separate run off routes for non-contaminated and contaminated run off. Treatment facilities for the contaminated run off. • installation of modular STP onsite. • Chemical storage should be covered.	During site preparation.
Clearance of trees (if existing)	At Drilling Site and supporting infrastructure locations	Inventory of trees likely to be cut and number of trees to be planted as part of Compensatory Tree Plantation Program.	During site preparation.

Table 61. Recommended Environmental monitoring protocol- During Drilling Phase

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Natural Resources	At drilling site	• Quantity of each type of material used including water consumption. • Quantity of fuel used for power	Daily during drilling phase
Ambient Air quality	At drilling site	• PM 10, PM 2.5, NO_X, SO_X, VoCs and HC	Once in six months
Surface Water Quality (if available)	Water bodies within the radius of 1 km from the Drilling Site	• pH, Total Suspended Solids, Total Dissolved Solids, BOD, COD, O&G, heavy metals (Zinc, lead, iron, nickel, cadmium and chromium)	Once in a season
Noise and Vibration	At Drilling Site, near DG sets and drilling pumps.	• Noise level monitoring. • Maintenance of Machineries. • No unnecessary operation of machinery when not required. • Use of ear plug by workforce. • Presence of sound barriers or acoustic enclosure around DG sets.	Once in a month
Drilling Wastes	At drilling sites	• Drill cuttings wash water: its quantification, characteristics (TSS, TDS, organic compounds, heavy metals, oil & grease), its treatment and safe disposal.	Quantity of wastes to be recorded on daily basis. Characterization of the waste to be done every month.

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
		• Spent drilling fluid: its treatment and reuse. • Maintenance of effluent pits, drill cutting storage pit and waste mud pit.	
Wastewater Generation	At drilling site	Waste water generation rate	Quantity to be recorded every day.
Oil Wastes	At Drilling Site	Spent oil from engines.	A logbook should be maintained daily during drilling phase. If no spent oil is produced, the same should be noted in the logbook.
Oil Spills	At drilling sites	• Facilities oil spill contingency plan should be in place.	During drilling phase.

Table 62. Recommended Environmental monitoring protocol- Post Drilling Phase

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Drilling wastes	At drilling sites	Quantification of drill cuttings and safe disposal as per norms.	At the end of the drilling operation.
Land	At drilling sites	Restoration and rehabilitation through: Well head should be removed and well mouth to be capped if HC is not discovered commercially.	At the end of the drilling operation

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
		Removal of all wastes such as used chemical bags, cotton, jute, rags, papers etc. as per restoration policy in case no commercial discovery. Treatment and disposal of waste products, solids and liquid in accordance with regulatory requirements. Removal of fencing and gates. Backfilling and closing of all on site disposal pits as per legal requirements.	
Surface Water Quality (if available)	Water bodies within the radius of 1 km from the Drilling Site	pH, Total Suspended Solids, Total Dissolved Solids, BOD, COD, O&G, heavy metals (Zinc, lead, iron, nickel, cadmium and chromium)	At the same location where pre and during drilling phase monitoring was done. Once after the closing of drilled well.
Compensatory tree plantation (If tree cutting is involved during drilling phase)	Tree plantation locations	Survival rate of tree saplings	Once in a year for three years

7. Additional Studies

Based on the TOR specified by the Ministry of Environment & Forest and Climate Change (MoEF&CC) issued vide letter no. F. No. IA-J-11011/86/2019-IA-II(I) dated 14 Apr 2019 for preparation of EIA/EMP Report for proposed project, the following additional studies, as suggested in EIA Notification, were conducted:

- Risk Assessment Study
- Disaster Management plan

Public Hearing and Consultation would be conducted based on this draft report. The suggestions and issues received during the public hearing would be addressed suitably and incorporated in the Final EIA report, for onward submission to EAC of MoEF&CC for obtaining the Environment Clearance (EC).

7.1 Risk Assessment

Risk" is defined as the combination of the expected frequency and consequence of accidents that is caused by a hazard. A risk assessment (RA) is a systematic approach of identifying objects, events or processes that may cause harm or hazard to people, environment and asset or property. After identification of hazards, the severity of the risk is evaluated, and measures are suggested to effectively eliminate or control the hazards. This process of control usually involves monitoring, re-evaluation, and compliance with decisions

RA are crucial as they form an integral part of an occupational health and safety management plan. RA play a vital role in the following aspects:

- Create awareness of hazards and risk.
- Identify who may be at risk
- Determine whether a control program is required for a particular hazard.
- Determine if existing control measures are adequate or if more should be done.
- Prevent injuries or illnesses, especially when done at the design or planning stage.
- Prioritize hazards and control measures.
- Meet legal requirements where applicable.

In the present context, the scope of RA study includes the following:

- Identification of hazards arising in the proposed projects
- Identification of potential risk scenarios that may arise from the identified hazards.
- Consequence prediction of potential risk scenarios if consequences are high, establish the same by through application of quantitative simulations.
- Recommendation of feasible preventive and risk mitigation measures as well as provide inputs for drawing up of Emergency Response Plan (ERP) for the project.

Hazard Identification includes investigation of all events or processes which could result in possible adverse impacts on people, environment & equipment. On identification of potential incidents of hazards, its risk potential is assessed.

Drilling rig floor is the core area of exploration and development projects and extremely susceptible to accidents. Safety precaution with utmost care is required to be taken during drilling as per the prevailing regulations and practices so that accidents can be avoided. Due to advancement in technology, number of equipment has been developed over a period to cater the need of smooth operation on a rig floor. Various standards are required to be referred to cover the variety of equipment used for safe operation in drilling and it is desirable to use a properly prepared manual for occupational safety while working or drilling over a rig. It may, however, be noted that well testing and production testing of hydrocarbons also require proper analysis of hazards involved in production testing operations and preparation of an appropriate Emergency Control Plan. Hydrocarbon Operations are generally hazardous in nature by virtue of intrinsic chemical properties of hydrocarbons or their temperature or pressure of operation or a combination of them. Fire, Explosion, Hazardous Release or a combination of these are the hazard associated with Hydrocarbon Operations

Risk assessment is measured by the risk potential which is factored by the likelihood of occurrence of an event and its probable Impact.

The likelihood of occurrence is measured using the following relative scale.

RATING	LIKELIHOOD	DESCRIPTION
1	Very Low	Highly unlikely to occur. May occur in exceptional situations.
2	Low	Most likely will not occur. Infrequent occurrence in past projects.
3	Moderate	Possible to occur.
4	High	Likely to occur. Has occurred in past projects.
5	Very High	Highly likely to occur. Has occurred in past projects and conditions exist for it to occur on this project.

The scale of impact is defined as follows:

RATING	IMPACT ON PEOPLE	IMPACT ON ASSET	IMPACT ON BUUSINESS SCHEDULE
1	No significant impact	No impact	No change in schedule
2	Physical injury requiring first aid	Temporary damage to equipment	< 1-week delay to schedule
3	Physical injury leading urgent medical aid, other health impact	Significant but temporary address to equipment	1 - 2 weeks delay to schedule
4	Critical injury causing significant physical injury and other health impact	Critical damage to equipment leading o disruption in operation for a time period	2 - 4 weeks delay to schedule
5	Irreversible impact on human health, death	Permanent damage to equipment leading to temporary suspension of operation	> 4 weeks delay to schedule

The level of risk using the likelihood of occurrence & its impact is presented in the matrix below in figure 54:

Consequence ↑		Likelihood → Frequent	Probable	Remote	Not Likely	Improbable
		5	4	3	2	1
Catastrophic	5	25	20	15	10	5
Major	4	20	16	12	8	4
Moderate	3	15	12	9	6	3
Minor	2	10	8	6	4	2
Insignificant	1	5	4	3	2	1

Figure 54. Risk Matrix

The risk criteria and action requirements are mentioned in Table 63

Table 63. Risk Criteria and Action requirements

Risk Significance	Criteria Definition & Action Requirements
High (16 - 25)	**"Risk requires attention"** – Project HSE Management need to ensure that necessary mitigation are adopted to ensure that possible risk remains within acceptable limits
Medium (10 – 15)	**"Risk is tolerable"** – Project HSE Management needs to adopt necessary measures to prevent any change/modification of existing risk controls and ensure implementation of all practicable controls.
Low (5 – 9)	**"Risk is acceptable" –** Project related risks are managed by well-established controls and routine processes/procedures. Implementation of additional controls can be considered.
Very Low (1 – 4)	**"Risk is acceptable" –** All risks are managed by well-established controls and routine processes/procedures. Additional risk controls need not to be considered

Events having major risk need identification and immediate attention for its mitigation, whereas events with moderate risk also need adressal and plan to mitigate its impact.

The types of hazardous events along with its risk potential for the proposed projects are presented below. The risk assessment has been done considering the embedded mitigation & management measures.

Table 64. hazard Identification and Risk assessment for the proposed project

Hazards	Events	Mitigation measures	Risk assessment		
			Likelihood	Impact	Risk potential
Fire and Explosion	Uncontrolled Blow out- medium, large, small	• Provision of Blow-out Preventer • Process control for monitoring of pressure • Provision of dyke around fuel storage area • Provision of appropriate fire fighting system at all potential location • Electrical fittings & cables to be as per specific standards and motor starters to be flame proof	3	5	15
	Release from diesel tanks- Catastrophic failure and leaks		3	3	9
	Possible cratering (a basin like opening in the Earth surface surrounding a well caused by erupted action of gas, oil or water flowing uncontrolled)		1	3	3
	Electrical fire		3	3	9
	Leaks and failure in the pipeline		3	3	9
Toxic release	Release of toxic gases like sour gas release Release of Chlorine used for water treatment Oil spill	• Leak detection and neutralization system to be provided • Oil spill kit to be provided	3	4	12
Impact and Collisions	Possibility of dropped objects on the drilling platform due to	• Imparting training to all personnel regarding safe working practices	3	3	9

Hazards	Events	Mitigation measures	Risk assessment		
			Likelihood	Impact	Risk potential
	lifting of heavy equipment including components like draw works, drilling pipe, tubing, drill bits, Kelly, mud equipment, shale shakers, BOP components, power generating equipment and others.	• Strict adherence to Standard operating Procedure • Provision of barriers to avoid direct impact as applicable			
Occupational accidents	Accidents such as slips, trips, falls, dropped objectives etc.	• Imparting training to all personnel regarding safe working practices • Useof appropriate Personnel Protective Equipment (PPEs)	3	3	9
Structural failure	Structural collapse of drilling rig due to static or rotating load, fatigue, construction defect, design defect, earthquakes etc	• Design of all structure as per Appropriate codes and standards	4	4	16

Consequences Modelling

Consequence models are used to predict the physical behaviour of hazardous incidents. Important inputs to the Consequence analysis calculations include the weather conditions and the damage criteria, both of which are discussed in the following.

Weather Conditions

The weather stability class considered is Class C/D for day time and Class F for Night time. The average wind speed most of the time is 5 m/s for day time and 1.5 m/s at night time. combining this with the before mentioned stability classes, consequence modeling is done for both these weather cases. The ambient condition considered in this study is as under:

Average Ambient Temperature = 32˚C

Average Humidity = 80 (%)

The six representative weather classes considered to determine the inputs are detailed in the table below:

Surface wind speed (m/s)	Day time conditions			Night sky	
	Strength of sunlight				
	Strong	**Moderate**	**slight**	**Thin Overcast ≥ 4/8 Cloudiness****	**≤3/8 Cloudiness**
<2	A	A-B	B	E	F
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

**Applicable to heavy overcast conditions day or night*
***Degree of Cloudiness = Fraction of sky above horizon covered by clouds.*
A- Extremely Unstable Conditions
B- Moderately Unstable Conditions
C- Slightly Unstable Conditions
*D- Neutral Conditions**
E- Slightly Stable Conditions
F- Moderately Stable Conditions

In its original form, the Pasquill system contains seven categories (A to F) but joint categories are also common. Categories A (Very Unstable), D (Neutral) and F (Very Stable) are discussed next.

Category A (very unstable) occurs typically on a warm sunny day with light winds and almost cloudless skies when there is a strong solar heating of the ground and the air immediately above the surface. Bubbles of warm air rise from the ground in thermals. The rate of change (decline) of temperature with height (lapse rate) is very high.

Category D (neutral) occurs in cloudy conditions or whenever there is a strong surface wind to cause vigorous mechanical mixing of the lower atmosphere.

Category F (very stable) occurs typically on a clear, calm night when there is a strong cooling of the ground and the lowest layers of the atmosphere by long wave radiation. There is a strong inversion of temperature (i.e. warm air over cold air).

Representative weather class

Weather class	Wind speed (m/s)	Pasquill stability
I	3	B
II	1.5	D
III	5	D
IV	9	D
V	5	E
VI	1.5	F

Source: Handbook of Chemical Hazard Analysis Procedures by FEMA, USEPA and USDOT

Damage Criteria

<u>Jet Fire</u>

The term jet fire is used to describe the flame produced due to the ignition of a continuous pressurised leakage from the pipe work. Combustion in a jet fire occurs in the form of a strong turbulent diffusion flame that is strongly influenced by the initial momentum of the release. Flame temperatures for typical jet flames vary from 1600°C for laminar diffusion flames to 2000°C for turbulent diffusion flames. The principal hazards from a jet fire are thermal radiation and the potential for significant knock-on effects, such as equipment failure due to impingement of the jet fire.

The consequence caused by exposure to heat radiation is a function of:

- The radiation energy onto the human body [kW/m^2];
- The exposure duration [sec];
- The protection of the skin tissue (clothed or naked body).

It can be assumed that people would be able to find a cover or a shield against thermal radiation in 20 seconds time. Furthermore, 99% lethality may be assumed for all people suffering from direct contact with flames. The effects due to relatively lesser incident radiation intensity are given below.

In the study, the following criteria were used for estimation of heat radiation due to jet fire fatalities:

Incident Radiation (kW/m^2)	Damage criteria
4.0	Will cause pain in 15 to 20 seconds and injury after 30 seconds' exposure
12.5	➢ Significant chance of fatality for medium duration exposure. ➢ Thermal stress level high enough to cause structural failure. ➢ Wood ignites after prolonged exposure.
37.5	➢ Significant chance of fatality for people exposed instantaneously. ➢ Cellulosic material will pilot ignite within one minute's exposure

Source: OGP

Pool fire

A pool fire is a turbulent diffusion fire burning above a pool of vaporizing hydrocarbon fuel where the fuel vapor has negligible initial momentum. The probability of occurrence of pool fires for oil and gas exploration is high due to continuous handling of heavy hydrocarbons. The evaporation of hydrocarbons from a pool forms a cloud of vapor above the pool surface which, on ignition, leads to generation of pool fire.

In the study, the following criteria were used for estimation of heat radiation due to pool fire fatalities:

Incident Radiation (kW/m^2)	Damage criteria
4.0	➢ Escape action within 1 minute ➢ Caused second degree burn within 60 seconds
12.5	➢ Escape action within few seconds. ➢ Caused second degree burn within 40 seconds.
37.5	➢ Results in immediate fatality. ➢ Pain threshold is instantaneous leading to second degree burns within 8 sec.

Overpressure effect

Overpressure criteria is presented below:

Overpressure level, bar	Effect on Assets & human
0.01 – 0.07	Glass damage resulting to cracking and shattering
0.07 – 0.17	Repairable damage to buildings, Chances of effect on human hearing & injuries from flying objects

Overpressure level, bar	Effect on Assets & human
0.17 – 0.35	Heavy damage to buildings & equipment, serious hearing disabilities & wounds from flying objects, Chances of lethalities

Identification of Major Hazardous Substances

The bulk storage in the unit involves the storage of High-speed diesel in the site and the details are as follows:

Material	Physical State	Storage capacity	Hazard
High speed Diesel (HSD)	Liquid	42 KL	Pool fire, explosion

HSD would be stored in an atmospheric storage tank, but the placement of the HSD storage unit has not been confirmed yet. So, as per professional judgment of the consultant, the placement of HSD tank and storage capacity of the tank has been decided.

There is a possibility of failure associated with each mechanical component (vessels, pipes, pumps or compressors) etc. These are generic failures and can be caused by such mechanisms as corrosion, vibration or external impact (mechanical or overpressure). A small event (such as a leak) may escalate to a bigger event, by itself causing a larger failure. The range of possible releases for a given component covers a wide spectrum, from a pinhole leak up to a catastrophic rupture (of a pipeline) or full-bore rupture (of a pipe). It is both time consuming and unnecessary to consider every part of the range; instead, representative failure cases are generated. For a given component these should represent fully both the range of possible releases and their total frequency. In line with previous similar projects executed and per the standard approach and guidelines, the following typical types of failures are considered for the different isolatable sections: -

Description of section	Scenarios
HSD storage vessel	➢ Partial release of containment - 20 mm leak ➢ Complete release of containment

For each identified failure case, the appropriate data required to define that case is input into the model. An estimate of the failure frequency is assigned to the failure cases, which is based on the published database in March 2010 of International Association of Oil & Gas Producers (OGP). When the appropriate inputs are defined, the model calculates the source terms of each release, such as the release rate, release velocity & release phase.

The results of consequence modelling from various scenario of release from HSD storage vessel is presented below:

Early Pool Fire (20 mm leak)

Path	Scenario	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\Atmospheric storage tank	Leak	Category 1.5/F	4.4783	23.858	15.4483	8.07107
		Category 5/D	4.45634	25.0138	17.5882	8.76511

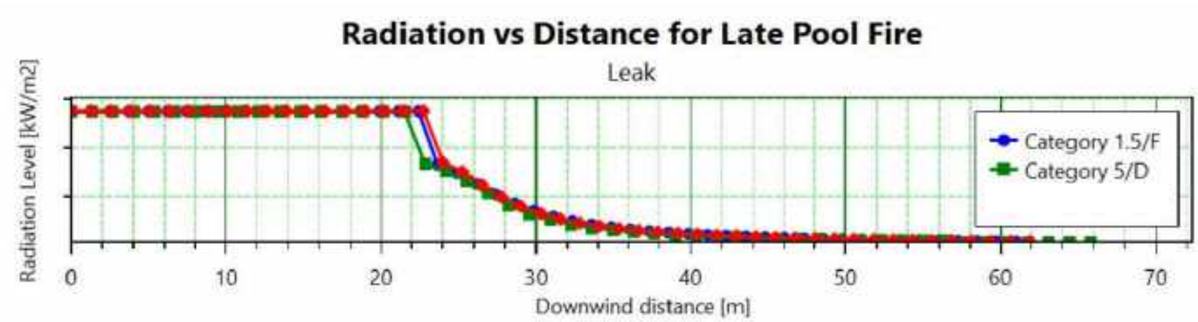
Late Pool Fire (20 mm leak)

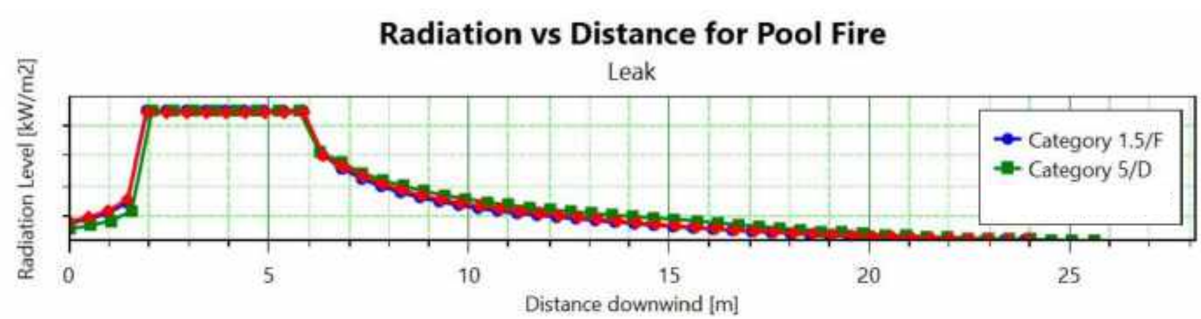
Path	Scenario	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\Atmospheric storage tank	Leak	Category 1.5/F	37.9973	60.9557	39.3291	29.4669
		Category 5/D	34.3484	57.7986	37.3718	28.7251

Flash Fire (20 mm leak)

Path	Scenario	Weather	Distance downwind to LFL [m]	Distance downwind to LFL Fraction [m]
Study\Atmospheric storage tank	Leak	Category 1.5/F		14.7914
		Category 5/D	2.35161	3.70681

The downwind distance of impact due to the release scenario is presented graphically.





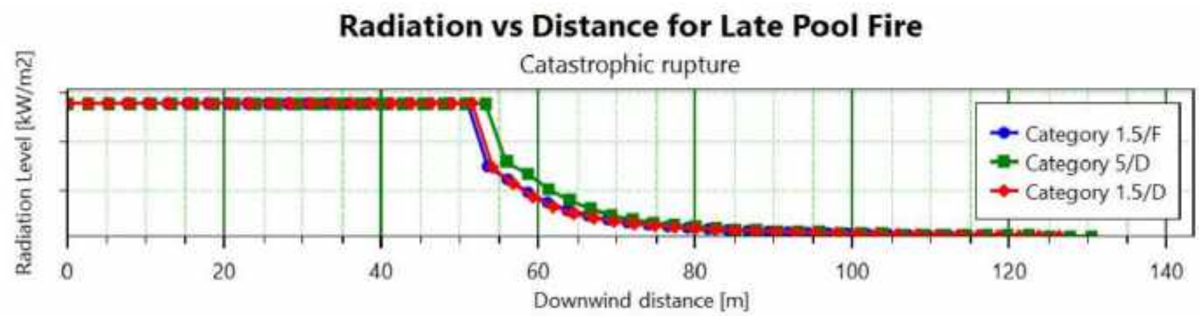
Late Pool Fire (Complete release of containment)

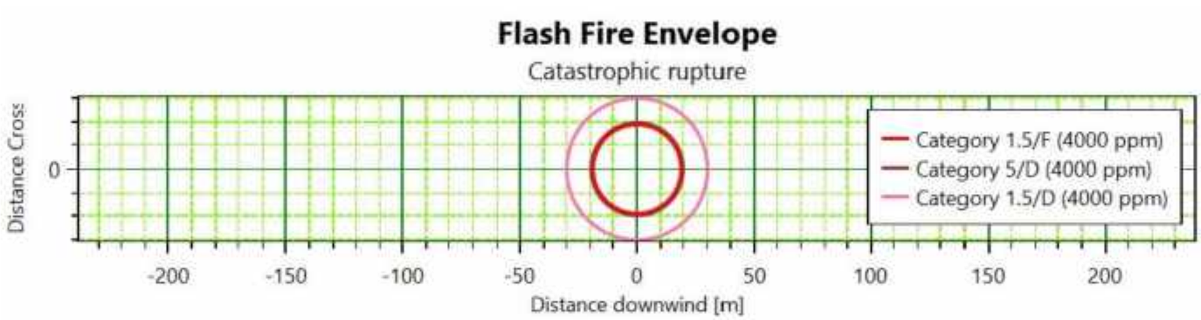
Path	Scenario	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\Atmospheric storage tank	Catastrophic rupture	Category 1.5/F	100.56	124.888	79.6666	61.4025
		Category 5/D	100.497	130.447	82.6828	64.6755

Flash Fire (Complete release of containment)

Path	Scenario	Weather	Distance downwind to LFL [m]	Distance downwind to LFL Fraction [m]
Study\Atmospheric storage tank	Catastrophic rupture	Category 1.5/F	12.3114	18.8241

Category 5/D	11.8949	19.7489





It may be seen that the farthest distance of impact would be at 130.45 if the entire containment of the HSD storage vessel releases and the level of intensity would be 4 kW/m^2. For the intensity level of 37.5 kW/m^2, maximum downwind distance of impact would be 64.67 in case of complete release of HSD.

7.2 Disaster Management Plan

The Offsite & Onsite Disaster Management Plan (DMP) and Emergency Response Plan (ERP) are available for existing facilities in the asset, which would be extended to proposed activities. The scope of the DMP On-site Emergency Preparedness Plan is to evaluate the various types of emergencies that can occur during Drilling and Production activities and to formulate emergency plans,

procedures that can be implemented by ONGC in house. In case the impact of the contingency extends beyond ONGC's capability, the off-site Emergency plan shall be activated simultaneously with the help of District administration.

The following are the main objective of Disaster Management Plan:

- Safeguarding lives both at installations and in neighbourhood.
- Containing the incident & bringing it under control.
- Minimizing damage to property & environment.
- Resuscitation & treatment of causalities.

- Evacuating people to safe area.
- Identifying persons and to extend necessary welfare assistance to causalities.
- Finally, when situation is controlled, efforts are to be made to return to normal or near normal conditions.

Statutory Requirements

1. Oil Mines Regulation, 2017 of Mines Act 1952

Contingency plan for Fire shall be prepared for any oil installation – OMR 72.

2. Environment Protection act and the rules:

In exercise of the provisions under the Environment Protection Act 1986, the 'Manufacture, Storage and Import of Hazardous Chemicals Rules" came into force in November 1989. Under these rules, 'Preparation of On-site Emergency Plan' is covered in Rule No.13 and 'Preparation of Off-site Emergency Plan' in Rule No.14,

Nature of Emergencies

In ONGC, there are three tiers of Emergency Preparedness at Work centres:

Emergency response plan (ERP) On-site DMP off-site DMP

A unit specific emergency response plan prepared by every unit considering the emergency scenarios envisaged in the risk register activated in case the emergency requires mobilization of resources from the other units / Asset.Acts when

- an Onsite emergency spreads beyond the boundary of installation and causes damage to the life or property outside the boundary
- An emergency originated from outside the premises of the installation/Drilling Rig/Work over Rig which is likely to affect the operations of installation.

In case of emergency respective installation activates emergency response plan (ERP) and the emergency is mitigated with the facilities available within the installation. Activated by the Chief Emergency Coordinator (CEC) Requires mobilization of resources beyond ONGC capabilities such as state emergency services.

The ERP is activated by the Installation Manager. Asset Manager will exercise control through the Asset Emergency Control Room (ECR).

Onsite Emergency Organization

The Asset Manager is head of the On-site emergency organization and is designated as the Chief Emergency Coordinator (CEC) at Asset level. He will exercise control through the Asset Emergency Control Room (ECR). The CEC is assisted by an expert team drawn from various disciplines.

The Chief Emergency Coordinator (CEC) will assume control through the Assistant Emergency Coordinator (AEC). The emergency coordinator (CEC) may appoint Surface

Manager / Head Drilling Services / Head Well Services as Assistant Emergency Coordinator (AEC). The flow chart of onsite emergency organisation is shown in Figure 55 below.

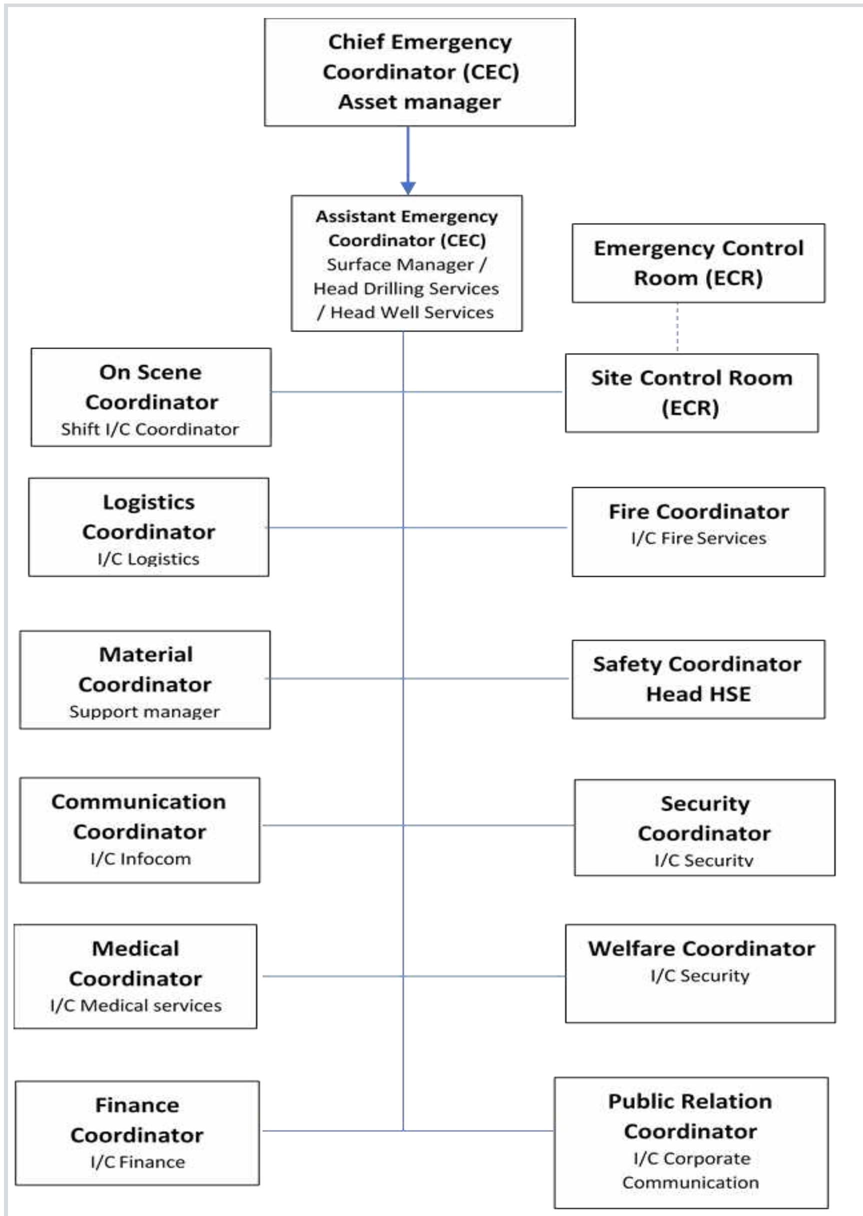


Figure 55. Onsite Responsibility Organization

The specified functions and responsibilities of the different coordinators are elaborated below. These emergency functions become void during the normal time functions.

Chief Emergency Coordinator (CEC): Asset Manager will be the Chief Emergency Coordinator for all the Emergency Management activities at the Emergency Control Centre.

- Establish a control centre and will be In-charge of the entire on-site emergency operation.
- Passing on information to relevant persons and agencies and also warning and advising people who are likely to be affected.
- Convene an emergency meeting of all coordinators to discuss issues such as Rescue operations, Evacuation, Mobilizing the foods and also plans to augment the manpower.
- Get feedback from all coordinators on the latest developments, other information and requirements at frequent intervals to decide on the future course of action.
- Arrange to operate Mutual Aid Scheme through I/c HSE. In case of Major Fire /Explosion, he must get mobilized force and appliance from State / Municipal Fire Service.
- In case On-site emergency is escalating and speeding to an off-site emergency, the matter to be informed to the District Collector to enable them trigger off-site
- Emergency plan activities to combat emergency.
- Assistant Emergency Coordinator (AEC): In case of an emergency in production operations, the I/C Surface Team will assume the responsibilities of AEC. He will work under the orders of CEC. The responsibilities are:
- Assessment of the gravity of the situation and to declare the state of emergency
- Establishment of Site Control Room (SCR)
- Mobilization of resources
- Control of logistic support
- Control of rescue operations
- Supervision of Medical attention to injured
- Oversees all situation reports
- Organizes all Post emergency operations

On-Scene Coordinator (OSC): The senior most person or the Installation Manager will assume the role of OSC, unless otherwise directed. In case of abandoning the installation in distress, the In-charge of the nearest Installation will take over the role of OSC. CEC may also appoint a person from base to take over the task of OSC at Site Control Room.

On-scene coordinator is the key person in emergency situation. After receiving the message, he shall reach the spot immediately.

He will take control of Fire Fighting operation / damage control measures till the arrival of In charge Fire.

– In coordination with Incharge Fire, arrange to take all steps to control emergency situation.

– Closely monitor the emergency situation and change action plan as per need

– In case of Major / Serious Emergency arrange to blow all clear siren when the emergency situation is under control.

Key personnel for respective services, depending upon the nature of the emergency shall arrive at the site to take charge of their respective positions such as Logistics Coordinator, Safety (HSE) Coordinator, Fire Coordinator, Finance Coordinator, Medical Coordinator, Communication Coordinator etc.

Emergency Control Room (ECR) at Base office

An emergency control room (ECR) will be set up at base office in radio room under the control of Chief Emergency coordinator (CEC). Management decisions and plans will be conveyed from ECR to emergency site by AEC. From Site Control Room (SCR) all developments at emergency site will be communicated to ECR at base.

Responding to an Emergency

The procedures for combating emergency situations viz. Blowout at a rig, release of toxic gases in an uncontrolled manner, fire or explosion are defined as emergency procedures. There are written laid out action sequences to be followed while fighting an emergency.

1. A person who detects say a fire, an explosion or a leak of hazardous gas should shout "Fire, Fire, Fire" Help, Emergency as applicable" and communicate the event to the people all around and to Shift I/C by using fire alarm / bell.
2. Should attempt to control or contain the emergency with the available resource if possible.
3. The emergency actions are put into action immediately by the Shift In-charge / Tool Pusher / Rig Manager, who then assumes the role of On Scene Coordinator (OSC). He then accesses the nature of emergency and informs AEC regarding requirement of crisis management team if any to mitigate the emergency.
4. The "Crisis Management Team" arrives at the scene and joins hands with the site crew, other supporting team to further combat the crisis under the guidance of the OSC and AEC.
5. A buddy team is created from the available manpower and kept as standby to the main team.

Emergency procedures in the event of blowout

A blow out situation is a consequence of uncontrolled flow of oil / gas and there is every likelihood of fire being triggered off. To tackle such an emergency situation the flow of action can be divided into following two steps.

Step - I: Action on the spot - On-site.

Step - II: Action of Asset in co-ordination with Basin.

The various functions regarding these steps have been elaborated in the form of action flow sequences and kick control procedures. With a view to avoid overlapping of functions, the various actions required to be taken during a blowout have been identified and the personnel responsible for taking actions have been specified. The position of blowout well being different in different cases the exact action plan of work to control the blowout spill / blowout fire and for capping of the well would be finalized by competent authorities of the Asset / Basin / Headquarters.

Functions of On-Scene Coordinator (OSC):

The OSC will take charge of the situation at the rig and follow the standing instruction given below

- Evacuate all personnel to safe site. Switch off engines and generators.
- Remove and secure all well records.
- Avoid and extinguish all naked flames / sparks.
- Pull out all inflammable materials i.e. HSD, Petrol, Gas Cylinders, Chemicals etc. from well premises.
- Pull out all possible equipment to safe distance.
- Start spraying water on well mouth to keep it cool.
- Cordon off the area and do not allow entry of any unauthorized person. Allow only the persons directly involved in operations to go near blowout well and maintain record of such persons.
- Intimate Emergency Control Room (ECR) at base for deployment of additional manpower, materials, logistics / transport arrangements and technical support if any.
- Keep in touch with ECR through Site Control Room (SCR) for update, feedback and instructions from base.
- Assign responsibilities to the concerned persons to control the situation.
- Evacuate all equipment and materials to safe location if required.
- Make record of following information for forwarding to Emergency Control Room (ECR) at base:

– Well condition.

– Position of drill string / Tubing string in the well.

– Last tubing and annulus pressure recorded.

– Number, Name and Designation of persons at site, measures initiated to meet the

– situation, details of injury / casualty, if any.

Emergency procedure for Control of Kick

A kick during drilling or work over operations is an event preceding a blowout. A blowout situation is never sudden and almost always follows several indications or pointers. A kick is sudden outflow or upsurge of the drilling mud or work over fluid due to unexpected encountering of a gas zone or high-pressure fluids, which throws out the fluids upwards out of the well bore. The kick of the out flowing fluid needs immediate remedial attention lest it assumes a more dangerous form of blowout. The remedial action by the crew and the kick control procedures are elaborated below.

Duty guidelines for Rig operational crew

All operations will be carried out under the control and guidance of the Shift In-charge / Tool Pusher, who then functions as the OSC. When a kick is detected, the Shift In-charge will give a signal and all members of the crew will take up their respective positions. The signals will be in the form of short sirens in a continuous manner from the driller's console.

SHIFT INCHARGE (SIC)	Stand on brake and control as necessary. Supervise all activities to control the situation. Ensure functioning of BOP and choke manifold lines. Ensure help is provided to Chemist in order to maintain mud parameters as directed by authorities. Ensure safe removal of records, men and materials to safe and secure place.
ASSISTANT (SIC)	Be available at control panel of BOP to operate as per direction of RM / SIC / AE(D) / AEE(D) and the guidelines issued to close BOP, install Kelly cock etc. Keep watch on pressure on discharge line, stand pipe and annulus pressure and increase in mud volume in the pit / tanks. Help Chemist in preparation of mud and maintaining mud parameters as required. Ensure operation of degassing unit, if any. Also keep watch for rise in mud level in the suction tank. Work on choke line / kill line of BOP. - Keep watch on the float in the mud pit for loss or gain of mud and inform SIC the status and request SIC to alert site personnel of impending danger.
TOP MEN	Both of them will work on choke-line and valves.
RIG MEN	They will help the SIC in fitting NRV / Kelly etc. and will be available at derrick floor.
RIG ENGINEER (M)	To be near the engine waiting for directives from SIC
FITTER	To be available near the pump and will give pump connection as and when advised by SIC / Chemist.

RIG ENGINEER (E)	To be available near BOP panel board and will attend electrical work if any needed for charging the accumulators
CHEMIST	To liaison with SIC and calculate kill mud weight as per available data and take necessary steps to prepare mud as per requirement. It must be ensured however, it should be checked at the time of kick control and SIC should be informed of condition.
GEOLOGIST	To keep contact with the SIC and keep him abreast of possible reservoir condition and convey the data recorded at Mud Logging Unit.
SECURITY GUARD	To see that no unauthorized person enter the site. He should remain at the drill site and not allow the villagers to assemble near the gate. He should ensure that there is no open fire nearby
OTHERS	To assemble near the bunk house or storehouse within full view of SIC so that any of them is summoned by SIC at the time of need. They should also ensure that there is no open fire at the site and nearby area.

After above mentioned steps are completed, all lines, valves, closed position of BOP are to be inspected by shift In-charge and certified.

Well Kick Shut in procedure for On Land and Jack up Rigs

A well kick shut in procedure for On-land and Jack up rigs as listed below is adopted from OISD STD 174.

i) Shut in procedure while drilling

1. Stop rotary

2. Pick up Kelly to clear tool joint above rotary table.

3. Stop mud pump, check for self-flow. If yes, proceed further to close the well by any of the following methods for shut in the well as shown in the table 65.

Table 65. Shut in procedure during drilling

Sl. No	Soft Shut-in	Hard Shut -in
1	Open hydraulic control valve (HCR valve) / manual valve on choke line.	Close Blow out Preventer. (Preferably Annular Preventer)
2	Close Blow out Preventer	Open HCR/Manual valve on choke line when choke is in fully closed position.

Sl. No	Soft Shut-in	Hard Shut -in
3	Gradually close adjustable /remotely operated choke, monitoring casing pressure.	Allow pressure to stabilize and record SIDPP, SICP and Pit Gain.
4	Allow the pressure to stabilize and record SIDPP, SICP and Pit gain.	-

SIDPP – Shut in Drill Pipe Pressure SICP – Shut In Casing Pressure FOSV - Full Opening Safety Valve

ii) Shut in procedure while tripping

1. Position tool joint above rotary table and set pipe on slips.
2. Install Full Opening Safety Valve (FOSV) in open position on the drill pipe and close it.

Following methods are recommended for shut-in the well as shown in the table 66.

Table 66. Shut in procedure during tripping

Sl. No	Soft Shut-in	Hard Shut -in
1	Open hydraulic control valve (HCR valve) / manual valve on choke line.	Close Blow out Preventer. (Preferably Annular Preventer)
2	Close Blow out Preventer	Make up Kelly and open FOSV.
3	Gradually close adjustable /remotely operated choke, monitoring casing pressure.	Open HCR/Manual valve on choke line when choke is in fully closed position.
4	Make up Kelly and open FOSV.	Allow pressure to stabilize and record SIDPP, SICP and Pit Gain.
5	Allow the pressure to stabilize and record SIDPP, SICP and Pit gain.	

iii) Shut in procedure when string is out of hole

1. Close blind/shear ram.

2. Close adjustable/remotely operated choke and open HCR valve.

3. Record shut in pressure.

Offsite Emergency Plan

The OFF-SITE Emergency Plan for existing processing/production facilities of PML areas in ONGC, Assam Asset is a compilation of various emergency scenarios. It also includes the probable impact on "off the site" due to emergency and the action plan to combat / mitigate the consequences of a disaster situation.

Assessment of Hazard leading to Off-Site Emergency

The hydrocarbons produced from the seven PML locations in Golaghat & Jorhat districts would be was transported to the nearest Gas Gathering Station (GGS) via pipeline. The equipment at the installation mainly consist of bank of separators, storage tanks and oil dispatch pumps. Fire is the most common hazard in a Crude Oil and Natural Gas processing operations and there are also possibilities of explosion and toxic gas dispersion which can arise due to the severe operating and storage conditions. Any incident of the above nature is likely to cause extensive damage to the plant property and personnel. Other than above technical and operational hazards ONGC units also poses disasters due to man-made causes such as Terrorist attack, Bomb threats. The action plan for these scenarios is as below:

a. IED Attack

Primary rule

If a suspected device is encountered, it should not be handled, and the area should be secured. Improvised explosive devices are very unstable. They are extremely sensitive to shock, friction, impact, and heat, and may detonate without warning. Even the smallest devices can cause serious injury or death.

Secondary rule

- Always assume that there is more than one device present, whether any other bomb or a device has been located.
- Package-type IEDs: Institute security procedures in receipt and dispatch section and instruct employees on how to recognize suspicious packages.
- Luggage-type IEDs: Train security personnel and employees regarding unattended packages of any type. Never pick up or open any suspicious package or piece of luggage. If an IED is discovered, call the police and do not touch the device.
- Vehicle-borne IEDs: Perform a vulnerability/threat assessment for the facility with special attention to this type of explosive delivery mechanism. Consider the use of enhanced security away from your key buildings (such as a vehicle checkpoint) or the use of bullards or barriers to block vehicular access to building entrances.

b. Chemical Attacks

A chemical emergency occurs when a hazardous chemical has been released and has the possibility of harming people"s health. Potentially lethal, chemical agents are difficult to deliver in deadly amounts. If released outdoors, the agents often dissipate rapidly. As such, the most lethal area for a chemical release is inside a confined space, such as a building, public place, or subway system.

Industrial chemicals, while not as lethal, can be just as effective if released in sufficient quantities. Chlorine, ammonia, benzene, and other toxic chemicals are routinely transported through densely populated areas in rail tankers or truck tankers and could be the target of a terrorist attack.

Chemical terrorist attacks will most likely be overt because the effects of most chemical agents are immediate and obvious. Your response will have to be thought out and practiced in advance to be effective.

Evacuation

Some types of chemical emergencies will require evacuation from the immediate area. If you are up-wind and in the open, evacuate up-wind and away from the incident. Cover your mouth and nose with a damp cloth. If you have been exposed, you will have to be decontaminated by first responders.

Shelter in Place If you are already in down-wind and/or in a multistory building, you may be instructed to shelter in place or to make that decision on your own. Most likely you will only need to shelter for a few hours. The procedure includes:

– Go inside as quickly as possible shut and lock all windows and doors; turn off all HVAC equipment and any fans.

– If you have multiple floors, go as high as practical, three to five floors. (Most chemical agents are heavier than air. .If you have duct tape, tape over door and window cracks, vents, electrical outlets, and any opening to the outside.

– Wait for instructions from first responders before leaving.

c. Biological Attacks

A bio-terrorist attack could happen in any workplace, yet most company personnel know little about potential bio-toxins or bio-pathogens or how to recognize these agents and respond in the event of an attack.

There are several ways a bio-terrorist event may manifest itself. The biological event may result from a covert attack. A covert attack may be unleashed by the receipt of an object, such as a package or piece of mail, accompanied by a warning or threat.

Biological agent release also could occur via the ventilation system (HVAC) in a building, where dispersal could take place within a matter of minutes. Because the covert release is not witnessed, the effects of such an event can be widespread and difficult to isolate or recognize. While terror is intended to produce casualties, disruption, and fear, the use of biological agents is particularly injurious.

Biological attacks are delayed events. The sudden appearance of generalized symptoms in victims who present themselves to medical providers may initially disguise the true source of exposure. Only when a trickle of patients turns into a flood or mysterious pathogens quickly make their presence felt does the magnitude of the event reveal itself.

The goal of the medical care community (i.e., hospitals, physicians, and other health care providers) is to recognize and diagnose the disease (which frequently may be unfamiliar to most clinicians) and to provide treatment. The goal of public health authorities is to detect and control the outbreak of the illness. Public health officials will focus on identifying and treating exposed persons and preventing the spread of disease. In response to a covert release, it is important for ONGC health officials to recognize the signs and symptoms of an emerging disease among employees.

If an overt release is recognized, take immediate action to isolate the exposed employees and/or area of agent dispersion and to remove others from the area of release. Notify local public health authorities immediately and follow their directions. Decontamination may also be warranted in response to an overt release.

d. Radiological Attacks

A radiological weapon or “dirty bomb” is a crude device that combines a conventional explosive with highly radioactive material. When detonated, the blast vaporizes the radioactive material and propels it across a wide area. The main danger from a dirty bomb is the initial blast, which could cause serious injury or property damage. The radioactive materials will likely not be concentrated enough to cause immediate serious illness, except to those very close to the blast site or those who inhale smoke and dust. Dirty bombs are designed to cause tremendous psychological damage by exploiting the public’s fear of radiation. These are not weapons of mass destruction, but weapons of mass disruption aimed at wreaking economic havoc by making target areas uninhabitable for extended periods. There are three basic ways to reduce the exposure:

- Reduce the time near the source of radiation,
- Increase the distance from the source of radiation,
- Increase the shielding between person and the source of radiation. Shielding is anything that puts distance and mass between person and the radiation source.

Evacuation

If a person is outside, evacuate up-wind from the blast site cover the nose and mouth with a wet cloth to reduce the risk of inhaling radioactive smoke or dust. Once out of the immediate area, seek shelter and wait for instructions from first responders. If individual has been exposed to dust or smoke, follow the decontamination procedure. Shelter in Place If a person is close to the blast and inside a building, stay inside if the building is intact. Move to the basement and turn off all HVAC equipment and fans bringing in outside air it is not necessary to seal doors and windows, but it may be helpful. Wait for instructions from first responders.

Reporting of an Off-Site Emergency

The off-site disaster management plan will be put into action in the following situations:

a) In case of an Onsite emergency spreads beyond the boundary of installation and causes damage to the life or property outside the boundary.

b) In case an emergency originated from outside the premises of the installation/Drilling Rig/Work over Rig which is likely to effect the operations of installation.

The off-site emergency requires mobilization of resources beyond ONGC capabilities such as state emergency services. In case of an off-site emergency, the On-site Chief emergency coordinator (Asset Manager) will report the matter to the District Collector, who is Chairman of District emergency committee. Further, the Chairman will mobilize other members of District Emergency committee as per the organization Chart for an Off-site emergency management presented in the figure 56.

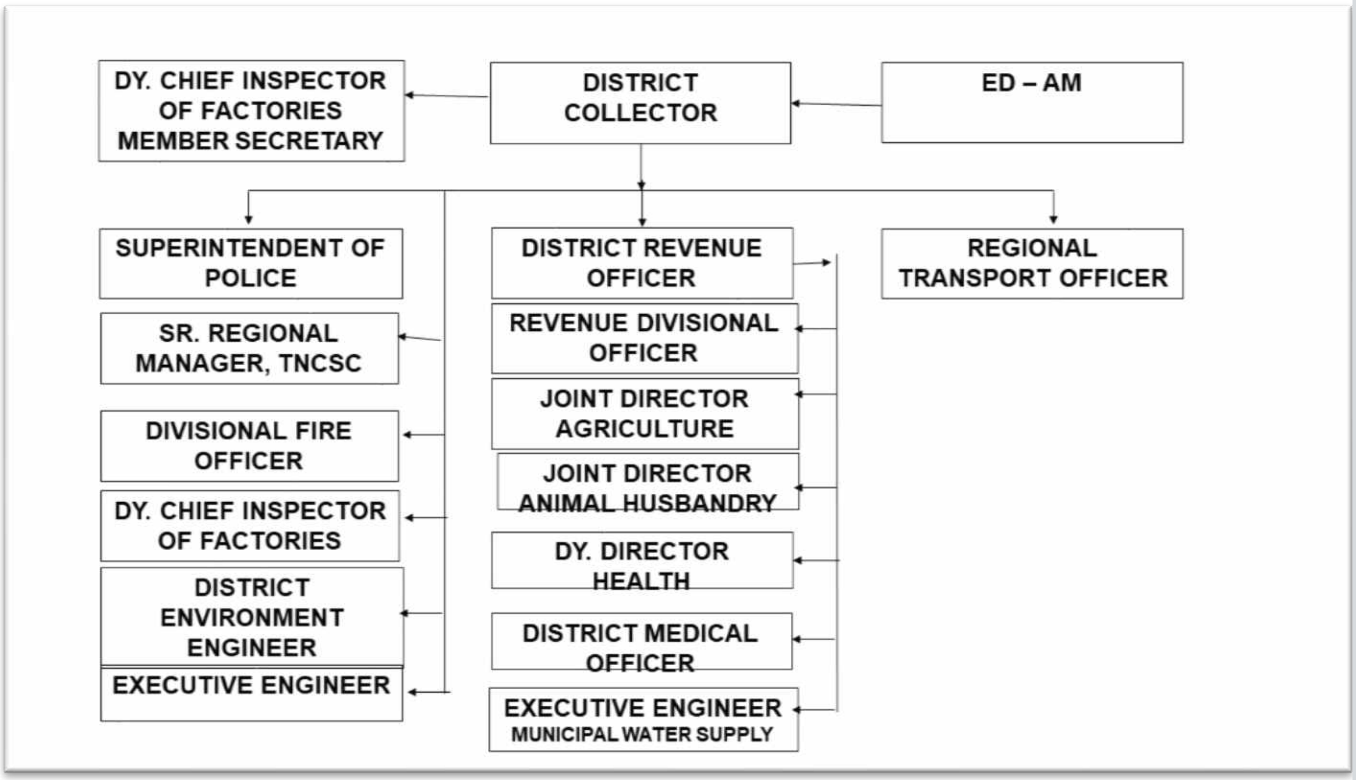


Figure 56. Offsite Emergency Management flowchart

Communication to Corporate Disaster Management Group (CDMG)

The Chief Emergency coordinator shall immediately inform CMD, Director (HR),-CCEC, Director-concerned and Director-I/C HSE on the situation and his assessment for intervention of Corporate Disaster Management Group (CDMG).

Functions and responsibilities of emergency Committee

When a call is received from On-site Emergency coordinator regarding emergency / disasters, District Collector of district, who is also chairman of the District Emergency committee, will initiate the district level action plan to combat the emergency. Responsibilities of Chairman of District Emergency Committee

i. Take overall responsibility for combating the off-site emergency.

Declare an area of 500 m or up to 1.5 Kms as felt appropriate around the site as a "Hazardous Zone".

ii. Inform the District Police, Fire Personnel to combat the emergency. Arrange if necessary, for warning and evacuating the public from the villages by the Superintendent of Police.

iii. Inform the Executive Engineer of state electricity department to give uninterrupted power supply or de-energize power supply, as required.

iv. Inform the Revenue Divisional Officer (RDO) and District supply officer to provide safe shelter, food and other life-sustaining requirements for the evacuees.

Responsibilities and duties of members of Service group

In the implementation of the Off-site emergency plan a service group will assist the Collector of respective district. This group consists of the following members from the district area & has responsibilities as indicated.

District Collector	Press and Public relations
Superintendent of Police	Warning & Advice to the public security measures, Rescue & evacuation
District revenue Officer	Coordinates transport, civil supplies, Health, medical and other services
Revenue Divisional Officer	Rallying post
Regional Transport Office	Provide transport
Deputy Director Health	To take care of Public Health & Preventive medicines
Sr. Regional Manager, GCSC	Catering to the evacuees and others involved in the relief measures
District Medical Officer	Treatment of affected persons
Divisional Fire Officer	Help in firefighting operations & rescue
District Environmental Engineer	Advice for protection of environment and reduction in environmental losses
Joint Director, Animal Husbandry	Taking care of cattle in the affected area.
Joint Director, Agriculture	Taking care of standing crops
Executive Engineer, GEB	Ensuring uninterrupted powers supplies deenergizes power supply as required.

Mock Drill for Onsite and Off-Site Emergency Management

ONGC may conduct Mock Drill to check the efficacy of Onsite and Off-site Emergency plan for review and updation in association with Government officials. Once in every year this plan will be practiced on field mock exercise involving dramatized scenarios to test the communication system, action plan and response of all Key agencies within ONGC and Government officials. Such on field mock exercise will be selected from high risk areas and near real approach of actual fire fighting / evacuation operations will be undertaken. An emergency will be alerted through different types of Siren Sound Code example fire, explosion, toxic release etc. Siren codes as per OISD STD 116 reproduced in the table below will be followed.

Emergency Siren Codes	
Scenario	**Siren Sound Code**
Major Fire	A wailing siren for two minutes. Siren should be sounded three times for 30 seconds with an interval of 15 seconds.
Disaster	Same type of siren as in case of Major fire, but the same will be sounded for 3 times at the interval of 02 minutes.
Gas Leak	A wailing sound for 2 min. 5 times for 20sec at 5 sec interval
Blow-out with Fire	same as „Major Fire" Siren
Blow-out without Fire	same as „Gas Leak" Siren
Air Raid	As per guidelines of Air Defence Dept. of the area.
All Clear	Straight run siren for 2 minutes
Test Run	Straight run for 2 minutes

(Reference: OISD-STD 116, page 26)

Figure 57. Emergency Siren Codes

Note: Sound for Gas situation and blow-out sirens have been devised internally, as it is not mentioned in OISD-116. During mock drill exercise observers would be appointed in key areas to take note of individual responsibilities, response time and lapses. Every mock exercise will be followed by "post – mock-drill meeting" to discuss the findings of observers and shortcomings. The lessons learnt from such exercises will be summarized in the form of a report to improve upon the overall preparedness and will also be used as inputs for updating the plan to the extent necessary. If in any case the exercise cannot be carried out due to operational reasons the same shall be done as the table top exercise to test the communication system, action plan and response of all Key agencies within ONGC and Government officials.

Blow Out Contingency Plan

The Contingency Plan for Blowout is shown in the figure below.

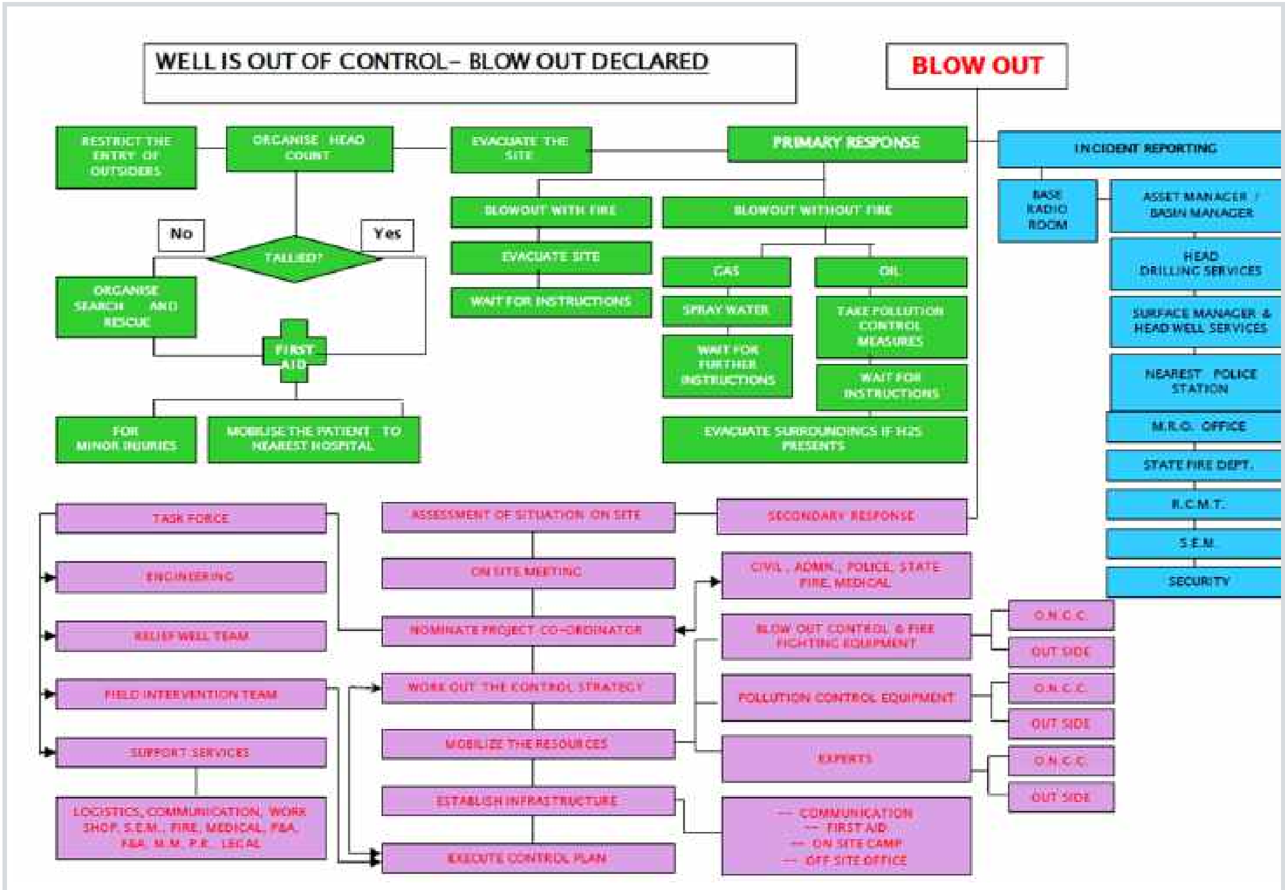


Figure 58. Blow Out Contingency Plan

8. Project Benefits

The proposed onshore development project would establish the potential of hydrocarbons in the region. The development of the oil block would result in appreciable growth of service and would also general direct or indirect employment and opportunities in the adjoining area. The major benefits of the project include reduction of the oil . The major benefits of the project include reduction of the oil import bill of the nation as well as reduction of the imbalance in oil production and consumption.

The commercial development would also lead to investment in Assam, bringing oil and gas revenues both to the State and to the Central Government.

8.1 Revenue earning of central and state government

ONGC has been allotted the PML Blocks in Assam Arakan Basin by Government of India under the revenue sharing contract for exploration and development drilling of hydrocarbon. Due to hydrocarbon discovery and then its production, use & sell, central as well as state government would get benefited.

8.2 Employment Potential

The employment of local people in primary and secondary sectors of project shall upgrade the prosperity of the region. This in-turn would improve the socio-economic conditions of the area. In case of development drilling in the Block, considerable number of people would be benefited by provision of services to the residents including hotels, restaurants, transport services etc. Thus, the direct and indirect employment generation by this project.

8.3 Corporate Social Responsibility

ONGC has already developed various CSR programme in and around its present operational area as per the CSR Act and Rules, Government of India. CSR measures would be taken up in case of commercially viable hydrocarbon discovery, and further full-fledged development of the hydrocarbon block and production and associated facilities.

8.4 Proposed CER Strategy

ONGC would comply with the 1st May 2018 OM w.r.t. CER and the cost would be assessed on actual project capex expenditure of that particular financial year.

9. Environmental Management Plan

9.1 Introduction

The environmental management plan and monitoring framework is a site-specific document, for the purpose of exploration and development drilling of hydrocarbons that has been formulated to ensure that ONGC can operate the proposed project through a environmentally conscious manner and where all individuals associated with the project could understand the potential environmental risks arising out from the proposed project and take appropriate mitigation measure to manage such risk.

This EMP will be an overview document that will guide environmental management of all aspects of ONGC's activities i.e. construction and operation of exploration/development wells, GGS and Pipelines within the PML. This EMP will be backed up by more specific Environmental Action Plans, Procedures and Bridging Documents with the progress of the well site preparation, development drilling, well testing and site decommissioning activities.

9.2 Purpose and Objectives of the Environmental Management Plan

The purpose of EMP is to provide a delivery mechanism to address the ill environmental impact of a project during its operational phase, to increase the project benefits and to introduce standards of good practice to be adopted for all project related activities.

The primary objectives of the EMP are:

- Facilitate the implementation of mitigation measures for identified Adverse Impacts;
- Define the responsibilities of the Project Proponents and Contractors in order to effectively implement the Environmental Management Plan;
- Define a Monitoring Mechanism and identify Monitoring Parameters in order to:
    - Ensure the complete implementation of all Mitigation Measures;
    - Ensure the effectiveness of the Mitigation Measure;
    - Provide a mechanism for taking timely action in the face of Unanticipated Environmental Situations;
- Identifying training requirements at various levels.

9.3 HSE Policy of PML operator

The use of hydrocarbon will depend not only on technical, economic and political decisions but increasingly on environmental considerations and its impact. Project proponent would continue to conduct its activities in a professional and effective manner and comply with the legislative requirements and when found non-complaint, would promote creative measures and internal standards for safeguarding of Health, Safety &

Environment to a possible extent, for all who may directly or indirectly be affected by any of the activities.

Personal Safety and Employee Health should be the prime responsibility, followed by the protection of the Environment and organisation Property. ONGC would continue to take a positive approach towards creating safe work environment for all employees and would be concerned for promoting safety education and training for all employees and ensuring a detailed evaluation of any accidental incidents.

ONGC would put an effort to address the Environmental and Health impact of the operations by reducing Waste, Emissions, discharges and by using energy efficiently. The organisation would maintain awareness of HSE matters. This awareness is achieved through Education, Communication and definition of the goals and standards appropriate to operation and project related activities. The HSE policy of ONGC is mentioned in figure 59.

शशि शंकर
Shashi Shanker
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लि.
Oil and Natural Gas Corporation Ltd.

HSE Policy

1. We are committed to maintain highest standards of occupational health, safety and environmental protection with effective HSE risks management.
2. We shall comply with all applicable legislations, codes, standards and requirements to promote occupational health, safety and environmental protection for sustainable development.
3. We shall always be alert, equipped and ready to respond to emergencies through effective and updated Emergency Response Plan.
4. We shall take all actions necessary to protect equipment and the integrity of the system to avoid accidental release of hazardous substances for minimizing environmental pollution.
5. We shall enhance awareness and involvement of all the stake holders in promotion of occupational health, safety and environment protection.
6. We shall set targets against the international benchmarks and strive to promote safety culture for continual improvement.

Shanker

(Shashi Shanker)

Dated : 11th December, 2017

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Figure 59. HSE Policy of ONGC

9.4 Organisational Structure and Responsibilities

This section would provide an organisational structure for Environmental Management during the proposed drilling project and evaluates the role and responsibility of some definite individuals through the duration of the project.

Management Approach

The management approach for the proposed project is summarized below:

- Project Proponent: The overall responsibility for compliance with the Environmental Management Plan and legal requirements lies with the Project Proponent.
- Contractor: The Contractors (Civil, Drilling and Others) would be carrying out field activities as part of the Development Drilling project. The contractors would be subjected to certain liabilities under the environmental laws of the country, and under their contract with the project proponent.

A certain degree of redundancy is unavoidable across all management levels, but this should be in order to ensure that compliance with the environmental management plan is cross checked and properly implemented.

Other essential features of the EMP are:

- Project proponent would appoint a site Manager to oversee HSE compliance throughout the duration of the Drilling Program. HSE Officer/ Safety Officer as per DGMS would be assisting him in implementation and monitoring;
- Project Proponent would ensure that all contracts comply with the requirements given in the Environmental Management Plan;
- Project Proponent would also cooperate with regulatory agencies (such as the State Pollution Control Board, CPCB, DGMS, OISD, MoEF&CC) who might send their own teams to monitor the activities during the Drilling Program.

Organisational Responsibilities

The core features of the environmental responsibilities of the organisation is summarized below:

Primary Responsibilities

- The primary responsibilities for the environmental performance of the Project Proponent & the Contractors would be assumed by their senior level officers during the project period.
- Site Manager would be responsible for the Organisation's compliance with the EMP throughout the project.
- The contractor would develop the main responsibility for all environmental matters pertaining to their work.

- Project Proponent would coordinate with relevant Government Departments.

Site Management and Quality Control

- Conducting Drilling Activities in an environmentally sound manner will be the responsibility of the Drilling Contractor/Company.
- Project proponent's Safety Officer (Drilling) will be responsible for the overall environmental soundness of all field operations.

Job Supervision and Monitoring

- Project proponent has a safety officer, who is responsible for ensuring compliance with the EMP during the drilling operation. He is also responsible for communicating with and training the Drilling Crews in all aspects of the EMP.
- HSE coordinator would be responsible for all the environmental issues and for the environment management plan in the site.

The organisational structure of environmental management team of ONGC is presented in figure 60.

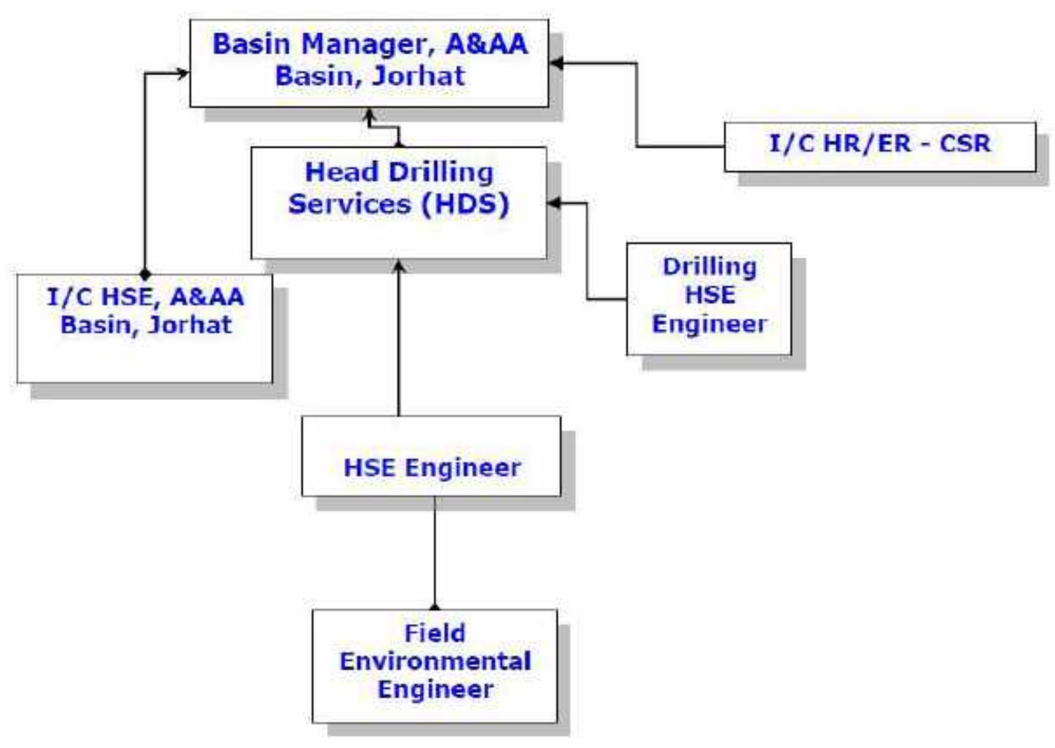

Figure 60. Organisational set up of ONGC

9.5 Mitigation Plan

The mitigation plan is the crucial component of any EMP. It documented all potential impacts of the project and their associated mitigation measures identified. For each impact, the following information is presented in the plan:

- A comprehensive documentation of impacts and associated mitigation measures.
- Actions required to implement the EMP in the site.

The mitigation plan for proposed exploration and development drilling is enlisted in Table 67 (prior drilling), and Table 68 (during drilling):

Table 67. Mitigation Management Matrix (Prior to Drilling Phase)

Impacts	Proposed Mitigation	Required Action	Responsibility
Obtain necessary approvals from State Government for site construction and Project operation.	• Ensure that all necessary protocols are followed, and legal requirements implemented. • Ensure that appropriate legal requirements (Land Acquisition Act) have been met with regard to land occupancy, land ownership or usage rights, notice & compensation, etc. • Establish and clearly document all land agreements with owners,	• Project proponent to initiate interaction with the concerned officials in the State Government, prior to release of actual location to identify necessary permits and the approval mechanism. • Apply for approval for Land acquisition with proper toposheet maps and prescribed fees. • Preliminary site survey to be carried out by block Project	ONGC

Impacts	Proposed Mitigation	Required Action	Responsibility
	users and state authorities & mark out site boundaries.	proponent's civil works consultants to mark the road & site requirement on ground.	
Soil Erosion	• Minimize the extent of site clearance area, by choosing best layout with respect to existing topography. • Minimize removal of trees at site. • Collect topsoil during site preparation and stockpile the same to be used to the extent possible for site restoration later.	• Detailed contour maps of the site to be prepared with big trees marked on it to work out the best layout to minimize cut & fill & avoid cutting of trees. • Plan to minimize tree cutting prior to site construction and ensure implementation on ground during site construction phase. • To provide retaining walls to arrest flow of cut earth to nearby areas and to check that arrangement is in place for collection.	ONGC

Table 68. Mitigation Management Matrix (During Drilling Phase)

Impacts	Proposed Mitigation	Required Action	Responsibility
Waste and Effluent Management			
Contamination of rain/storm water runoff with rig wash water & waste mud	Detailed drainage design will be developed as a part of the site design. It will be ensured that mud and associated drainage system is isolated from the rain/ storm water drainage system.	• Project proponent in association with Civil Works Consultants/ contractors to develop detailed drainage system addressing concerns outlined here. • Install and maintain effective run-off controls, including silt traps, straw barriers etc.	ONGC, Drilling Contractor & Civil team
	Pits must have adequate capacity to prevent flooding during high rains (maintain free board) and should be fully bounded.	• Project proponent to work out required pit volumes based on maximum case scenario including rainwater.	
Wastewater & cuttings may contain trace amounts of drill fluid and residual chemicals.	All wastewater, which will be generated from washings & spent mud will be contained in HDPE lined pits and will be solar evaporated.	Site design will include adequately sized pits to contain wastewater for solar evaporation.	Site Manager-ONGC Drilling Contractor-HSE
	Cuttings will be dried to maximum extent possible using suitable equipment and will be contained in separate pits, before final disposal as per direction from Regulatory Authority.	Drier system to treat the cuttings coming from the shakers to achieve fairly Dry cuttings.	
	The water generated during drilling operation is likely to have very high	Mobile ETP part of the drilling rig will be used for treatment and if any excess water, it will be sent to	

Impacts	Proposed Mitigation	Required Action	Responsibility
	turbidity and salt contents. This water will be treated in ETP and the treated water after conforming to MoEF&CC standards will be discharged to Effluent Injection Well.	permanent ETP attached with GGS (nearby ML areas).	
Fuels, Lubricants and Chemicals Management pose threat of major, moderate & minor spills	Prepare a comprehensive Oil Spill Contingency Plan (OSCP) to handle all major, moderate & minor spills.	Implementation of OSCP will be ensured.	Site Manager-ONGC Drilling Contractor-HSE
	Keeping all fuels, lubricants and chemicals in well designed storage facility with regular inventory checking.	Checklist of all drums and containers located within footprint of the storage area will be prepared.	
	Ensure that OSCP is implemented during operations.	Training and awareness programme would be developed among all workers associated along with mock exercises.	
Contamination through oil/lubricant spills and leaching	Used and unused chemicals would be stored in a lined & bunded area.	The lined & bunded area for the diesel tank would have extra space to contain used and unused lubricants in drums.	Site Manager-ONGC Drilling Contractor-HSE
	• Executing delivery of fuel to drilling site under strict supervision and carrying out refueling operations in a area with impervious flooring and	• Keeping an inventory of all fuelling and refuelling operations. • Impervious liners in place for fuel, lubricants storage area. Fuel/lubricant containment and generator area to have drains with oil Entrapment provision.	

Impacts	Proposed Mitigation	Required Action	Responsibility
	surface drainage. • Use of suitable fuel delivery vehicles.	• Check all delivery trucks for suitability & ensure that they meet safety requirements.	
	Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials. To be used for fuel/lubricants storage area	Site design to incorporate bund requirement for the fuel/lubricant storage area.	
Major Spills	Non-contaminated and contaminated runoff will be kept separate. Non-contaminated runoff will be routed to offsite area. Potentially contaminated runoff will be treated.	Ensure separate runoff routes during site design.	Site Manager-ONGC Drilling Contractor-HSE
	Major Spills: OSCP could be in place and associated equipment and tools should be available.	• These spills will be handled and controlled with special care and the soil contaminated with oil will be sent to Bioremediation site. • All spills/leaks contained, reported and cleaned up immediately.	
Noise and Vibration			
Noise and Vibration	Checklist of all machineries with record of date of procurement, installation etc.	Maintain data log book.	Site Manager-ONGC

Impacts	Proposed Mitigation	Required Action	Responsibility
	Periodic maintenance of all machineries.	Maintenance log book for all machineries.	Drilling Contractor-HSE
	Implementation of good working practices to minimize noise.	• No machine would be operated when not required. • Selection and use of low noise generating equipment equipped with engineering controls viz. mufflers, silencers etc. • Set up effective noise barrier.	
	Use of ear protector, when appropriate.	Project proponent has to distribute noise protection equipment and ensure utilization of the same.	
Air Emission			
Air emission	Operate all equipment within specified design parameters.	Ensure proper maintenance of equipment.	Site Manager-ONGC Drilling Contractor-HSE
	Minimize emissions during well testing.	• Effective separation of Oil & Gas to be achieved and the separated oil will be transported to nearest ONGC installation. • Flaring will be undertaken in accordance with the SI No.72. B CPCB Guidelines for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry. • Duration of flaring will be minimized by careful planning and High combustion efficiency	
	Exhausts of engines on the drilling rig	Preventive maintenance of DG sets will be undertaken	

Impacts	Proposed Mitigation	Required Action	Responsibility
	diesel generators would be positioned at a sufficient height to ensure dispersal of exhaust emissions; engines will not be left running unnecessarily	as per manufacturers schedule to ensure compliance.	
	Watering of unpaved roads if required to control dust generation.	Ensure absence of stock piles and open containers of dusty material.	
Solid Wastes			
Wastes will include organic wastes, scrap metal, waste oil & chemicals, sacks, medical wastes, etc.	Ensure proper documentation of all wastes generated.	Pre-operation inspections to ensure waste disposal facilities are in place.	Site Manager-ONGC Drilling Contractor-HSE
	Litter and debris not to be discarded at site and to be segregated at segregation pit on the well site.	Well site must be equipped with segregation pits.	
	Material such as scrap metal, waste oil will be disposed of in a controlled manner through authorized waste contractors.	Project Proponent to arrange for proper disposal and waste recycling contractors.	
	Non-Toxic Biodegradable Waste to be buried during operations and de-commissioning, ensuring that local water resources are not contaminated in any way.		
Accidental Events			
Loss of well control	Proper well design, which will ensure that the hydrostatic weight of mud will overcome formation pressure.	Well monitoring equipment to detect influx from reservoir. Pressure detection service provided through Mud-logging.	

Impacts	Proposed Mitigation	Required Action	Responsibility
	Proper drilling program design to ensure selection of properly rated BOP equipment.	Blowout preventers tested on installation and routinely.	
	Ensure that the supervision team & Rig Contractor's relevant operating personnel are trained to handle well control situations and hold relevant Well Control Training Certificates.	To ensure key personnel to have International Well Control Forum (IWCF) certificates.	Site Manager-ONGC Drilling Contractor-HSE
Well kicks, Blow out etc.	• To detect well kicks immediately to prevent blowouts. • Ensure advanced detection system is in place and BOP equipment is well maintained.	• Advance instrumentation system and Mud Logging unit should be available. • Gas Detector or Explosion meter will be provided at primary shale shaker and connected to audible or visual alarm near the Driller Stand.	
Socio economic Impacts			
Socio economic impacts	• Ensure no water (surface or ground) contamination occurs from drilling operations. • Undertake social welfare projects for the local communities through CSR strategy.	• Implementation of proper waste management plan and undertake water quality monitoring before and during the drilling operation. • Implementation of social welfare activities through ONGC's CSR scheme.	CSR team-ONGC

9.6 Environmental Training

HSE training would ensure that the requirements of the EIA and EMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel would be lie on ONGC. ONGC would train the site staff, the drilling contractor, and other staff engaged by for the project. Training would cover all staff levels, ranging from the management and supervisory to the skilled and unskilled categories. The scope of the training would cover the requirements of the EIA and the EMP, with special emphasis on sensitizing the project staff to environmental, social and tribal context of the area.

The Drilling In-charge will conduct Pit Level Meeting, Job Safety Analysis and Tool Box Meeting for the Staff and the Contractor Staff to better appreciate environmental risks and their mitigation measures. This would be undertaken after conducting audits on the operations. SOP and provisions of the Mines Act and relevant OISD standards should be discussed with Rig Operator.

9.7 Waste Management Plan

For the proposed drilling activity, it is expected that the drill cuttings would be free from oil and may not be considered as hazardous, provided it is out of the purview of concentration criteria laid down under the Rules. The sludge from the proposed drilling operations may free from oil by providing suitable pre-treatment measures. However, as per the Rules, any chemical sludge generated from wastewater treatment is considered as hazardous. Therefore, the chemical sludge from the wastewater treatment at the proposed Developmental Drilling can be rendered as hazardous.

The Drilling Mud and Other Drilling Wastes also considered as hazardous. However, based on sampling and analysis carried out through a recognized laboratory after the end of the drilling phase, if it is proved that the drilling mud and other drilling wastes do not contain any of the constituents mentioned in HWM Rules to the extent of concentration limits specified therein, the wastes may not be treated as hazardous.

Project proponent would require prior authorization from the State Pollution Control Board for treatment, storage, transportation and disposal of any hazardous waste generated at site during drilling operations. 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. To facilitate field level implementation, a Waste Management Plan is proposed, which will be subject to fine tuning before the start of the operations. This Waste Management plan is presented below in Table 69.

Table 69. Proposed Waste Management Plan

Category	Waste type	Proposed Action	Responsibility	Reporting object	Highest Authority
Drilling wastes	Drill cuttings	To be stored in HDPE lined pits on the well site. The pits would be bunded and kept covered with Tarpaulin sheets during monsoons. At the close of operations, if leachate analysis performed on properly washed and reasonably dried drill cuttings, showed, that it is non-hazardous in nature, then it can be disposed of as inert material either into a cuttings pit onsite or offsite or taken for beneficial use in construction of roads or spreading on land in the local area or land filling. For disposal on site, the waste pit after it is filled up will be covered with impervious liner over which a thick layer of native top soil with proper top slope will be provided. If found hazardous, disposal can be done onsite or offsite as per the approval of the State Pollution Control Board or to dispose it in some existing secured landfill operating in the region.	Drill contractor-HSE	Verify that volume of pit is adequate for storage of cuttings from the drilling site. Leachate analysis to be done on completion of the well from a recognized lab.	ONGC
	Unused Drilling Mud	As per GSR 546, the un-used drilling mud will be stored in HDPE lined bunded pit on site and solar evaporated.	Drill contractor-HSE	Check integrity of the HDPE lined pit.	ONGC
	Drilling and wash waste water	All wastewater, which would be generated from washings & spent mud would be contained in HDPE lined pits	Drill contractor-HSE	Check integrity of the HDPE lined pit and volume of	ONGC

Category	Waste type	Proposed Action	Responsibility	Reporting object	Highest Authority
		and will be solar evaporated, which is permissible as per GSR 546.		waste water generated.	
	Chemical sludge (generated as a product of waste water treatment)	The treatment of the sludge so generated can be for pH correction, if any, followed by dewatering either in centrifuge and or solar evaporation. The treatment is to be ensured in a pit properly lined with impervious HDPE liner. Disposal is dependent on establishing non-hazardous or hazardous nature after the end of operations.	Drill contractor-HSE	Check integrity of the HDPE lined pit. Volume of the sludge generated. Testing for stipulated standards from recognized Labs before deciding final disposal.	ONGC
Oily waste	Used oil	Oil changing activity is allowed only at the rig site. Oil to be collected in designated containers at the Rig site. Ensure that the used oil drums are safely transported to the approved recycling contractor.	Drill contractor-HSE	Collection and storage of oil. Used oil drums safely transported and sent to approved recyclers.	ONGC
Domestic waste	Sewage (Black water)	Domestic wastewater (sewage and sullage) would be generated from each drilling site. The treatment proposed for the domestic water through installation of a modular STP to be provided at a drilling site.	Drill contractor-HSE	Dimensions of pits, Integrity & maintenance of the pits, level of sewage in the pits.	ONGC
	Waste water from kitchen (Grey water)	All grey water to be channelized into STP. treated waste water will be sprinkled on the project access road.	Drill contractor-HSE	Dimensions of pits, Integrity & maintenance of the pits, Level of grey water in the Pits.	ONGC

Category	Waste type	Proposed Action	Responsibility	Reporting object	Highest Authority
				Check availability of grease collection pit and frequent collection of grease, regular checking of wastewater level in the pit.	
Recyclable waste	Tin packs, plastic and glass bottles and other metallic materials	To be properly segregated and temporarily stored in segregation pit at well site. Deliver to Approved Recycling Contractor	Drill contractor-HSE	Ensure daily collection of waste to the pit, segregation and storing of waste at the site. Sending of waste to Recycling Contractor.	ONGC
Bio medical waste	Medical waste (waste generated from First Aid Centre)	To ensure the availability of specified boxes, use of syringe cutters. Waste to be properly separated and stored temporarily at site separately from other wastes. Medical waste to be transported to the hospital capable of handling waste.	Medical officer (Doctor)	Segregation and transportation of waste as per Bio-Medical Waste (Management & Handling) Rules, 2011	ONGC

9.8 Restoration and Rehabilitation

The Restoration and Rehabilitation plan will identify all the activities which would be performed during the restoration of a particular site in case the well is not economically/commercially viable, and no further use of that particular well bore is envisaged or even during well suspension.

Well Abandonment

After well testing and evaluation, a decision on whether to abandon or develop the well will be taken. If no indications of a commercial quantity of oil are encountered either before or after testing, the well will be declared dry, accordingly plugged and abandoned, and the site restored in line with local regulations and good industry practice.

The abandon drill sites would be restored and rehabilitate as per the Standard Operating Procedure (SOP).

Well Suspension

After well testing and evaluation, if it is decided that the block is to be developed, the well site and the approach road will be maintained. The site will not be restored to its original condition until a decision is taken on the environmental assessment of the field development. Until then, the fencing will be left intact and the site sealed and protected. The road would be maintained but barriers installed at suitable locations will control access to it. Project proponent would provide a yearly environmental monitoring report for this period to the Regulatory Bodies for their information. The Report would consist of records of any activity, environmental issues, and the activities planned concerning the Block.

9.9 Occupational Health and Safety Management Plan

The Occupation Health & Safety Management Plan (OHSMP) has been formulated to address the occupational health and safety related impacts that may arise from proposed project activities viz. Development drilling and testing operation of construction machinery/equipment, storage and handling of fuel and chemicals, operation of drilling rig and associated equipment, decommissioning/site closure. Following measures will be adopted for safe operations of the Drilling site:

- 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.
- 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.
- Hazardous and risky areas, installations, materials, safety measures, emergency exits, etc. shall be appropriately marked.

- 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.
- The workplace must be equipped with fire detectors, alarm systems and fire-fighting equipment. Equipment shall be periodically inspected and maintained to keep good working condition.
- The sewage system for the DSA/Drill site must be properly designed, built and operated so that no health hazard occurs. Adequate sanitation facilities will be provided onsite for the operational workforce both during construction and operational phase of the project. Garbage bins would be provided in the DSA and regularly emptied, and the garbage disposed off in a hygienic manner.
- Records will be maintained for all the above activities.

ONGC has a periodic emergency medical policy, which is valid from 5th July 2007, details of the emergency medical policy is given in Appendix 9.1.

9.10 Recurring cost for Implementation of EMP

The forest PML block has already been explored by ONGC, in some areas. So, the ETP, sewerage system, Modular STP, storage tanks etc will also be utilized for proposed project activities. In view of this, the capital and recurring cost towards pollution control measures for proposed project is more of related to monitoring and maintenance of machineries/equipment. The capital and recurring cost for each Drilling Location is given in Table 66. The capital cost is about INR 15, 00, 000 and the recurring cost is INR 12, 00, 000 for Pollution Control Measures.

Table 70. Capital and Recurring cost for Pollution Control Measures

Sr. No.	Mitigation/Management measures	Total Capital Cost, Rs	Recurring Cost, Rs
1	Wastewater and effluent Management • Modular STP • Water Quality Monitoring	10,00,000	 40,000 40,000
2	Fuel, Lubricant and Chemical Management	15,00,000	65,000
3	Noise and Vibration Mitigation • Acoustic Enclosure and Personal Protective Equipment • Noise Monitoring	1,75,000	35,000 58,000

Sr. No.	Mitigation/Management measures	Total Capital Cost, Rs	Recurring Cost, Rs
	• Maintenance cost of equipment		
4	Solid Waste Management	1,50,000	50,000
5	Air emission mitigation • Maintenance of D.G. sets • Air monitoring	-----	10,00,000 1,25,000
6	Soil Quality	------	43,000
7	Training to Staff	------	1,25,000
8	General Awareness in Local Public	------	1,75,000
	Total	15,00, 000	12,00,000

Source: ONGC

The costs are calculated based on the current charges of an accredited laboratory/consultant/ contractor to perform the above said work.

9.11 Corporate Environmental Policy

The company would comply with the 1st May 2018 OM of Government of India w.r.t. CER and the cost would be assessed on actual project capex expenditure of that particular financial year. The Corporate Environment Policy of ONGC is mentioned in figure 61.

शशि शंकर
Shashi Shanker
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लि.
Oil and Natural Gas Corporation Ltd.

Corporate Environment Policy

Oil and Natural Gas Corporation Limited (ONGC) is committed to:

1. Achieve Environmental Leadership in all its Business Activities.
2. Abide by all applicable Legislative & other requirements associated with Environment Protection and Ecological Preservation.
3. Strive for Environment Protection and maintain Ecological Balance in and around its Operational areas for Sustainable Development.
4. Ensure Conservation of Natural Resources.
5. Enhance Community Awareness towards the Environmental Risks associated with Exploration & Production activities, mitigation measures undertaken and preparedness to tackle emergencies; to minimize its impact on Environment.
6. Minimize Waste Generation through Reduction at Source, Recycling & Reuse.
7. Maximize Recovery of Oil from Oily Waste and to exercise options for Utilizing Oily Waste for Energy purposes, wherever possible.
8. Prevent, Respond, Contain & Combat Oil Spill at Offshore & Onshore areas and ensure maximum reclamation of Oil.
9. Develop and Implement action plan on Social Needs around its Operational areas to meet obligations of Enterprise Social Responsibility.
10. Reduce Emissions at Source by adopting Clean and Green Technologies and phase out usage of Hazardous Substances in its Operations.
11. Meet provisions of Climate Change Treaty in line with Intended Nationally Determined Contribution targets of the Government of India including other applicable International Treaties.
12. Achieve Excellence in Knowledge Management and Skill Development for Environment Protection.

(Shashi Shanker)

Dated: 28th May, 2018

दीनदयाल ऊर्जा भवन, 5, नेल्सन मंडेला मार्ग, वसंत कुंज, नई दिल्ली -110 070 (भारत)
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Figure 61. Corporate Environmental Policy of ONGC

10. Conclusion and Recommendation

ONGC has found high potential oil and gas reserves in the Golaghat and Jorhat districts of Assam. Extending the exploration of these reserves, ONGC proposes a number of 28 onshore wells for exploration and development drilling in some Petroleum Mining Lease (PMLs) in Golaghat District PML (52.12 Sq. Km.), Kasomarigaon PML additional area (56 Sq. Km), Kasomarigaon PML (20 Sq. Km), East Lakhibari PML (8.5 Sq. Km), Khoraghat Extn – I PML (83 Sq. Km) and Nambor PML (26 Sq. Km). All the PMLs are located in the forest area of Nambor and Dayang Reserve forest. ONGC has also proposed to set up a Group Gathering station at Kasomarigaon PML (Additional area), and an Early Production system at Kasomarigaon PML.

The draft EIA report has assessed the overall significance of environmental impacts likely to arise from drilling of proposed exploratory and development wells. The overall impacts from the individual drilling sites have been assessed and are found to be of moderate to minor in nature when appropriate mitigation measures would be implemented with proper planning and design.

To adequately address the impacts, mitigation measures and management plans suggested are as per the best practices followed in the Oil & Gas exploration Industry. These plans include environmental management plan, monitoring plan, labour management plan. ONGC shall put in place a robust mechanism with adequate resources to implement the suggested mitigation measures and management plans. The measures would help to prevent any deterioration of quality of air, soil, groundwater and surface water beyond the prevailing status. Adequate safety measures would be adopted along with suitable emergency response and disaster management plan to safeguard against all man-made and natural disasters. Environmental monitoring of ambient air quality, noise levels, surface & groundwater etc. would be carried out at regular intervals to monitor and prevent any deterioration of baseline environmental quality due to the proposed project.

Compliance to all legal requirements and adherence to the suggested mitigation measures and plans would also enable ONGC in minimizing its impact on environmental and social parameter.

11. Disclosure of Consultants

AECOM has been accredited as EIA consultant for various sectors including Offshore and Onshore Oil and Gas Exploration and Development Projects from the National Accreditation Board for Education and Training (NABET) of Quality Council of India (QCI) under the Accreditation Scheme for EIA Consultant Organisations as per MoEF&CC requirements.

The following approved consultants and experts were engaged for preparation of the EIA report for the proposed study.

Table 71. EIA Team

S. No.	EIA Coordinator/ Functional Area	Professionals Environment Coordinator/FAE	FAA and Team Members	Signature
1	EIA Coordinator – Onshore Oil and Gas Exploration and Development Projects	Souvik Basu	Anindya Basu (Associate EC)	
Core Functional Areas				
2	Water Pollution Monitoring, Prevention & Control (WP)	Avijit Sarkar	Anindya Basu Aziz Hasan Moudipta Banerjee	
3	Ecology & Biodiversity (EB)	Mainak Majumdar	Sudin Pal	
4	Socio- Economic Aspects (SE)	Souvik Basu	Dripta Nag	
Significant functional areas				
5	Solid and Hazardous Waste Management (SHW)	Avijit Sarkar	Debleena MitraSinha Anindya Basu Moudipta Banerjee	

S. No.	EIA Coordinator/ Functional Area	Professionals Environment Coordinator/FAE	FAA and Team Members	Signature
6	Meteorology, Air Quality Modelling & prediction (AQ)	Avijit Sarkar	Swagata Mukherjee	
7	Risk and Hazards Management (RH)	Akhilesh Prasad Singh	Debleena MitraSinha Debsagar Das	
8	Air Pollution Monitoring, Prevention & Control (AP)	Avijit Sarkar	Debleena MitraSinha	
9	Hydrology, Ground Water & Water Conservation (HG)	Shiv Pratap Unya	Anindya Basu	
10	Noise &Vibration (NV)	Atul Kumar	Aziz Hasan Debsagar Das	
11	Land Use (LU)	Laxmi Reddy	Moumita Dey Aditi Deopujari	
12	Soil Conservation (SC)	Chetan Zaveri	Moumita Dey	

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

AECOM India Private Limited

9/F, Infinity Tower – 'C', DLF Cyber City, DLF Phase – II,
Gurgaon – 122002

Accredited as **Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including Open cast/ Underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & productions	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Metallurgical industries - ferrous only	8	3 (a)	A
6	Cement plants	9	3 (b)	A
7	Coke oven plants	11	4 (b)	A
8	Chemical Fertilizers	16	5 (a)	A
9	Synthetic organic chemicals industry	21	5 (f)	A
10	Oil & gas transportation pipeline	27	6 (a)	A
11	Air ports	29	7 (a)	A
12	Industrial estates/ parks/ complexes/ Areas, (EPZs),	31	7 (c)	B
13	Ports, harbours, break waters and dredging	33	7 (e)	A
14	Highways	34	7 (f)	A
15	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
16	Building and construction projects	38	8 (a)	B
17	Townships and Area development projects	39	8 (b)	A

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated October 05, 2018 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/18/0799 dated November 19, 2018. The accreditation needs to be renewed before the expiry date by AECOM India Private Limited, Gurgaon, following due process of assessment.

Sr. Director, NABET
Dated: Nov. 19, 2018

Certificate No.
NABET/ EIA/1821/ RA 0108

Valid till
13.01.2021

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

APPENDIX

List of Appendix

Appendix 1.1:
ToR Letter

No.IA-J-11011/99/2019-IA-II(I)
Goverment of India
Minister of Enviroment,Forest and Climate Change
Impact Assessment Division
***

Indira Paryavaran Bhavan,
Vayu Wing,3rd Floor,Aliganj,
Jor Bagh Road,New Delhi-110003
20 Apr 2019

To,

M/s ONGC
ONGC, Deendayal Urja Bhavan,5 Nelson Mandela Marg, Vasant KunjDelhi,
South West-110070
Delhi

Tel.No.11-26753166; Email:kumar_rajeeva@ongc.co.in

Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

1. Proposal No.:	IA/AS/IND2/99697/2019
2. Name of the Proposal:	Onshore Development and Production of oil and gas from 28 wells and establishment of kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat district, Assam
3. Category of the Proposal:	Industrial Projects - 2
4. Project/Activity applied for:	1(b) Offshore and onshore oil and gas exploration, development & production
5. Date of submission for TOR:	19 Mar 2019

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

1(b):STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR OFFSHORE AND ONSHORE OIL AND GAS EXPLORATION, DEVELOPMENT AND PRODUCTION PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

B. STANDARD TOR FOR ONSHORE OIL AND GAS EXPLORATION, DEVELOPMENT & PRODUCTION

1. Executive summary of a project.
2. Project description, project objectives and project benefits.
3. Cost of project and period of completion.
4. Site details within 1 km of the each proposed well, any habitation, any other installation/activity, flora and fauna, approachability to site, other activities including agriculture/land, satellite imagery for 10 km area. All the geological details shall be mentioned in the Topo sheet of 1:40000 scale, superimposing the well locations and other structures of the projects. Topography of the project site.
5. Details of sensitive areas such as National Park, Wildlife sanctuary and any other eco-sensitive area alongwith map indicating distance.
6. Approval for the forest land from the State/Central Govt. under Forest (Conservation) Act, 1980, if applicable.
7. Recommendation of SCZMA/CRZ clearance as per CRZ Notification dated 6th January, 2011 (if applicable).
8. Distance from nearby critically/severely polluted area as per Notification, if applicable. Status of moratorium imposed on the area.
9. Does proposal involve rehabilitation and resettlement? If yes, details thereof.
10. Environmental considerations in the selection of the drilling locations for which environmental clearance is being sought. Present any analysis suggested for minimizing the foot print giving details of drilling and development options considered.
11. Baseline data collection for air, water and soil for one season leaving the monsoon season in an area of 10 km radius with centre of Oil Field as its centre covering the area of all proposed drilling wells.
12. Climatology and Meteorology including wind speed, wind direction, temperature rainfall relative humidity etc.
13. Details of Ambient Air Quality monitoring at 8 locations for PM2.5, PM10, SO2, NOx, CO, VOCs, Methane and non-methane HC.
14. Soil sample analysis (physical and chemical properties) at the areas located at 5 locations.
15. Ground and surface water quality in the vicinity of the proposed wells site.

16. Measurement of Noise levels within 1 km radius of the proposed wells.
17. Vegetation and land use; flora/fauna in the block area with details of endangered species, if any.
18. Incremental GLC as a result of DG set operation, flaring etc.
19. Potential environmental impact envisaged during various stages of project activities such as site activation, development, operation/ maintenance and decommissioning.
20. Actual source of water and 'Permission' for the drawl of water from the Competent Authority. Detailed water balance, wastewater generation and discharge.
21. Noise abatement measures and measures to minimize disturbance due to light and visual intrusions.
22. Details on wastewater generation, treatment and utilization /discharge for produced water/ formation water, cooling waters, other wastewaters, etc. duringallprojectphases.
23. Details on solid waste management for drill cuttings, drilling mud and oil sludge, produced sand, radio activematerials, other hazardous materials, etc. including its disposal options during all project phases.
24. Disposal of spent oil and lube.
25. Storage of chemicals and diesel at site. Hazardous material usage, storage and accounting.
26. Commitment for the use of water based mud (WBM) only
27. Oil spill emergency plans for recovery/ reclamation.
28. H2S emissions control.
29. Produced oil/gas handling, processing and storage/transportation.
30. Details of control of air, water and noise pollution during production phase.
31. Measures to protect ground water and shallow aquifers from contamination.
32. Whether any burn pits being utilised for well test operations.
33. Risk assessment and disaster management plan for independent reviews of well designed construction etc. for prevention of blow out. Blowout preventer installation.
34. Environmental management plan.
35. Total capital and recurring cost for environmental control measures.
36. Emergency preparedness plan.
37. Decommissioning and restoration plans.
38. Documentary proof of membership of common disposal facilities, if any.
39. Details of environmental and safety related documentation within the company including documentation and proposed occupational health and safety Surveillance Safety Programme for all personnel at site. This shall also include monitoring programme for the environmental.
40. A copy of Corporate Environment Policy of the company as per the Ministry's O.M. No. J-11013/ 41/2006-IA.II(I) dated 26th April, 2011 available on the Ministry's website.
41. Any litigation pending against the project and or any direction/order passed by any court of law against the project. If so details thereof.

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Appendix 3.1:Well wise Land use

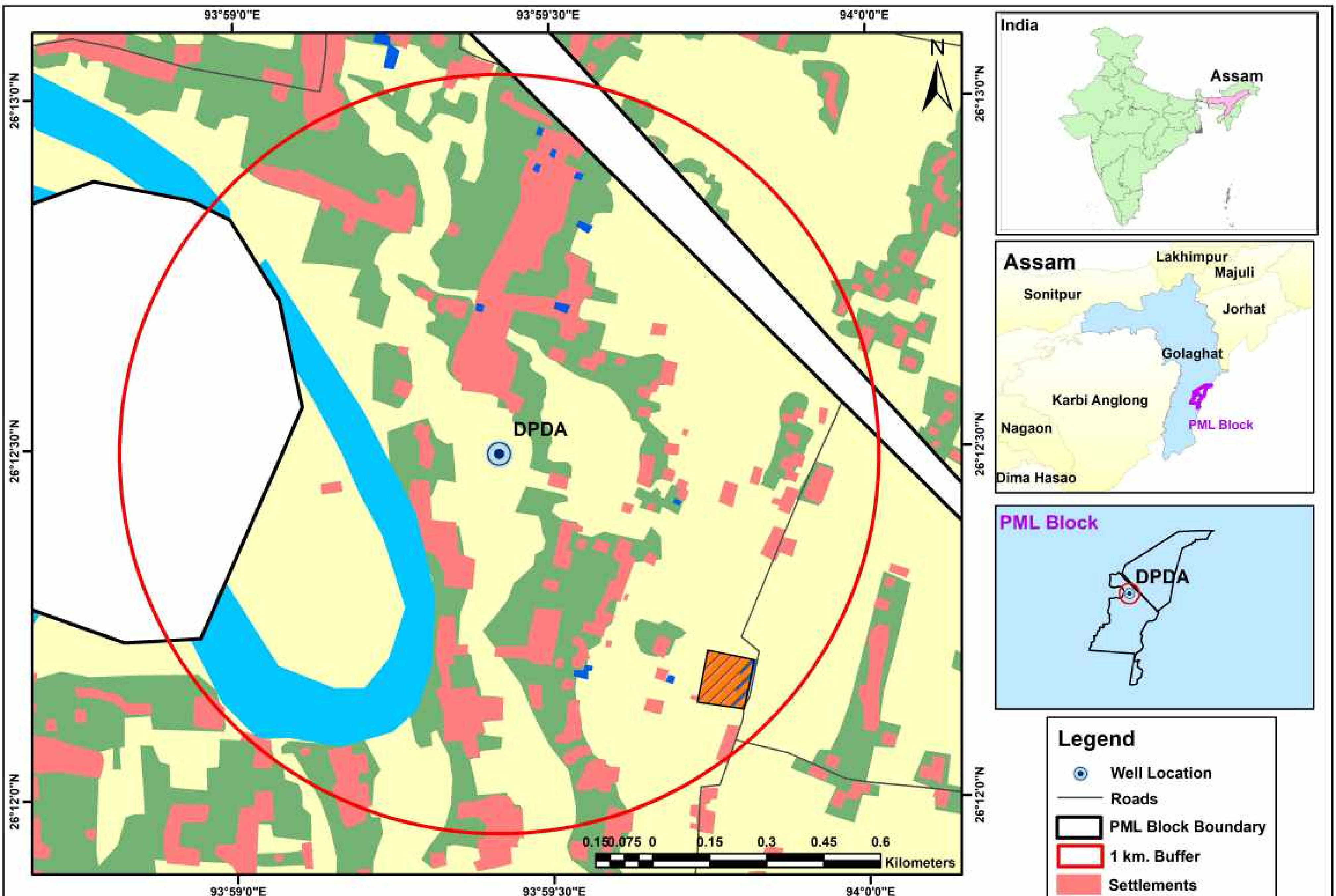


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDA Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community

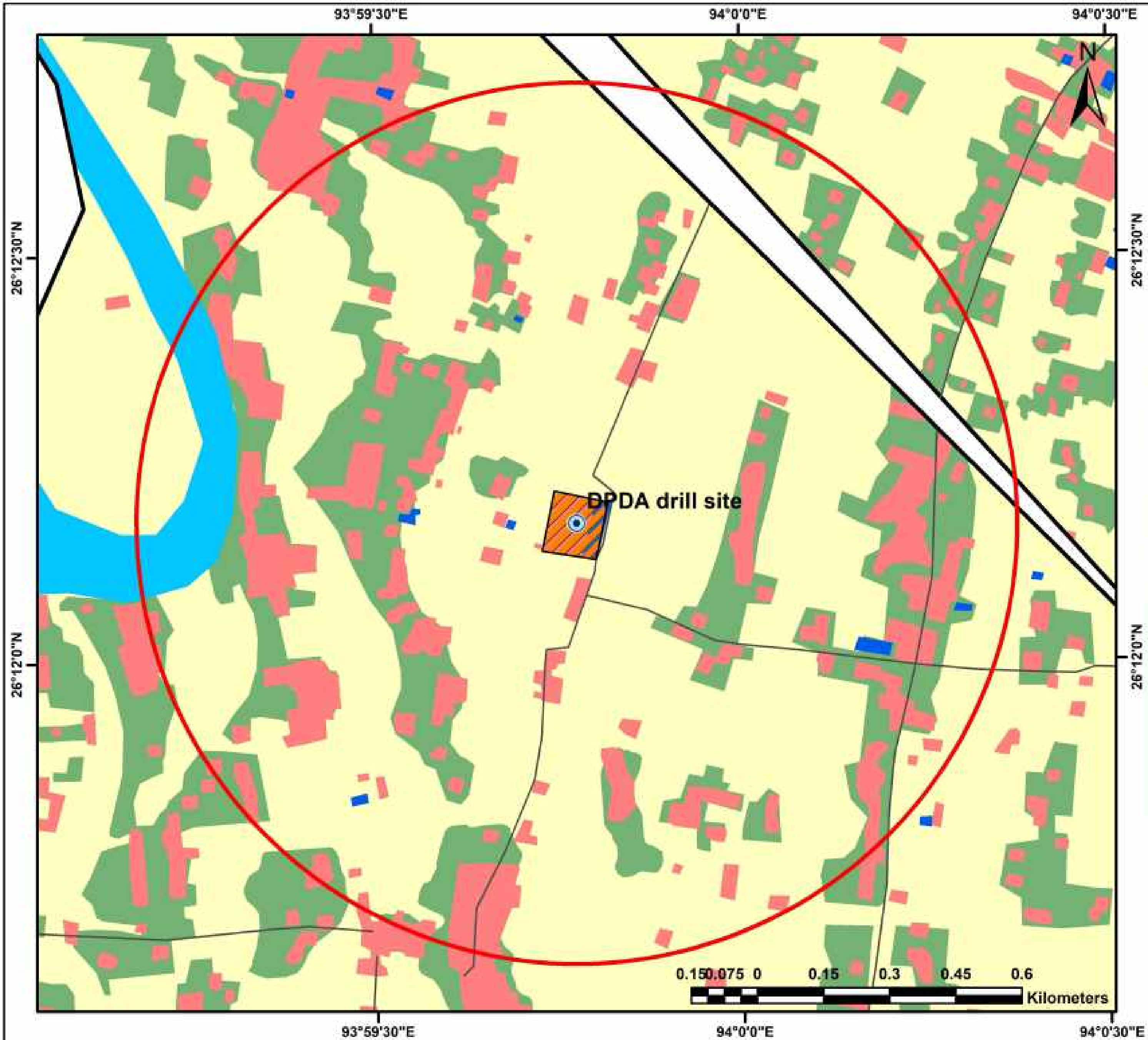


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDA Drill Site Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

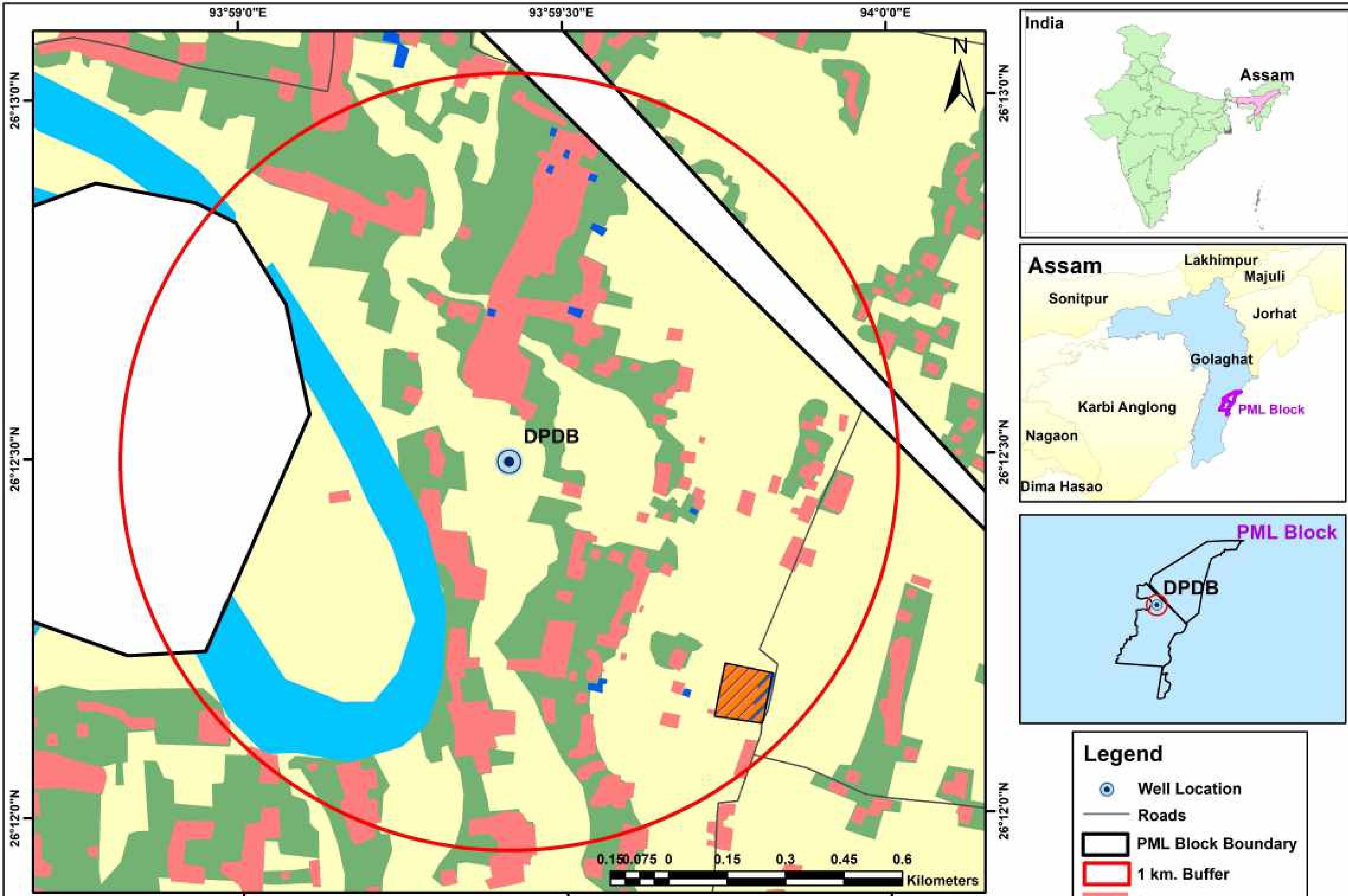


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDB Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No. G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community

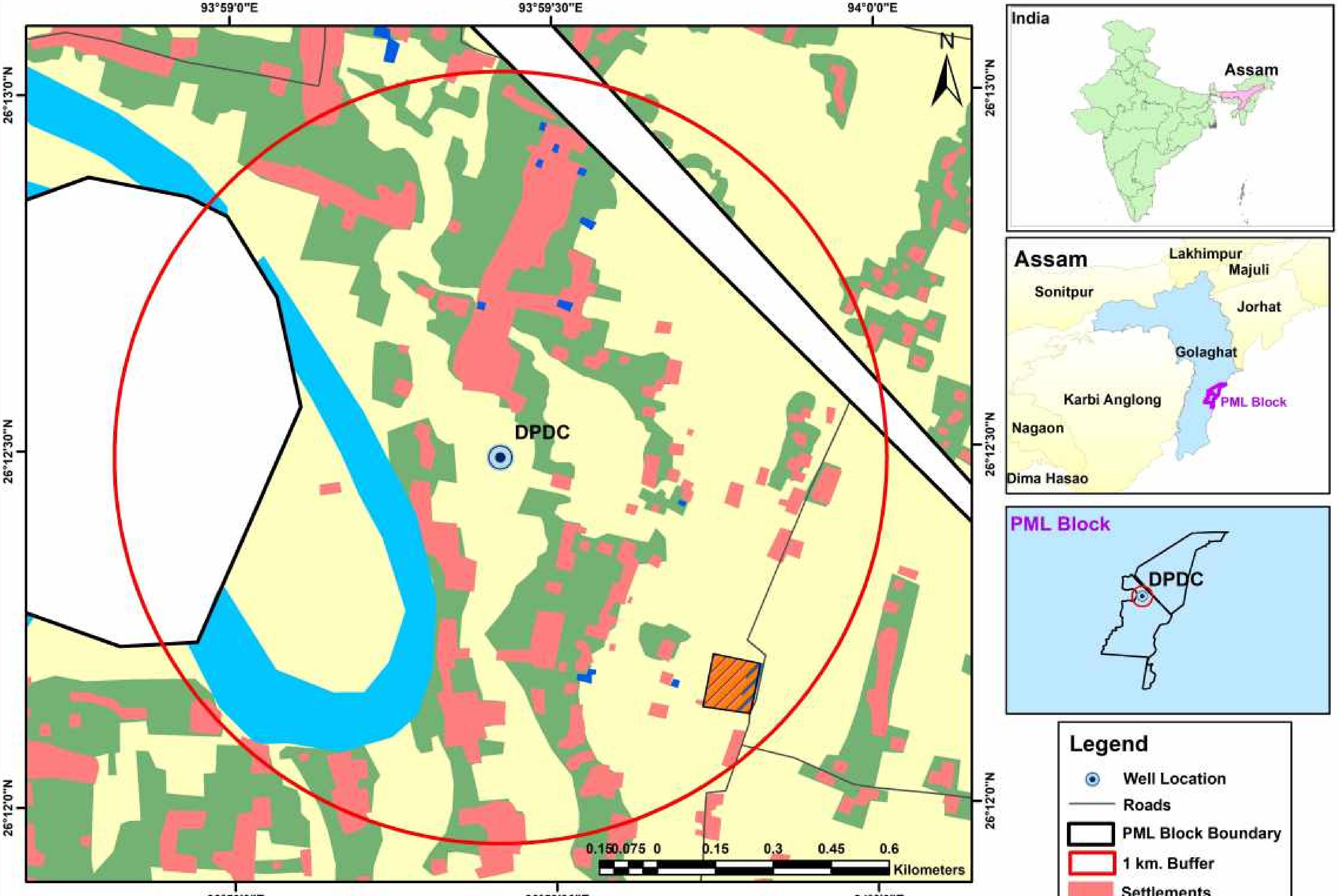


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDC Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3, satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye, Earthstar Geographics, CNES /AirbusDS, USDA, USGS, AeroGRID, IGN, and theGIS User Community.

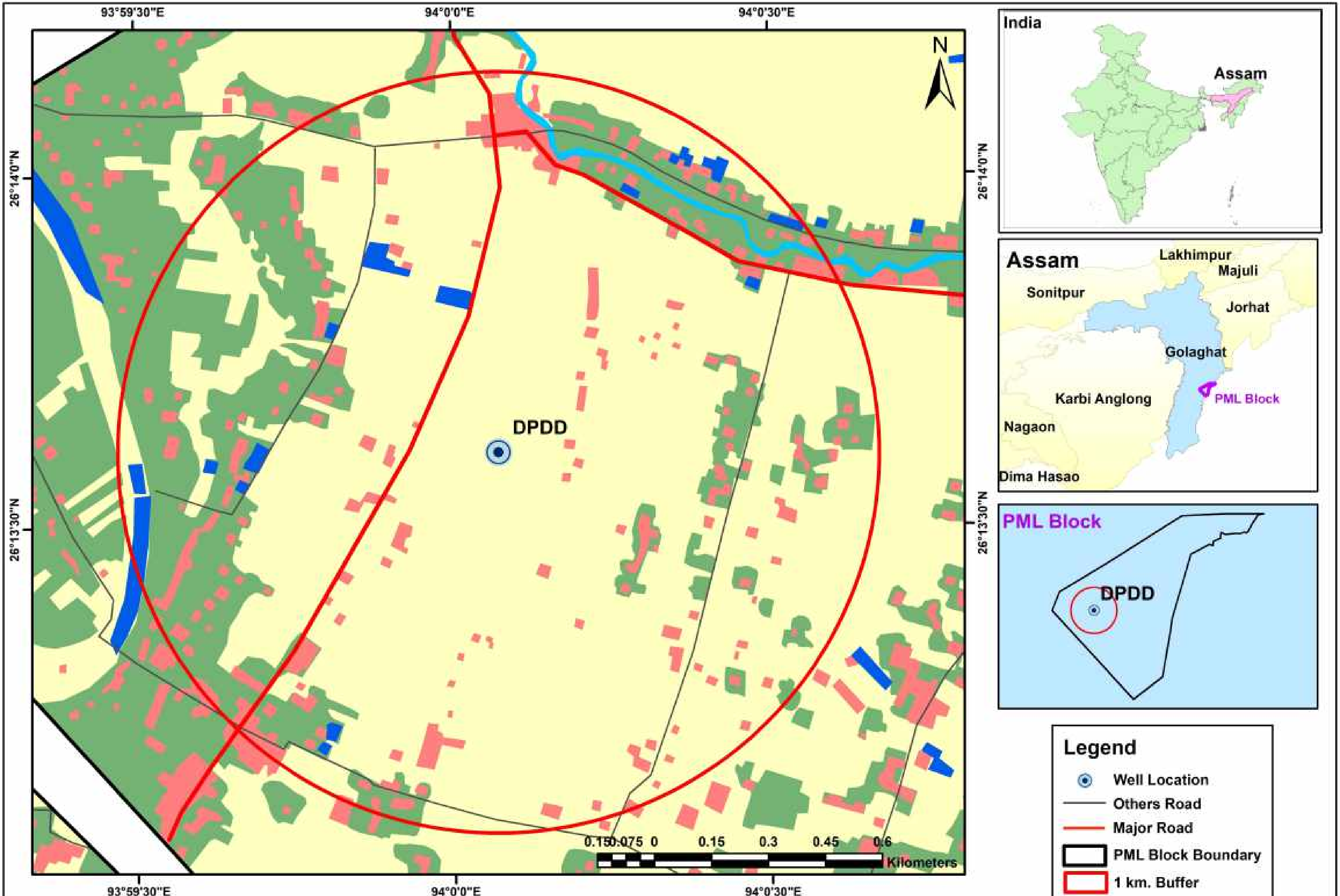


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				Title: Landuse and landcover Map of DPDD Well	AECOM
	Date: 31/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community

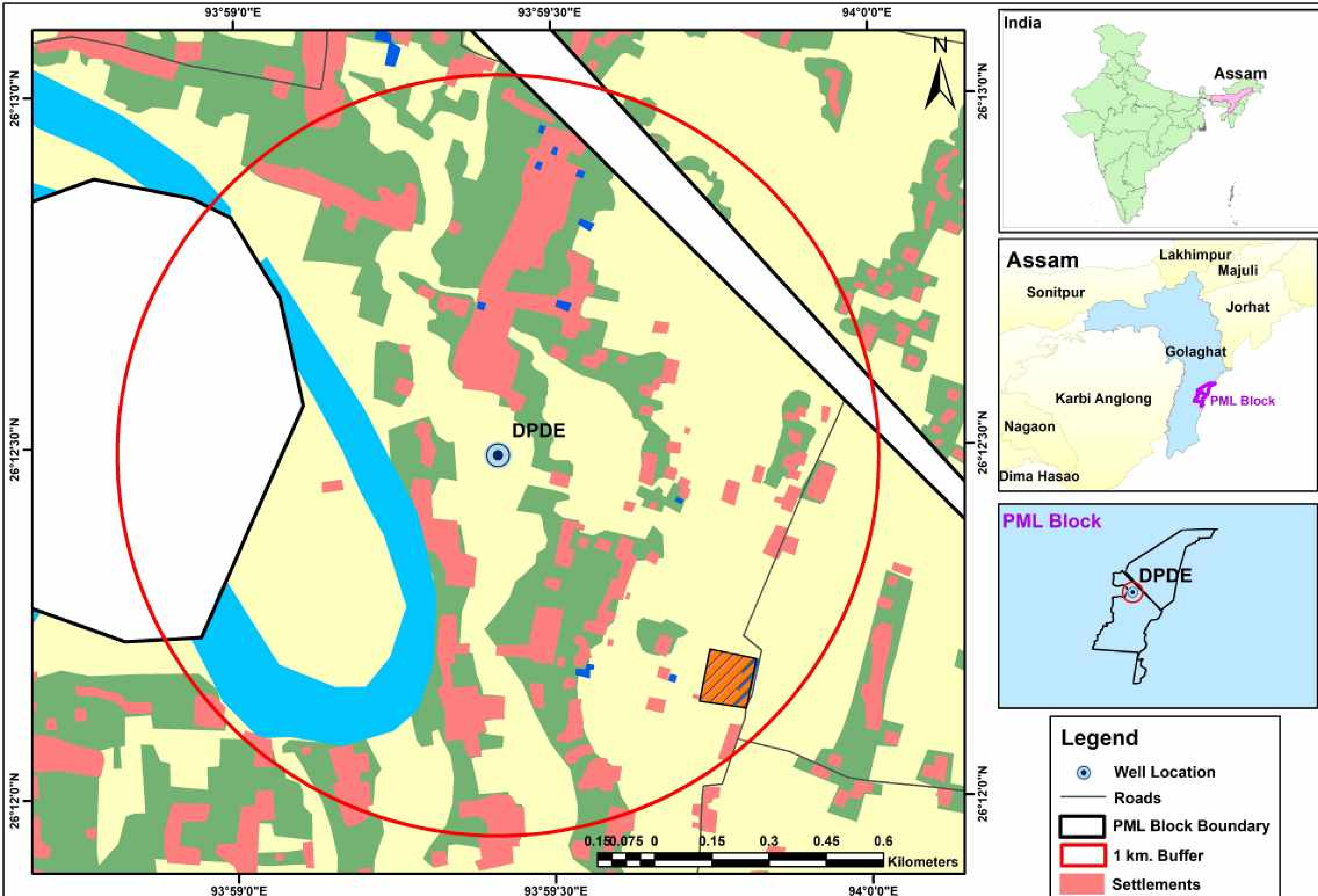
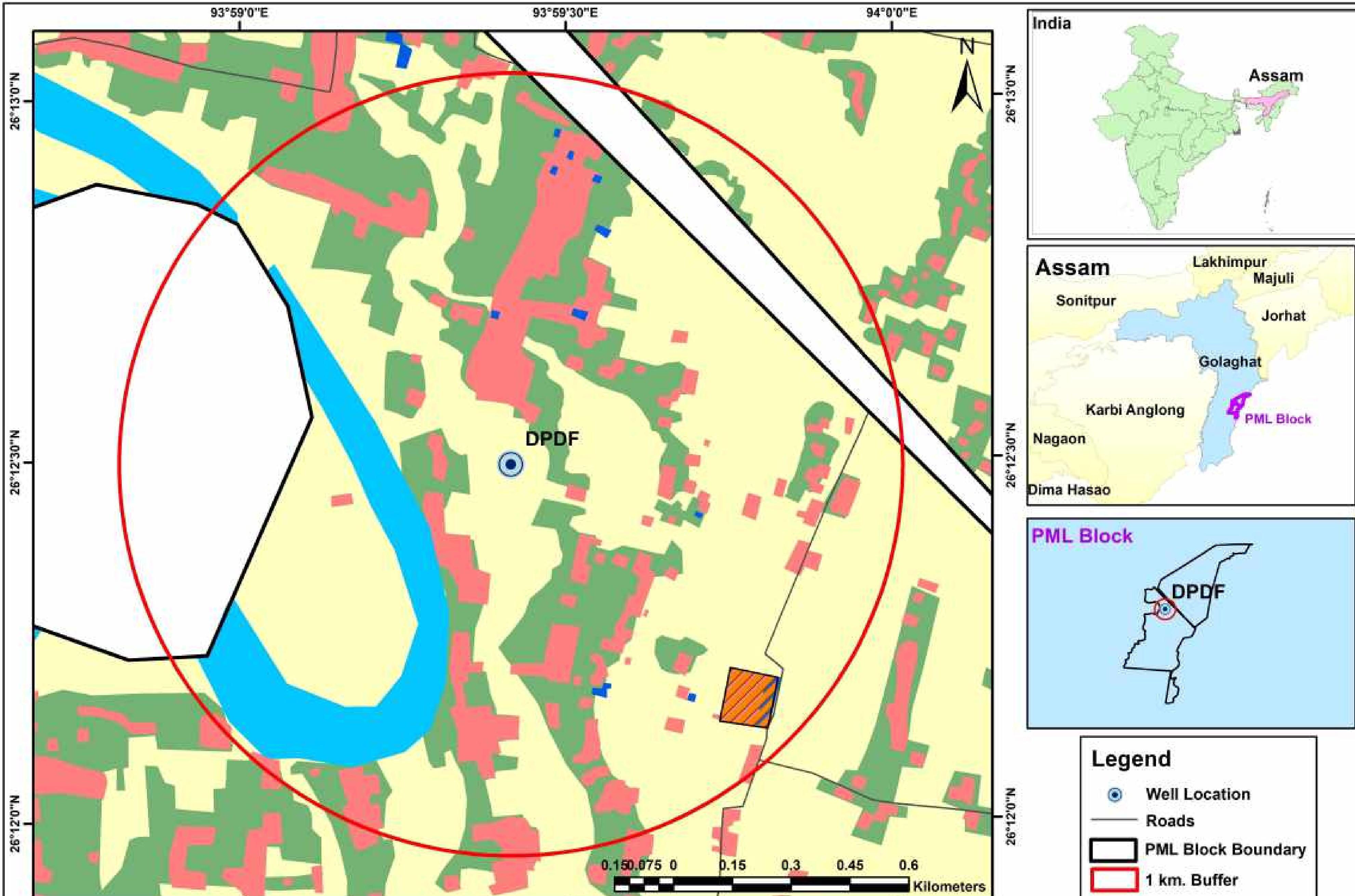


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDE Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3, satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye, Earthstar Geographics, CNES /AirbusDS, USDA, USGS, AeroGRID, IGN, and theGIS User Community



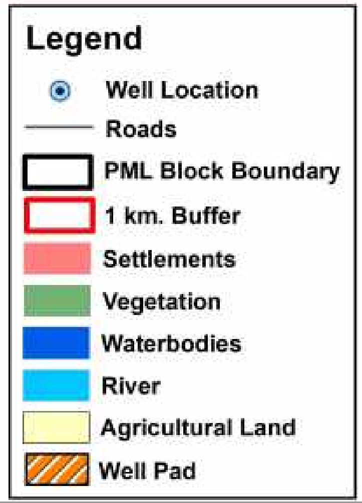


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					**Title:** Landuse and landcover Map of DPDF Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

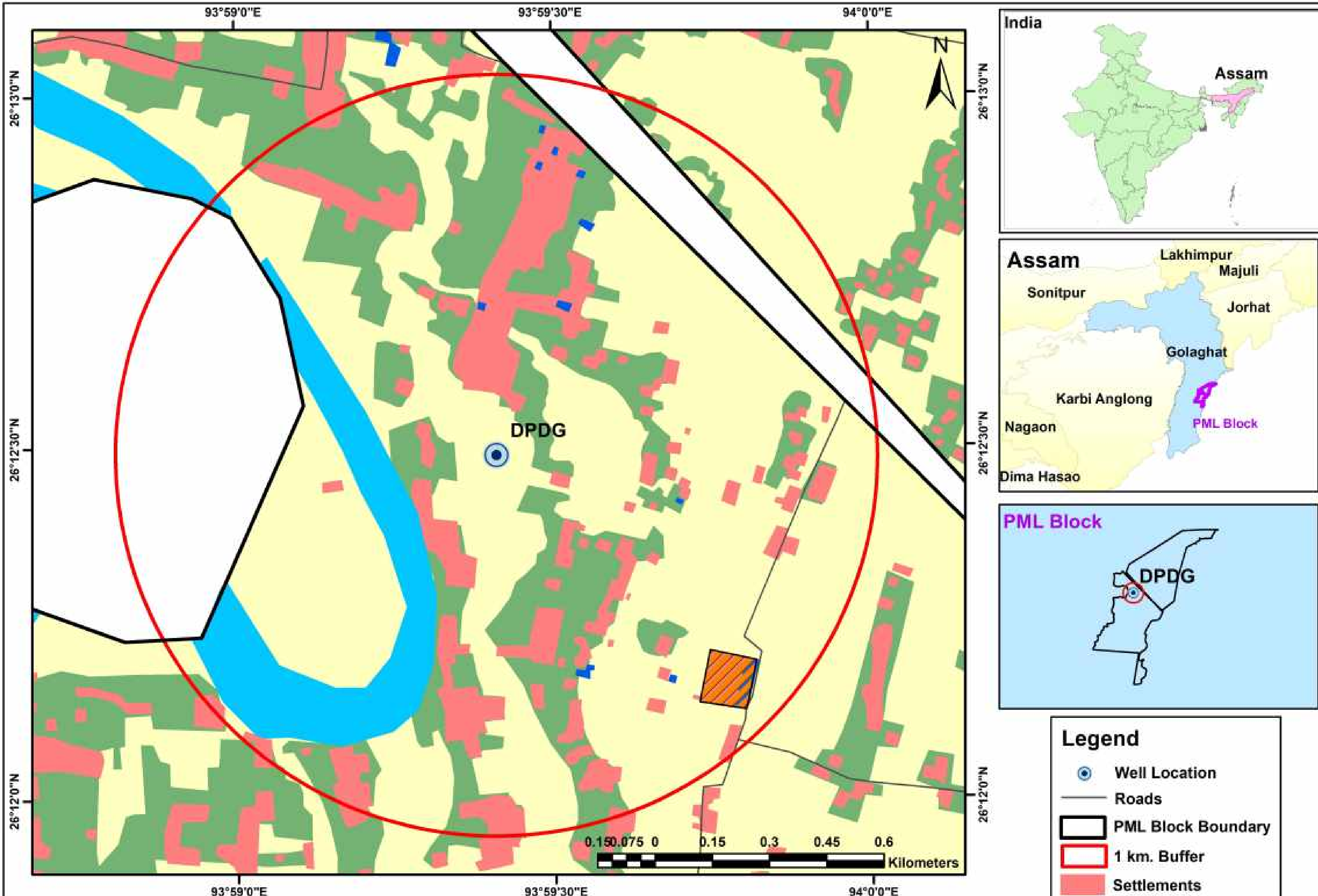
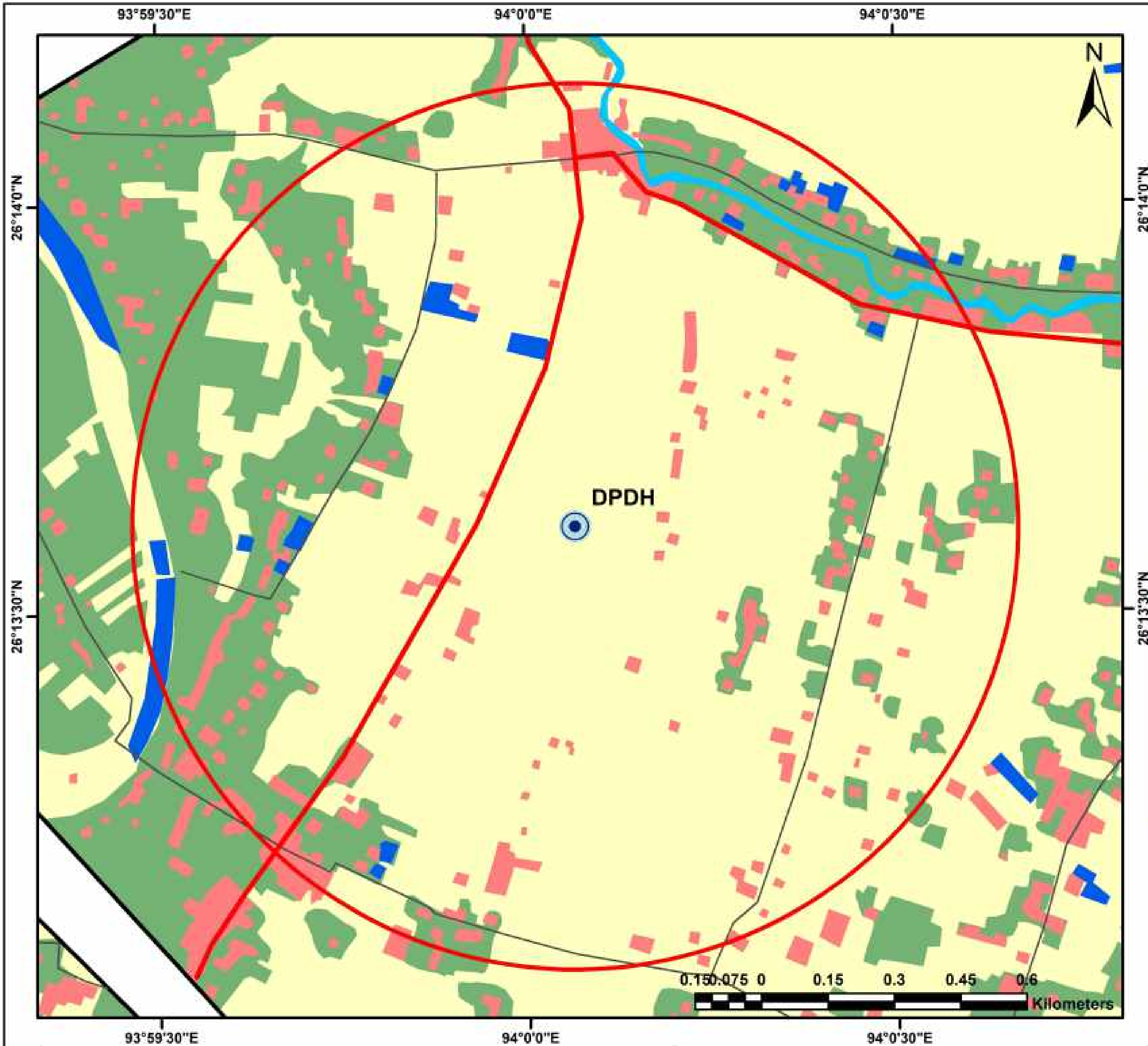


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDG Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe. GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	



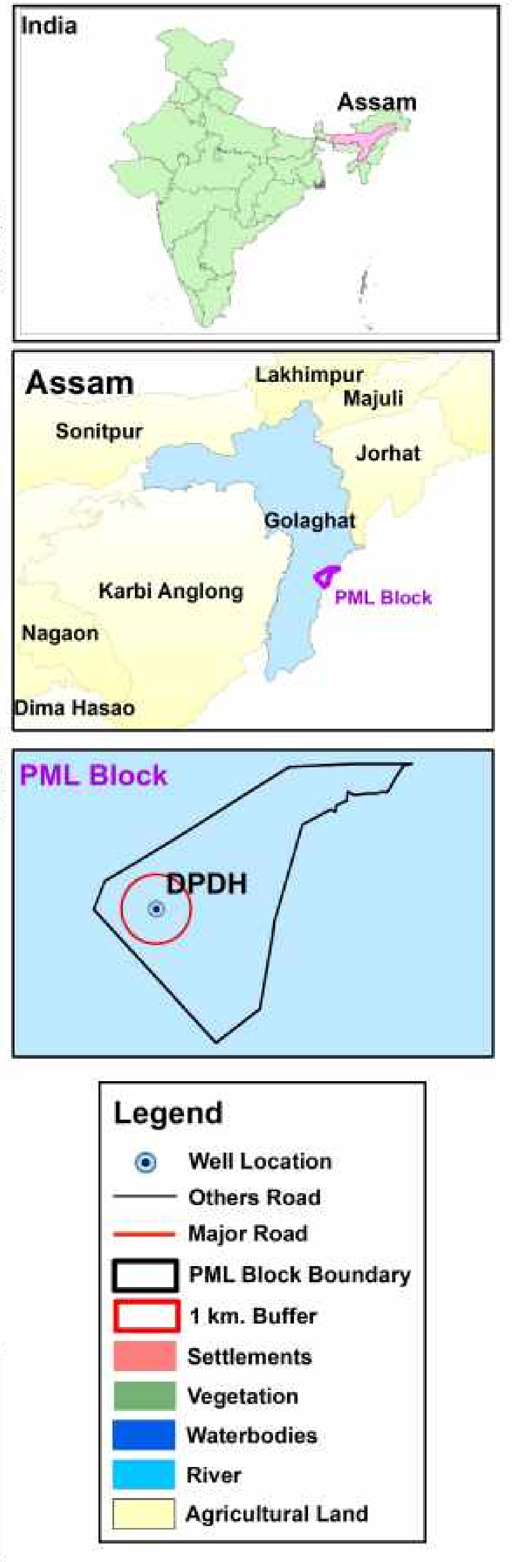


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDH Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.

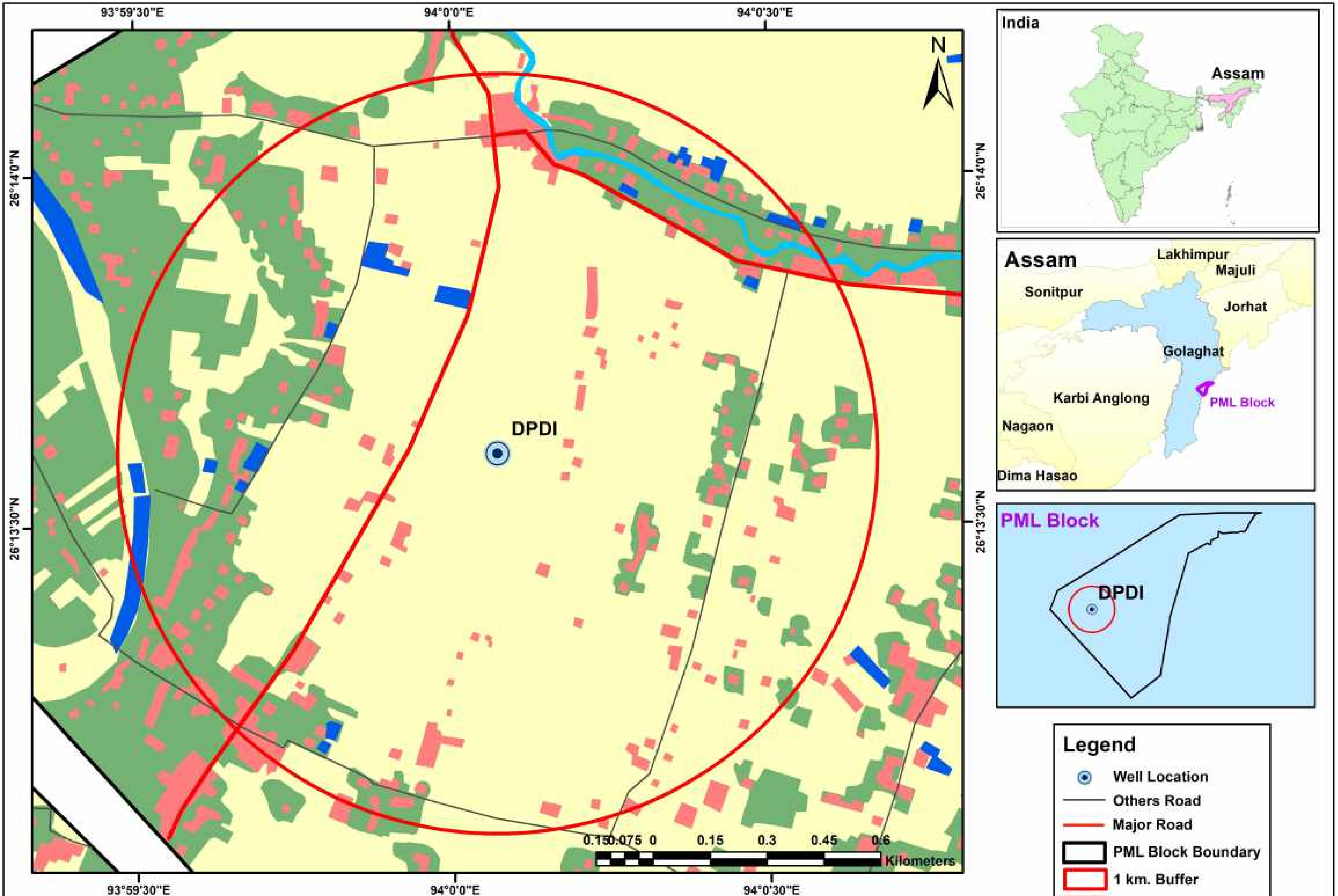
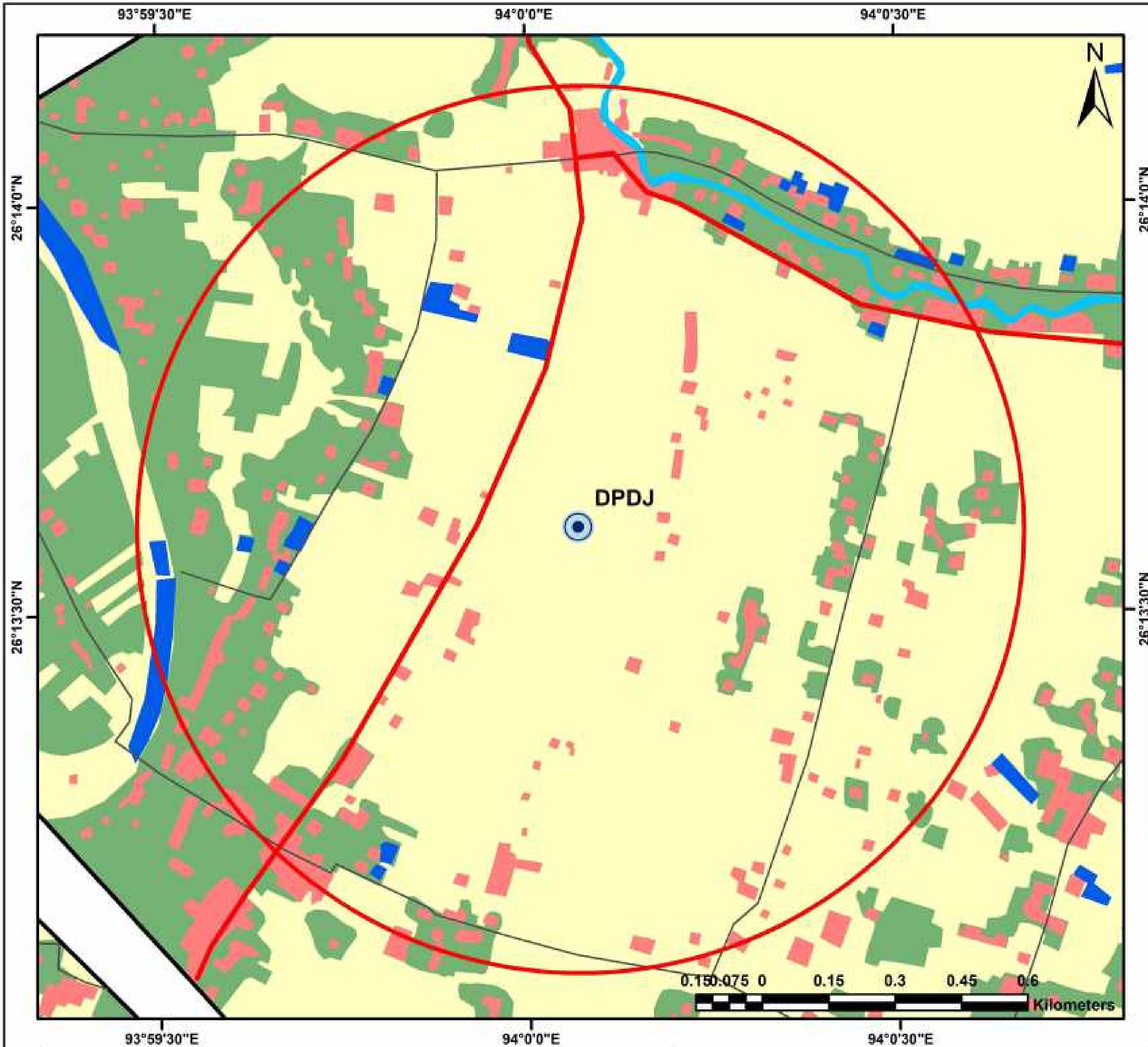
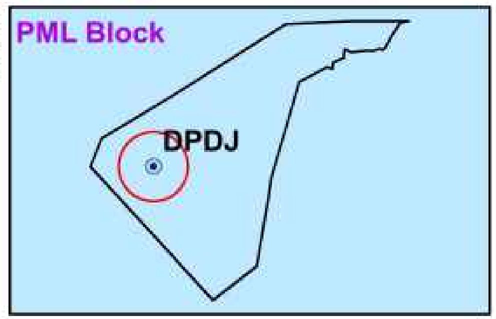


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					Title: Landuse and landcover Map of DPDI Well	AECOM
	Date: 31/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth. Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community	





Legend

- Well Location
- Others Road
- Major Road
- PML Block Boundary
- 1 km. Buffer
- Settlements
- Vegetation
- Waterbodies
- River
- Agricultural Land

FIGURE NO.	**Project name:**	Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam			**Title:** Landuse and landcover Map of DPDJ Well		AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community	

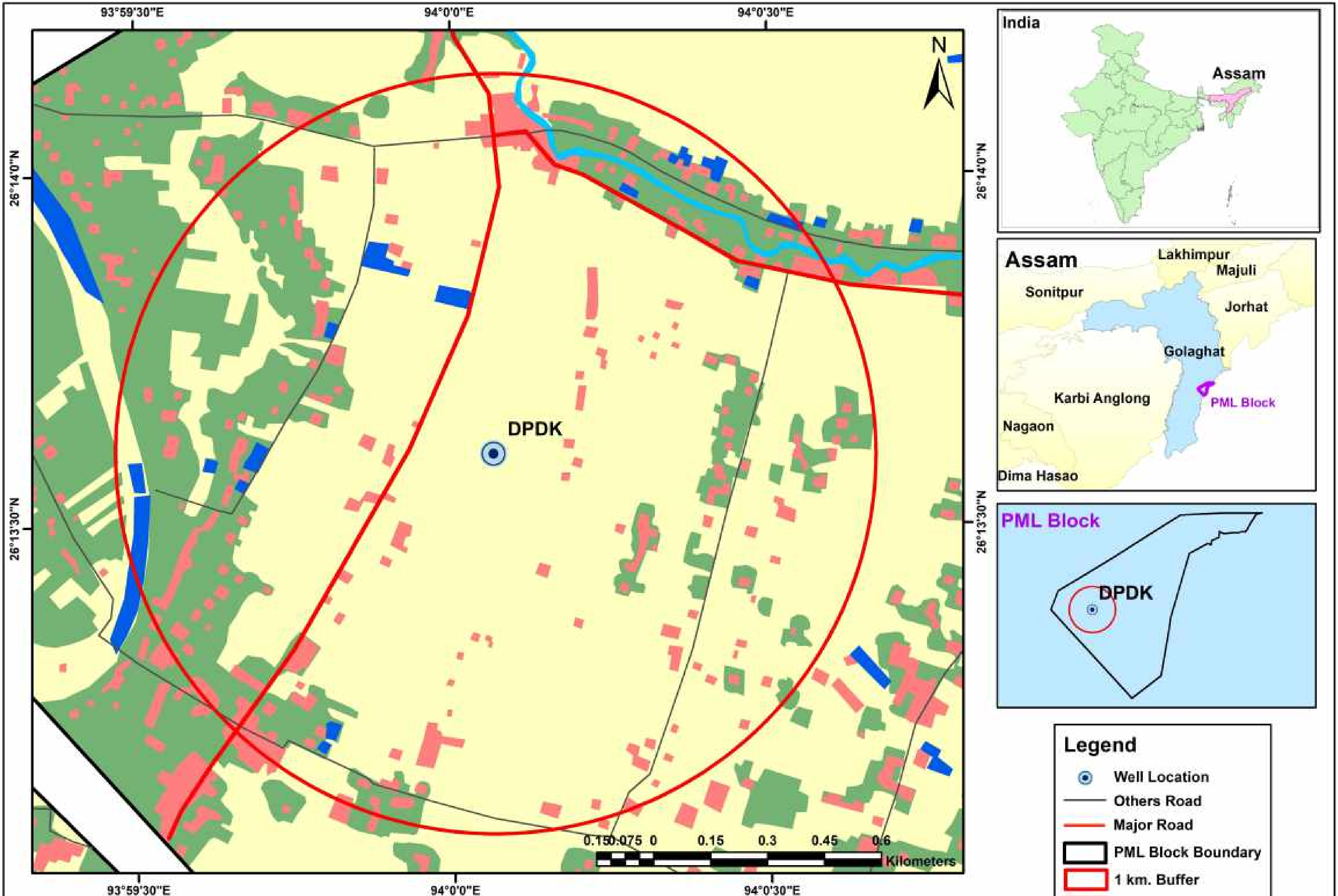


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				Title: Landuse and landcover Map of DPDK Well	AECOM
	Date: 31/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G48J/15, G48J/16, G48K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.

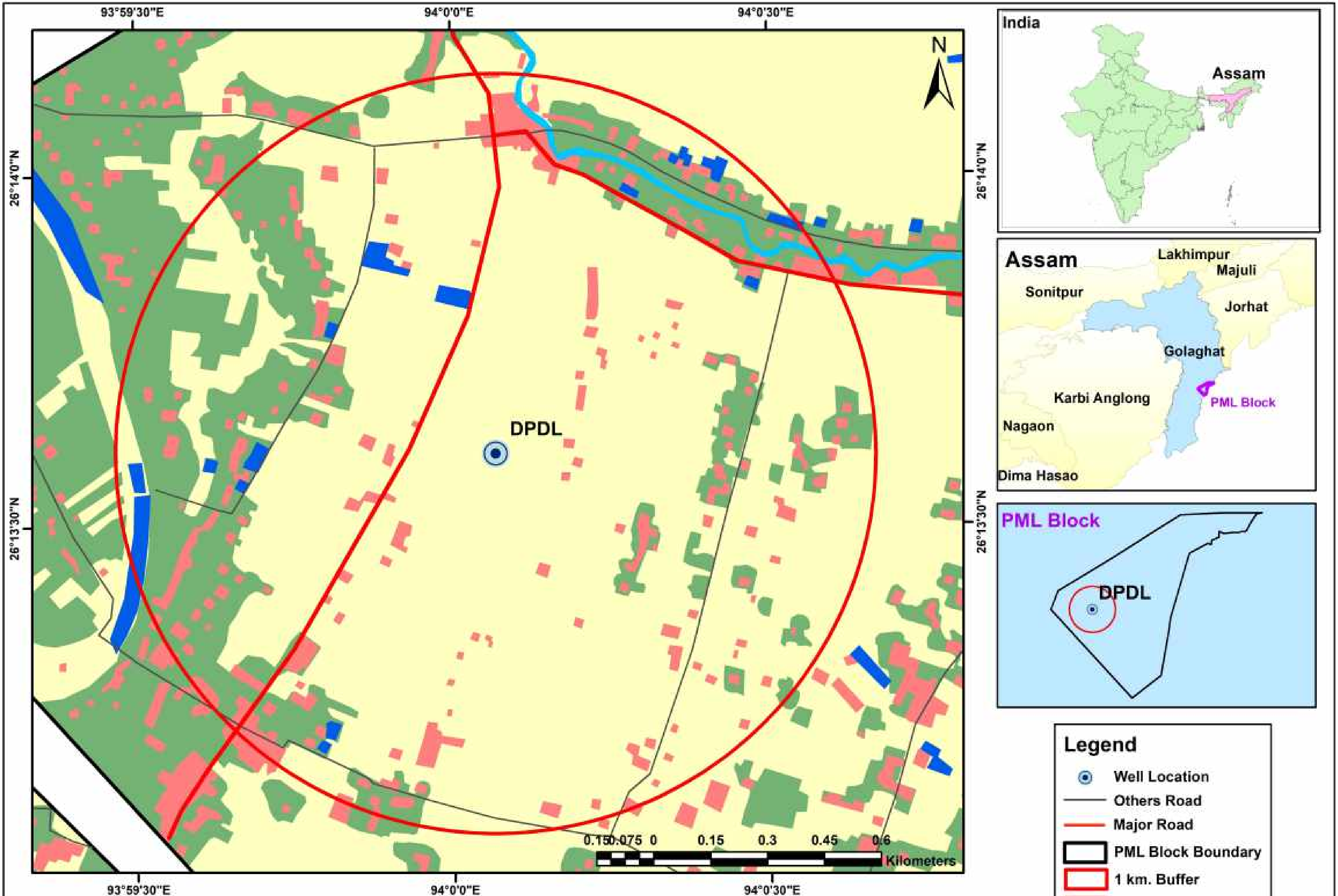


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDL Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.

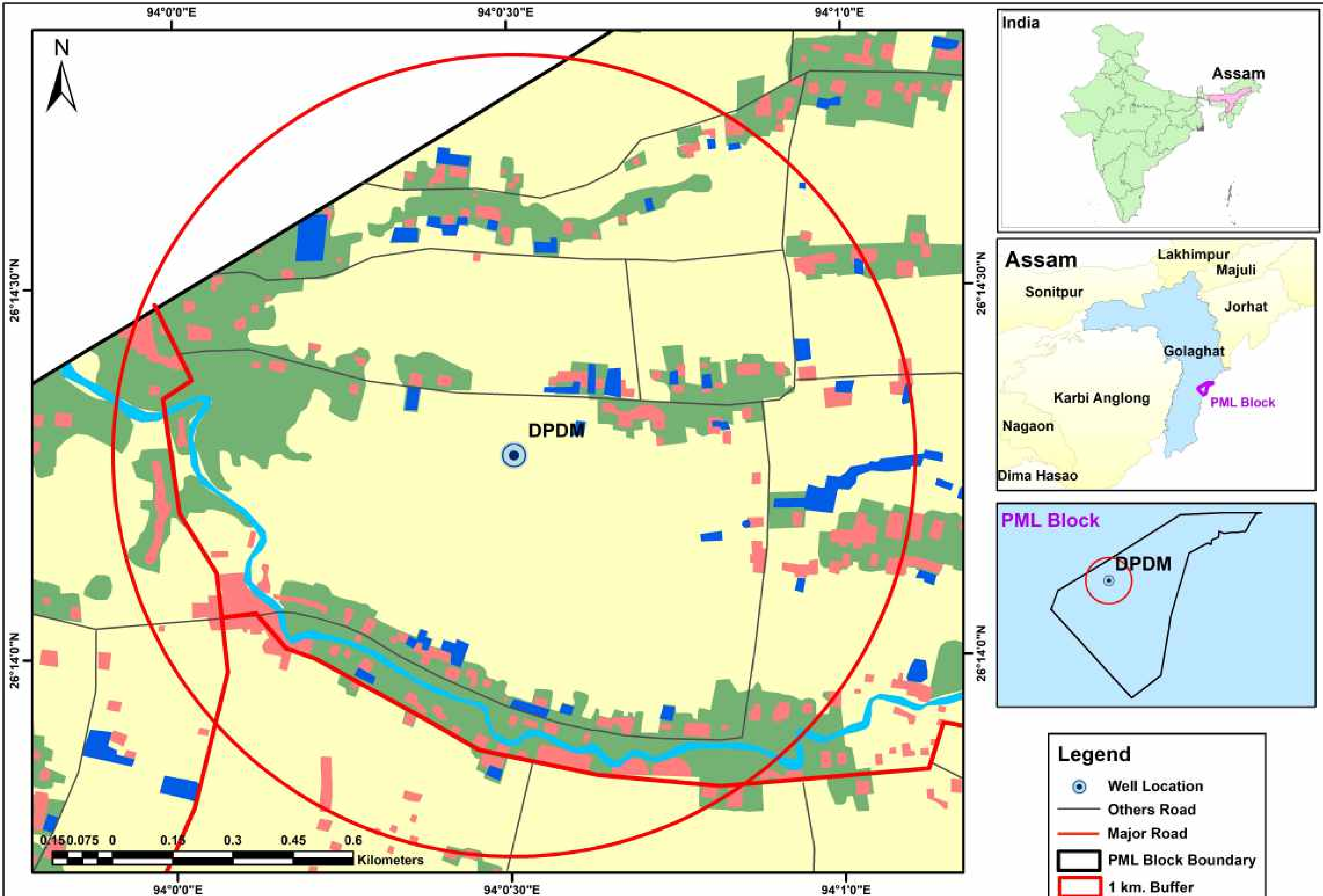


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDM Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G48J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.

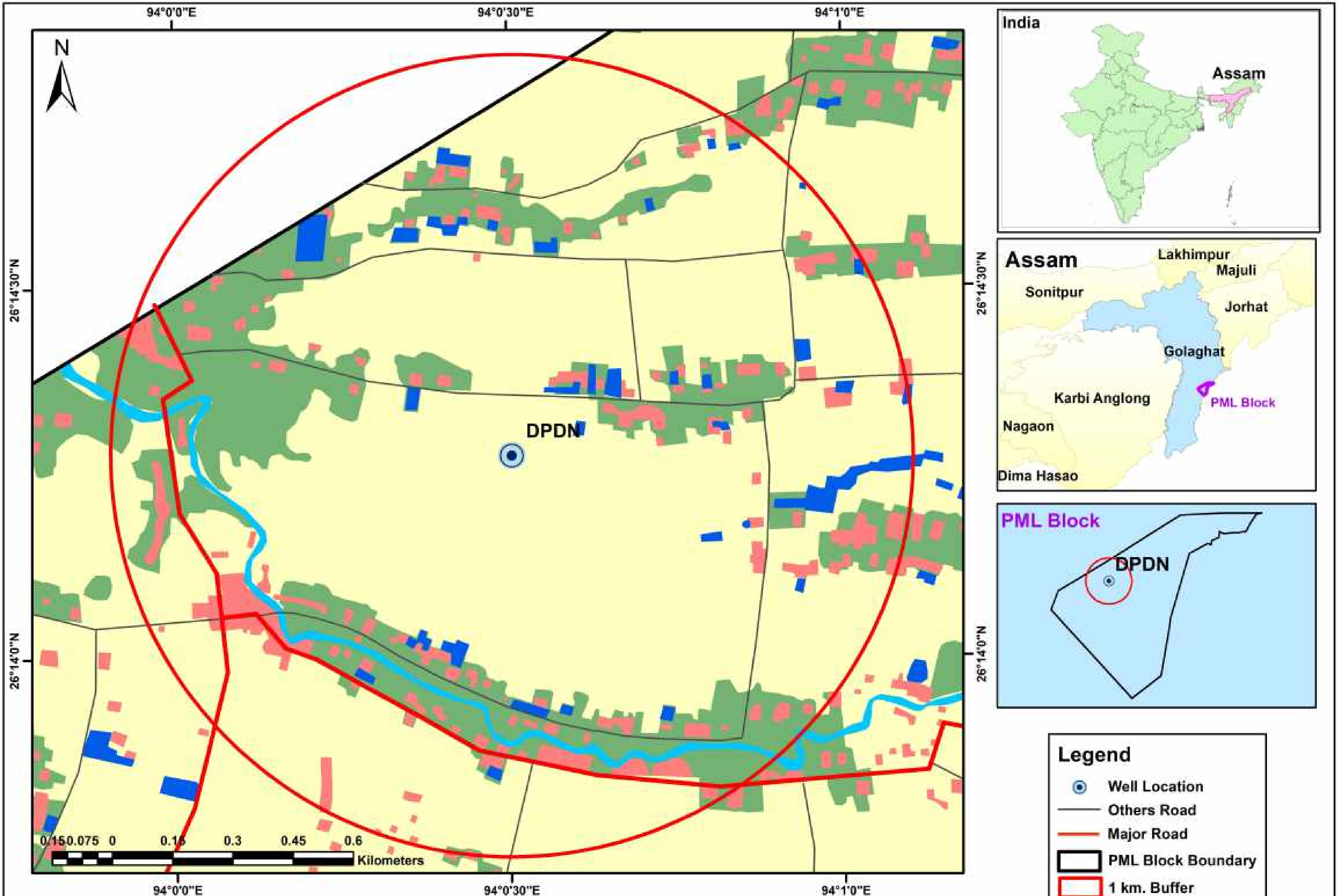


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					Title: Landuse and landcover Map of DPDN Well	AECOM
	Date: 31/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

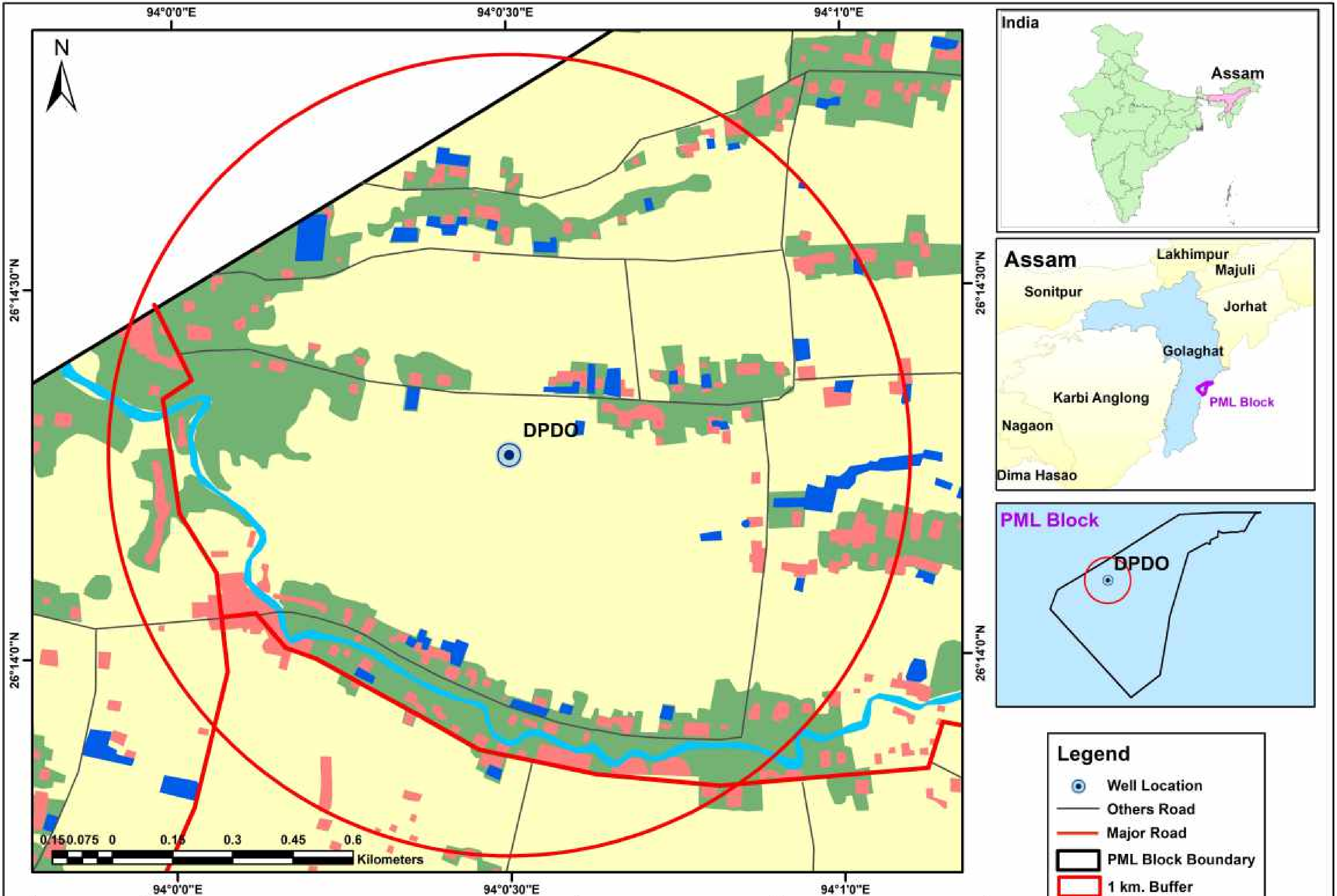
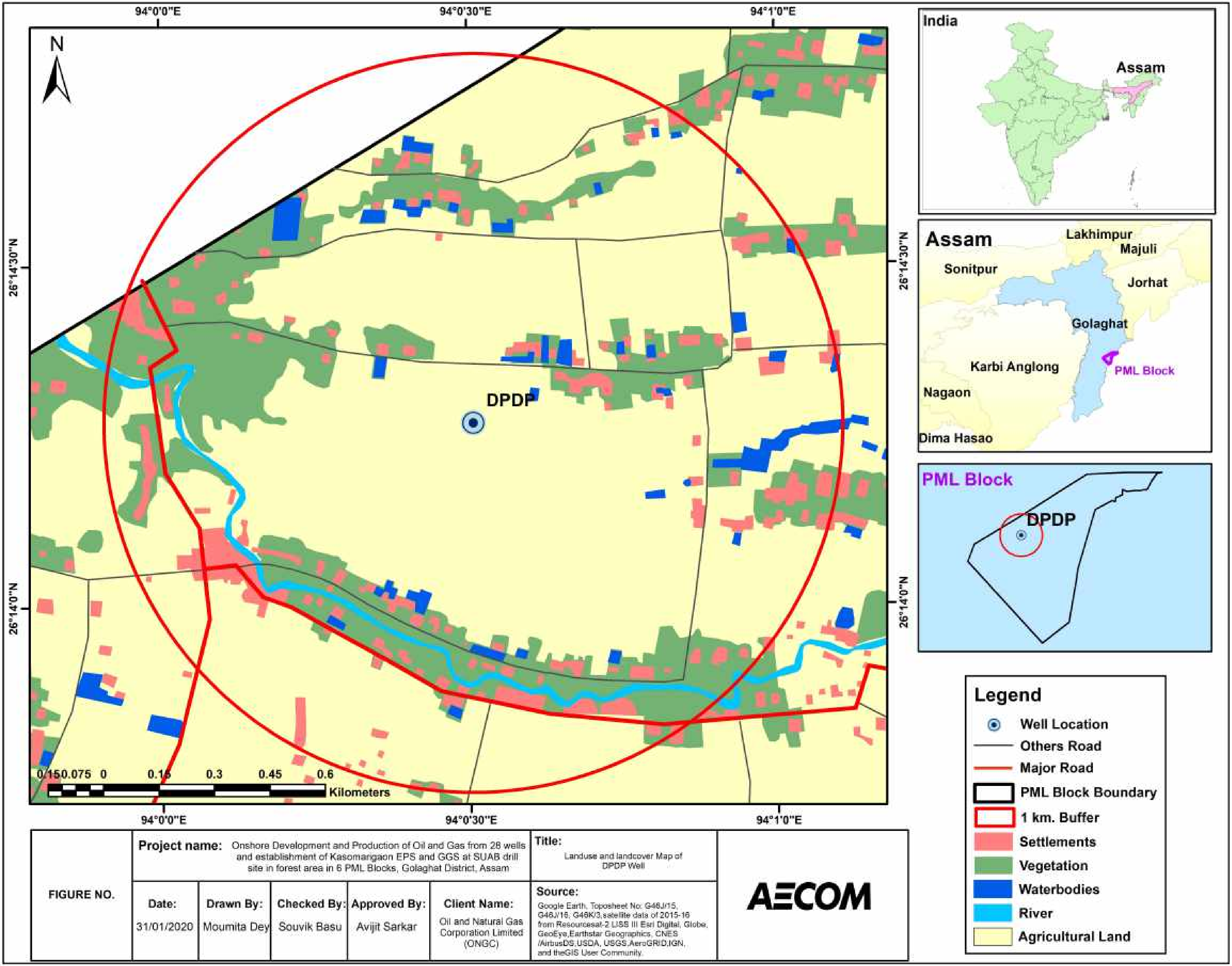


FIGURE NO.	Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				Title: Landuse and landcover Map of DPDO Well	AECOM
	Date: 31/01/2020	Drawn By: Moumita Dey	Checked By: Souvik Basu	Approved By: Avijit Sarkar	Client Name: Oil and Natural Gas Corporation Limited (ONGC)	Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3, satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye, Earthstar Geographics, CNES /AirbusDS, USDA, USGS, AeroGRID, IGN, and theGIS User Community.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DPDP
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Kilometers
India
Assam
Assam
Lakhimpur
Majuli
Sonitpur
Jorhat
Golaghat
Karbi Anglong
PML Block
Nagaon
Dima Hasao
PML Block
DPDP
Legend
Well Location
Others Road
Major Road
PML Block Boundary
1 km. Buffer
Settlements
Vegetation
Waterbodies
River
Agricultural Land
FIGURE NO.
Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam
Title: Landuse and landcover Map of DPDP Well
Date: 31/01/2020
Drawn By: Moumita Dey
Checked By: Souvik Basu
Approved By: Avijit Sarkar
Client Name: Oil and Natural Gas Corporation Limited (ONGC)
Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.
AECOM

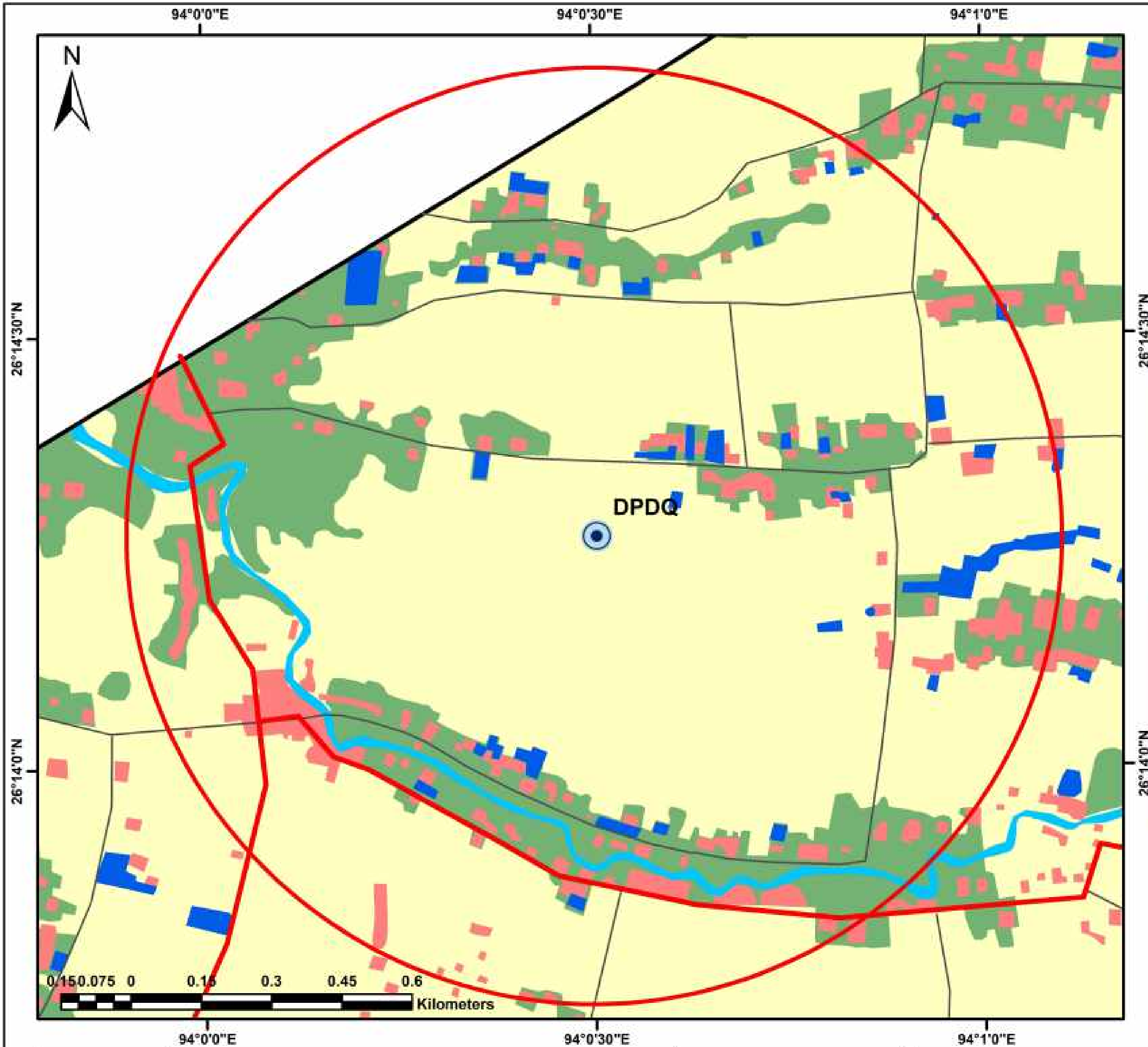
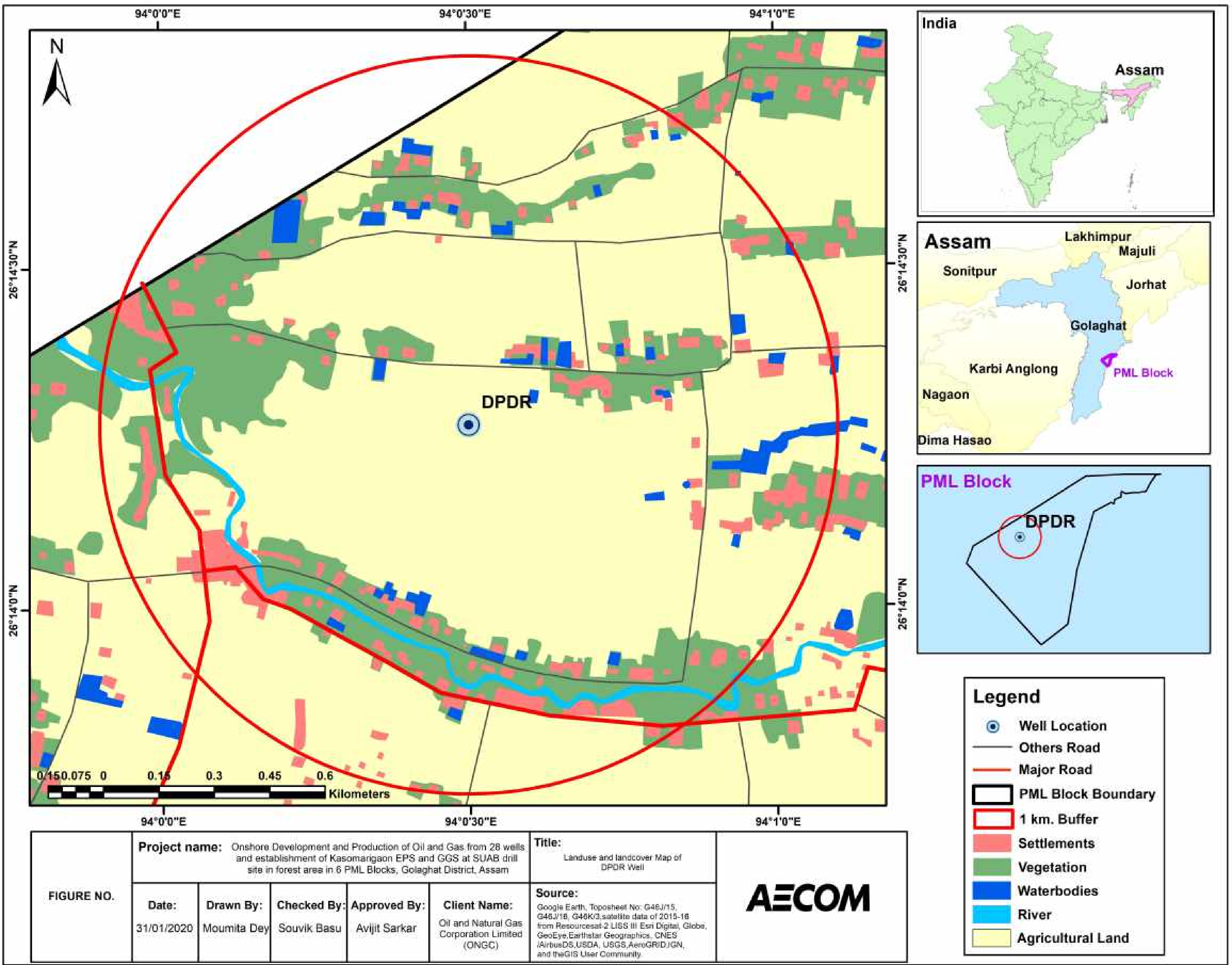


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of DPDQ Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.


94°0'0"E
94°0'30"E
94°1'0"E
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26°14'0"N
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DPDR
0.150.075 0 0.15 0.3 0.45 0.6
Kilometers
India
Assam
Assam
Lakhimpur
Majuli
Sonitpur
Jorhat
Golaghat
PML Block
Karbi Anglong
Nagaon
Dima Hasao
PML Block
DPDR
Legend
Well Location
Others Road
Major Road
PML Block Boundary
1 km. Buffer
Settlements
Vegetation
Waterbodies
River
Agricultural Land
FIGURE NO.
Project name: Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam
Title: Landuse and landcover Map of DPDR Well
Date: 31/01/2020
Drawn By: Moumita Dey
Checked By: Souvik Basu
Approved By: Avijit Sarkar
Client Name: Oil and Natural Gas Corporation Limited (ONGC)
Source: Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.
AECOM

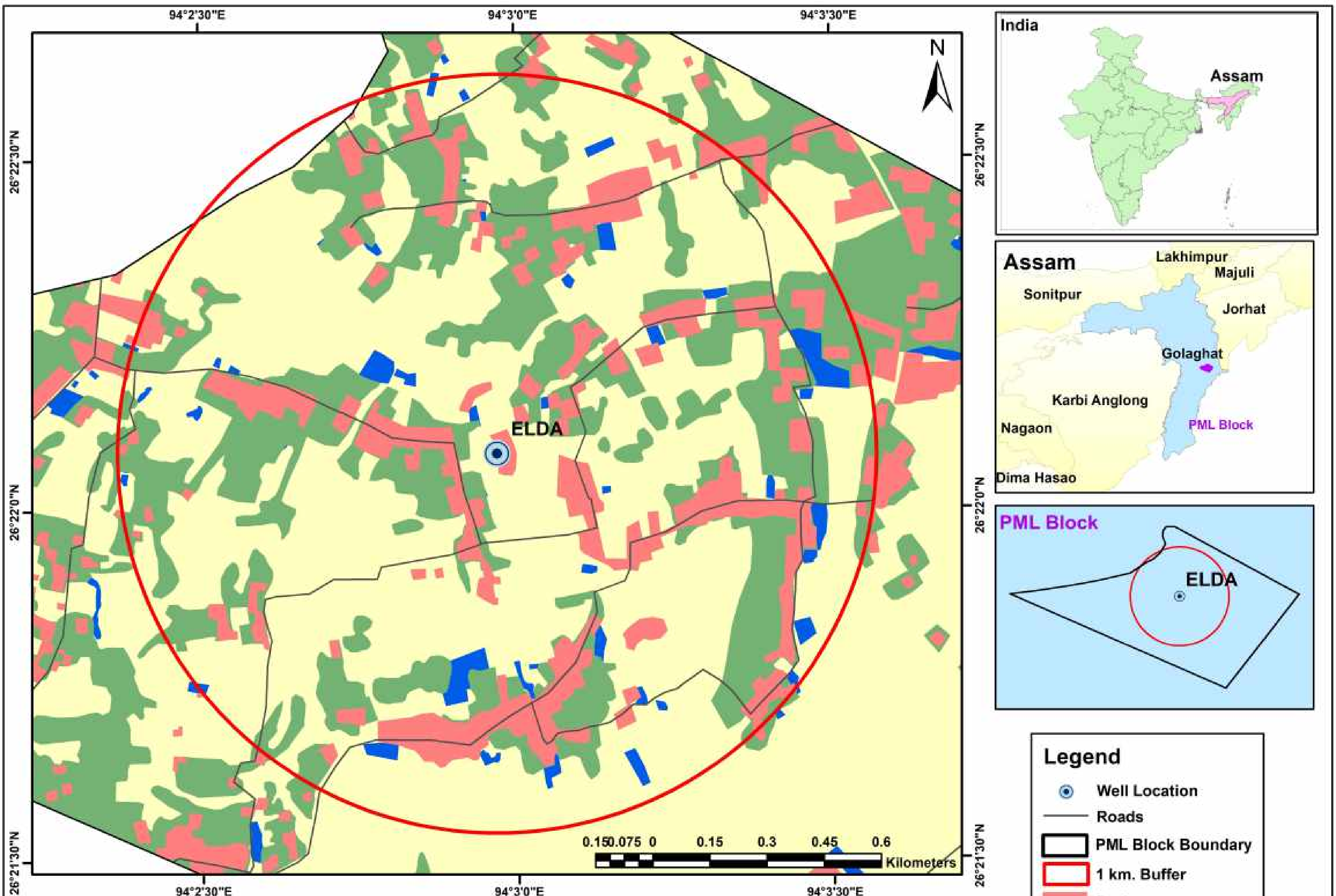
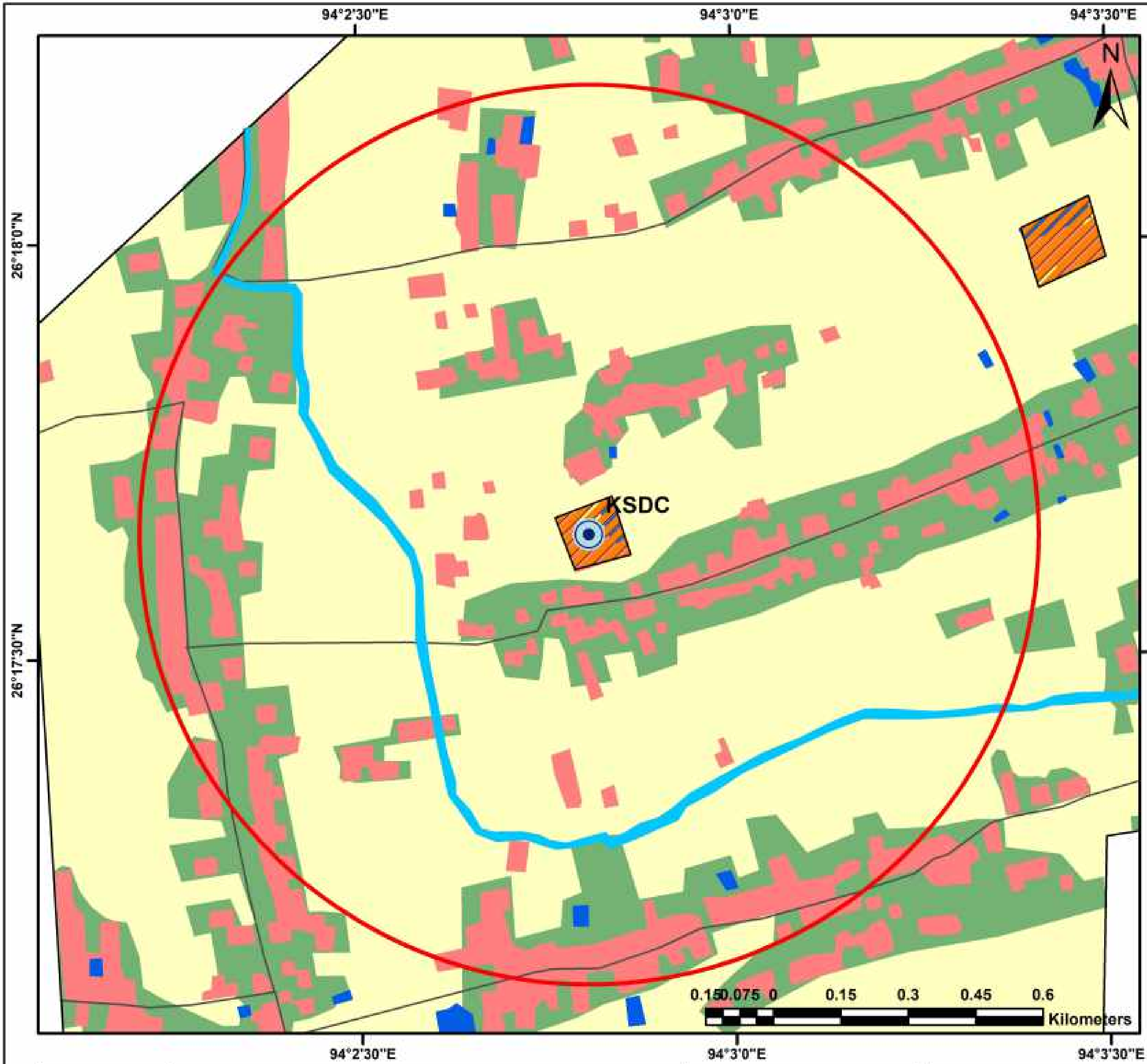


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of ELDA Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community



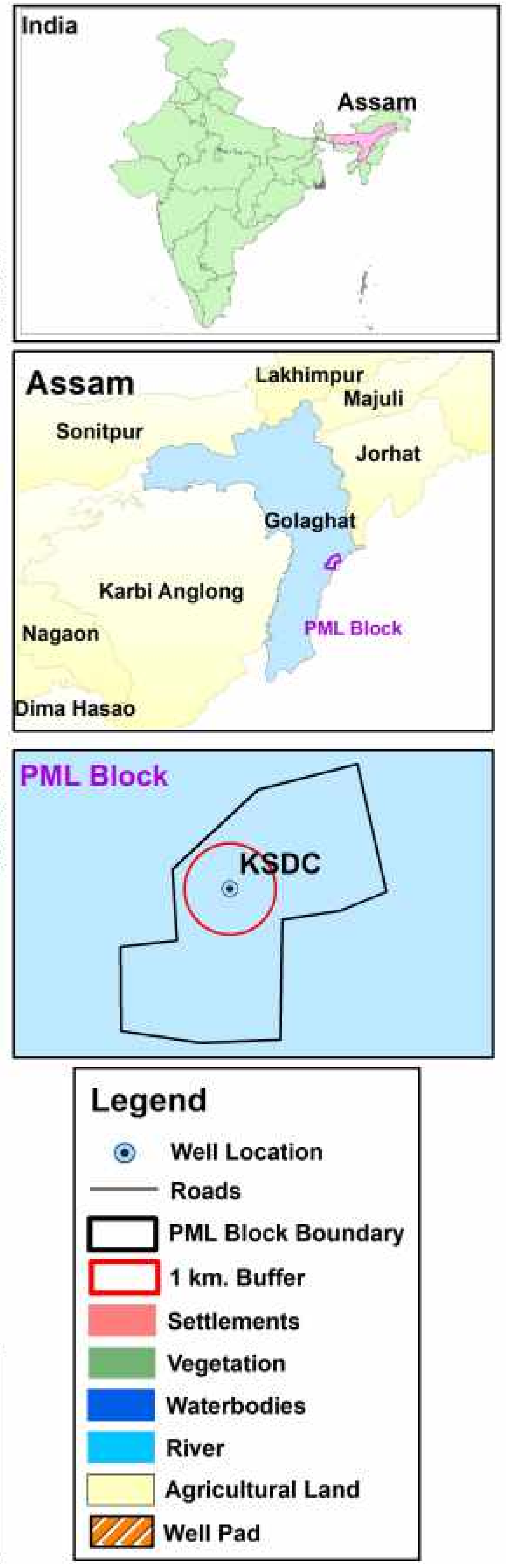
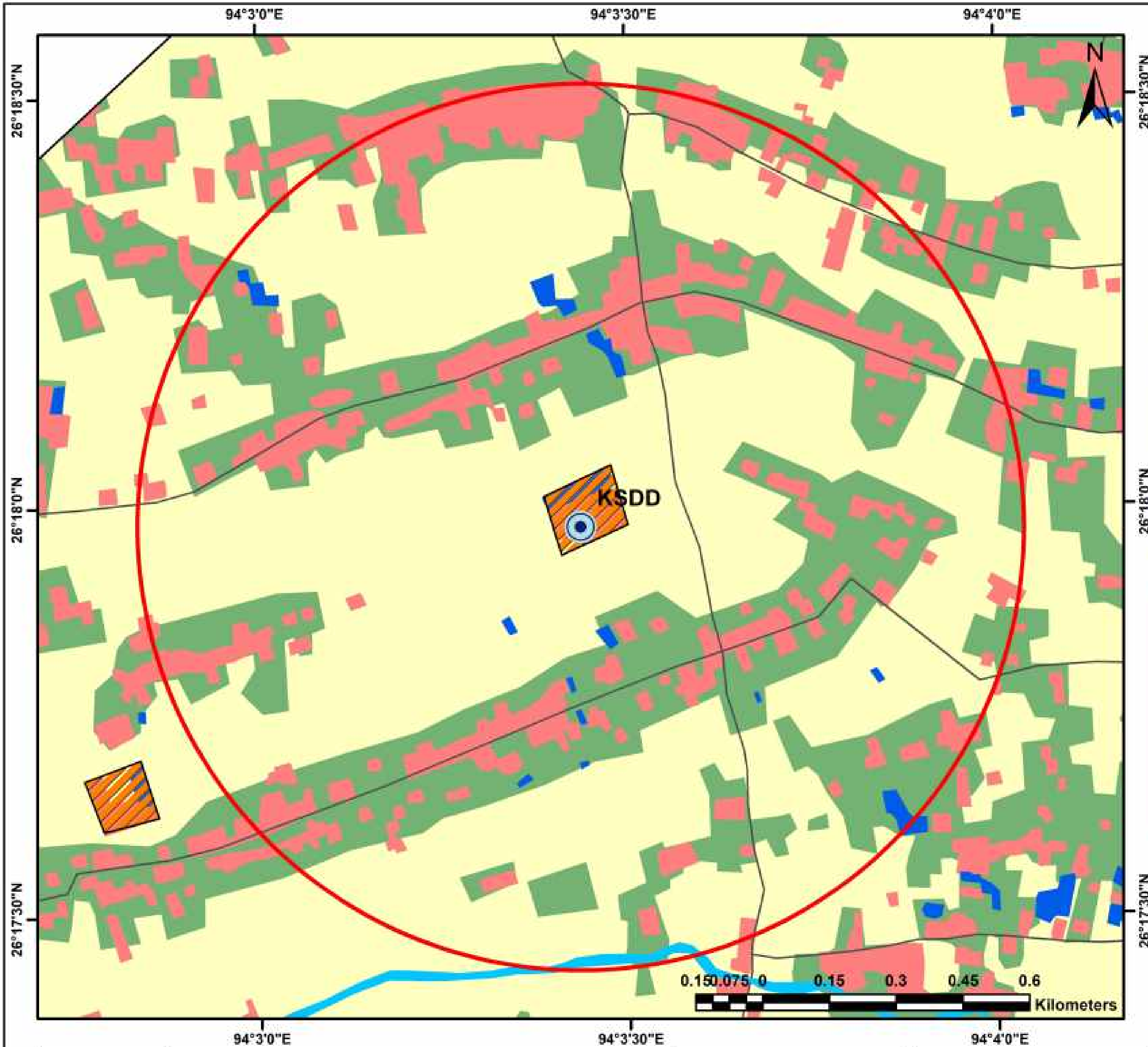


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					**Title:** Landuse and landcover Map of KSDC Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	



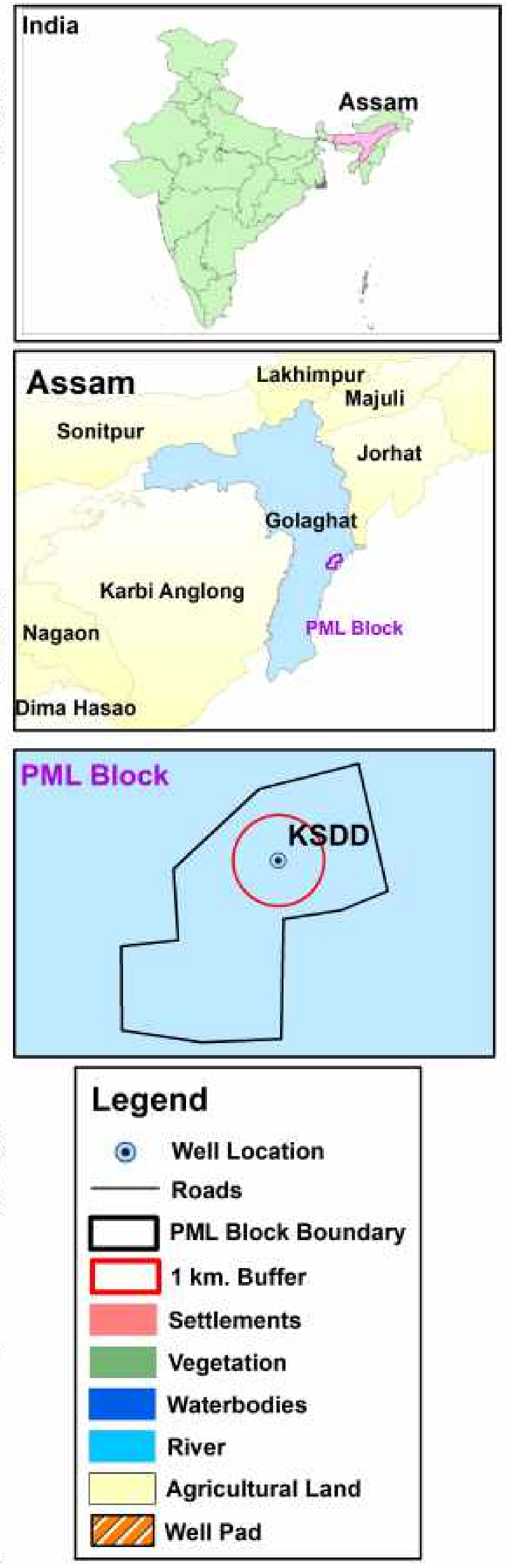
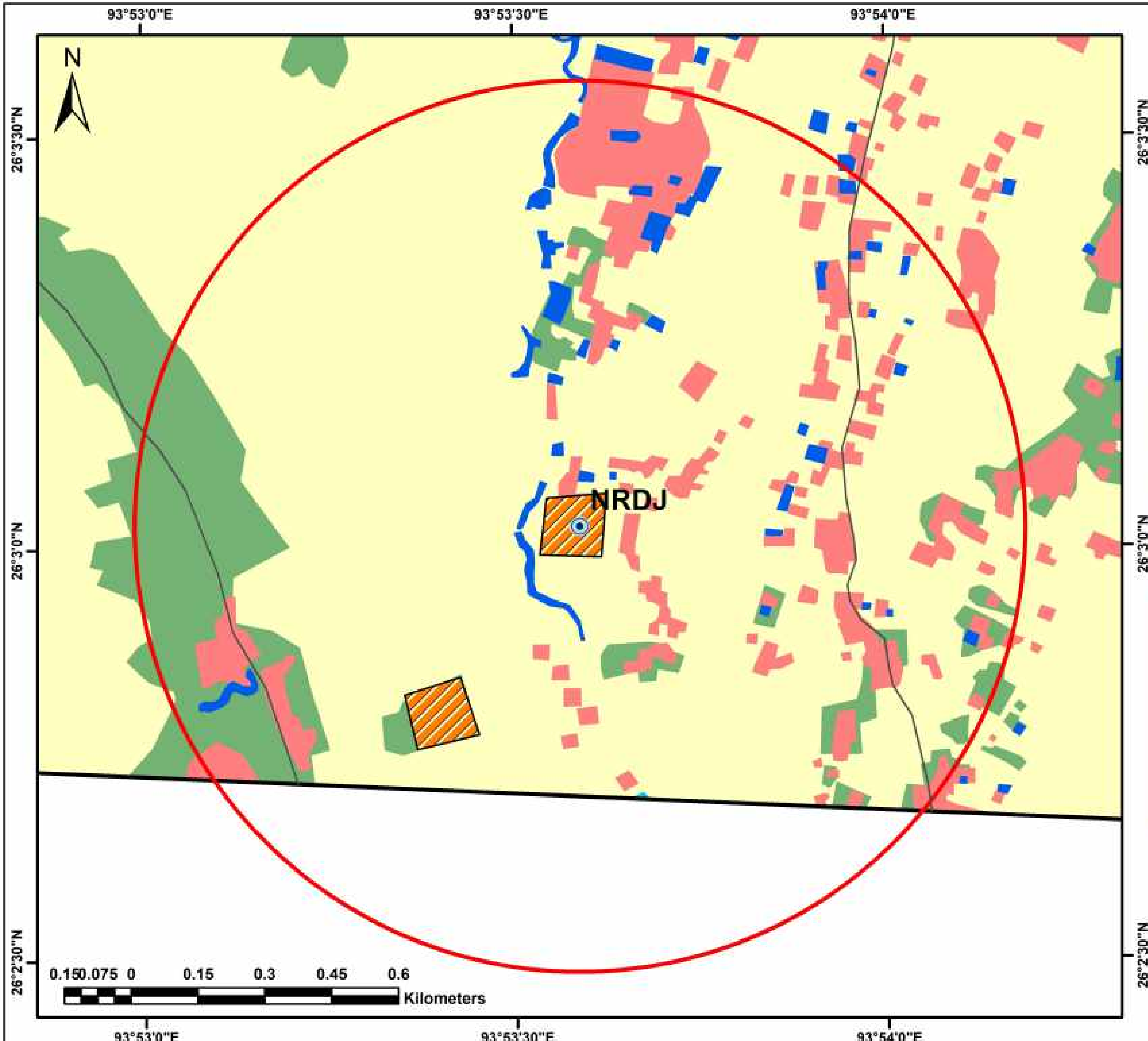


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of KSDD Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community



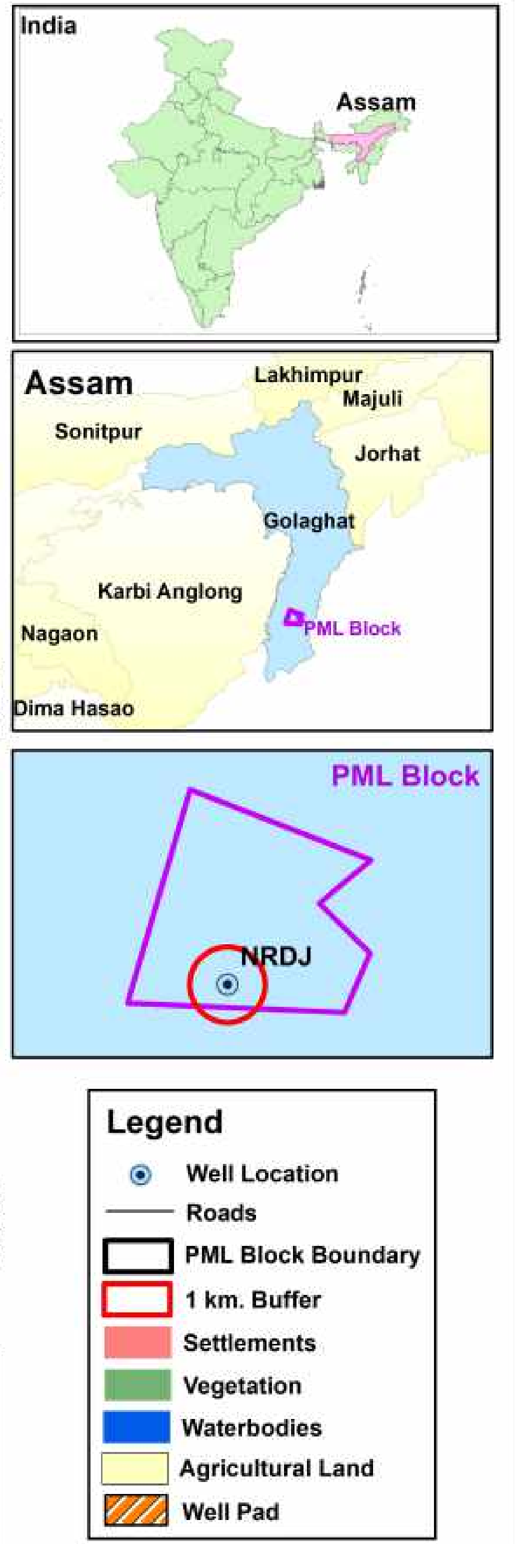


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam					**Title:** Landuse and landcover Map of NRDJ Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community.	

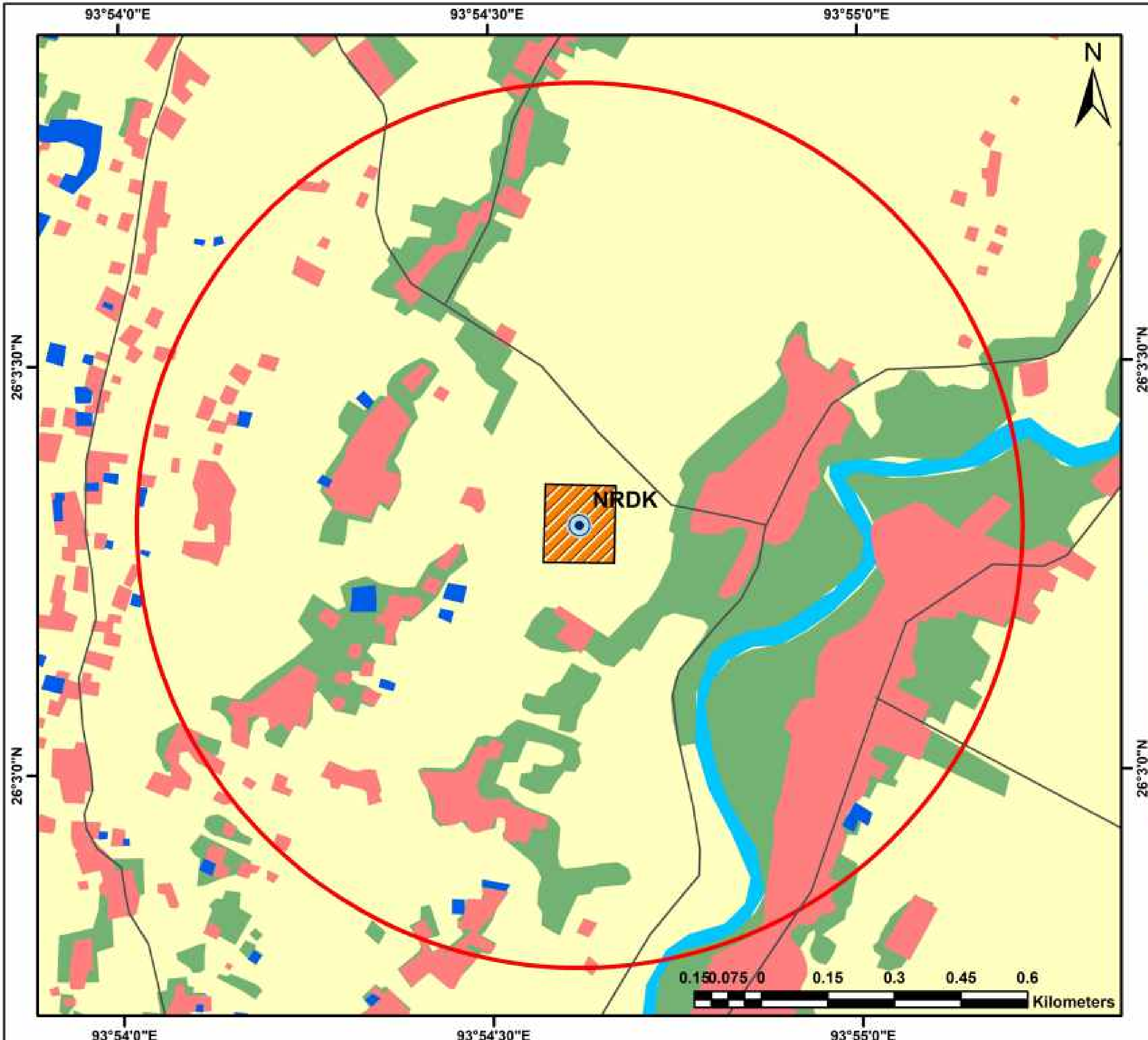


FIGURE NO.	**Project name:** Onshore Development and Production of Oil and Gas from 28 wells and establishment of Kasomarigaon EPS and GGS at SUAB drill site in forest area in 6 PML Blocks, Golaghat District, Assam				**Title:** Landuse and landcover Map of NRDK Well	AECOM
	Date: 31/01/2020	**Drawn By:** Moumita Dey	**Checked By:** Souvik Basu	**Approved By:** Avijit Sarkar	**Client Name:** Oil and Natural Gas Corporation Limited (ONGC)	**Source:** Google Earth, Toposheet No: G46J/15, G46J/16, G46K/3,satellite data of 2015-16 from Resourcesat-2 LISS III Esri Digital, Globe, GeoEye,Earthstar Geographics, CNES /AirbusDS,USDA, USGS,AeroGRID,IGN, and theGIS User Community

Edward Food Research & Analysis Centre Limited

No. EFL/AL/1920/3505

Date: 06/02/2020

TO WHOM IT MAY CONCERN

Sub: Environmental Baseline Monitoring for the EIA Study for 6 PML Blocks, in Golaghat district and 7ML blocks in Jorhat and Golaghat districts, Assam

This is to certify that EFRAC has conducted environmental monitoring programme in Jorhat and Golaghat Districts of Assam, from October 2019 to January 2020.

Further it is to certify that, Ambient Air Quality has been monitored twice a week during the above-mentioned period.

It is also being hereby certified that Soil quality, Noise levels, Traffic count survey and surface & ground Water Quality monitoring have been carried out once in the monitoring period and meteorological study for entire monitoring period.

For Edward Food research & Analysis Centre Ltd.

Authorised Signatory

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Phone : +91 33 6633 3939, Email : efracho@efrac.org, Website : www.efrac.org
CIN : U24100WB1921PLC004311

Appendix 3.2: Micro-Meteorological Data

Date	Month	Month	Year	Time	Air Temp.°C	RH %	Wind Speed mtrs/sec	DIREC	Speed	Direction	Barometric Pressure (milibar)	Rainfall (MM)	Cloud Cover (Oktas)
18	10	Oct'19	2019	10:00	22.3	59	2.3	53	0-5	NE	921	0	0
18	10	Oct'19	2019	11:00	22.4	56	2.1	35	0-5	NE	912	0	0
18	10	Oct'19	2019	12:00	22.6	57	3.2	58	0-5	ENE	927	0	0
18	10	Oct'19	2019	13:00	22.9	55	3.1	54	0-5	NE	903	0	0
18	10	Oct'19	2019	14:00	22.8	54	2.1	70	0-5	ENE	908	0	0
18	10	Oct'19	2019	15:00	23.1	59	2.2	50	0-5	NE	906	0	0
18	10	Oct'19	2019	16:00	23.2	58	2.3	55	0-5	NE	923	0	0
18	10	Oct'19	2019	17:00	22.8	55	2.6	53	0-5	NE	905	0	0
18	10	Oct'19	2019	18:00	22.6	60	2.5	40	0-5	NE	908	0	0
18	10	Oct'19	2019	19:00	22.5	59	2.5	45	0-5	NE	912	0	0
18	10	Oct'19	2019	20:00	22.2	61	2.9	22	0-5	NNE	923	0	0
18	10	Oct'19	2019	21:00	21.9	59	2.1	71	0-5	ENE	901	0	0
18	10	Oct'19	2019	22:00	21.6	58	2.6	66	0-5	ENE	903	0	0
18	10	Oct'19	2019	23:00	21.3	62	2.4	36	0-5	NE	921	0	0
19	10	Oct'19	2019	00:00	21.1	62	1.9	67	0-5	ENE	911	0	0
19	10	Oct'19	2019	01:00	20.8	63	1.5	64	0-5	ENE	918	0	0
19	10	Oct'19	2019	02:00	20.7	61	1.4	60	0-5	ENE	917	0	0
19	10	Oct'19	2019	03:00	20.5	62	1.6	50	0-5	NE	905	0	0
19	10	Oct'19	2019	04:00	20.3	63	1.5	67	0-5	ENE	901	0	0
19	10	Oct'19	2019	05:00	20.2	58	1.8	18	0-5	NNE	903	0	0
19	10	Oct'19	2019	06:00	20.3	59	1.6	77	0-5	ENE	905	0	0
19	10	Oct'19	2019	07:00	20.5	64	2.3	55	0-5	NE	912	0	0
19	10	Oct'19	2019	08:00	20.6	65	0.6	55	0-5	NE	913	0	0
19	10	Oct'19	2019	09:00	20.9	61	0.5	57	0-5	ENE	918	0	0
19	10	Oct'19	2019	10:00	21.2	59	1.8	63	0-5	ENE	914	0	0
19	10	Oct'19	2019	11:00	21.3	55	1.4	55	0-5	NE	919	0	0
19	10	Oct'19	2019	12:00	21.5	54	0.5	77	0-5	ENE	925	0	0
19	10	Oct'19	2019	13:00	21.6	51	0.9	58	0-5	ENE	928	0	0
19	10	Oct'19	2019	14:00	21.7	56	1.5	76	0-5	ENE	923	0	0
19	10	Oct'19	2019	15:00	21.8	55	2.3	52	0-5	NE	915	0	0
19	10	Oct'19	2019	16:00	22.2	53	2.4	57	0-5	ENE	927	0	0
19	10	Oct'19	2019	17:00	22.5	52	2.8	55	0-5	NE	915	0	0
19	10	Oct'19	2019	18:00	22.4	58	2.5	42	0-5	NE	908	0	0
19	10	Oct'19	2019	19:00	22.1	54	2.6	47	0-5	NE	901	0	0
19	10	Oct'19	2019	20:00	21.6	64	2.8	22	0-5	NNE	912	0	0
19	10	Oct'19	2019	21:00	21.5	62	2.1	59	0-5	ENE	923	0	0
19	10	Oct'19	2019	22:00	21.3	63	2.3	54	0-5	NE	901	0	0
19	10	Oct'19	2019	23:00	21.1	61	2.8	48	0-5	NE	903	0	0
20	10	Oct'19	2019	00:00	20.8	55	2.9	50	0-5	NE	921	0	0
20	10	Oct'19	2019	01:00	20.6	53	3.1	71	0-5	ENE	911	0	0
20	10	Oct'19	2019	02:00	20.5	54	3.5	44	0-5	NE	918	0	0
20	10	Oct'19	2019	03:00	20.3	58	3.6	18	0-5	NNE	917	0	0
20	10	Oct'19	2019	04:00	20.2	59	3.9	18	0-5	NNE	905	0	0
20	10	Oct'19	2019	05:00	19.9	51	3.7	11	3.6	N	901	0	0
20	10	Oct'19	2019	06:00	19.8	56	2.1	36	0	NE	903	0	0
20	10	Oct'19	2019	07:00	20.1	54	2.6	90	2.7	E	905	0	0
20	10	Oct'19	2019	08:00	20.4	57	2.8	77	3.6	ENE	912	0	0
20	10	Oct'19	2019	09:00	20.6	55	2.6	85	1.8	E	913	0	0
20	10	Oct'19	2019	10:00	20.8	65	2.1	60	2.7	ENE	918	0	0
20	10	Oct'19	2019	11:00	21.1	56	2.9	81	0	E	914	0	0
20	10	Oct'19	2019	12:00	21.5	62	2.4	67	2.7	ENE	919	0	0
20	10	Oct'19	2019	13:00	21.7	60	2.3	85	1.8	E	925	0	0
20	10	Oct'19	2019	14:00	21.9	59	2.1	60	2.7	ENE	928	0	0
20	10	Oct'19	2019	15:00	22.4	53	3.2	28	0.9	NNE	921	0	0
20	10	Oct'19	2019	16:00	22.7	63	3.1	60	0.9	ENE	902	0	0
20	10	Oct'19	2019	17:00	22.5	60	2.1	45	2.7	NE	903	0	0
20	10	Oct'19	2019	18:00	22.2	63	2.2	25	1.8	NNE	924	0	0
20	10	Oct'19	2019	19:00	21.8	51	2.3	51	0	NE	912	0	0
20	10	Oct'19	2019	20:00	21.4	50	2.6	24	2.7	NNE	913	0	0
20	10	Oct'19	2019	21:00	21.1	63	2.5	38	1.8	NE	902	0	0
20	10	Oct'19	2019	22:00	20.6	61	2.5	25	0.9	NNE	920	0	0
20	10	Oct'19	2019	23:00	20.4	63	2.9	79	3.6	E	922	0	0
21	10	Oct'19	2019	00:00	20.3	65	2.1	86	1.8	E	911	0	0
21	10	Oct'19	2019	01:00	20.1	58	2.6	19	0.9	NNE	921	0	0
21	10	Oct'19	2019	02:00	19.9	62	2.4	26	0	NNE	923	0	0
21	10	Oct'19	2019	03:00	19.8	63	1.9	18	2.7	NNE	924	0	0
21	10	Oct'19	2019	04:00	19.6	60	1.5	65	1.8	ENE	928	0	0
21	10	Oct'19	2019	05:00	19.4	65	1.4	38	2.7	NE	917	0	0
21	10	Oct'19	2019	06:00	19.5	64	1.6	52	3.6	NE	923	0	0
21	10	Oct'19	2019	07:00	19.7	65	1.5	86	1.8	E	901	0	0
21	10	Oct'19	2019	08:00	20.1	63	1.8	81	0.9	E	908	0	0
21	10	Oct'19	2019	09:00	20.3	60	1.6	50	3.6	NE	909	0	0
21	10	Oct'19	2019	10:00	20.5	56	2.3	50	0.9	NE	902	0	0
21	10	Oct'19	2019	11:00	20.7	63	2.1	82	2.7	E	917	0	0

21	10	Oct'19	2019	12:00	20.9	59	3.2	50	2.7	NE	913	0	0
21	10	Oct'19	2019	13:00	21.1	56	3.1	50	1.2	NE	928	0	0
21	10	Oct'19	2019	14:00	21.3	57	2.1	86	1.2	E	924	0	0
21	10	Oct'19	2019	15:00	21.6	55	2.2	11	0.5	N	921	0	0
21	10	Oct'19	2019	16:00	21.9	54	2.3	86	0.6	E	920	0	0
21	10	Oct'19	2019	17:00	21.8	59	2.6	22	1.5	NNE	928	0	0
21	10	Oct'19	2019	18:00	21.5	58	2.5	53	0	NE	915	0	0
21	10	Oct'19	2019	19:00	21.2	55	2.5	82	3.2	E	916	0	0
21	10	Oct'19	2019	20:00	20.8	60	2.9	69	1.1	ENE	924	0	0
21	10	Oct'19	2019	21:00	20.6	59	2.1	65	1.8	ENE	920	0	0
21	10	Oct'19	2019	22:00	20.4	61	2.6	66	0.9	ENE	922	0	0
21	10	Oct'19	2019	23:00	20.2	59	2.4	19	1.8	NNE	928	0	0
22	10	Oct'19	2019	00:00	19.6	58	1.9	58	0.9	ENE	929	0	0
22	10	Oct'19	2019	01:00	19.5	62	1.5	76	1.8	ENE	910	0	0
22	10	Oct'19	2019	02:00	19.2	62	1.4	79	1.8	E	918	0	0
22	10	Oct'19	2019	03:00	19.1	63	1.6	89	3.6	E	913	0	0
22	10	Oct'19	2019	04:00	19.2	61	1.5	65	3.6	ENE	904	0	0
22	10	Oct'19	2019	05:00	19.1	62	1.8	59	1.8	ENE	913	0	0
22	10	Oct'19	2019	06:00	19.3	63	1.6	29	0	NNE	903	0	0
22	10	Oct'19	2019	07:00	19.5	58	2.3	66	1.8	ENE	904	0	0
22	10	Oct'19	2019	08:00	19.6	59	0.6	76	2.7	ENE	909	0	0
22	10	Oct'19	2019	09:00	19.9	64	0.5	50	1.8	NE	911	0	0
22	10	Oct'19	2019	10:00	20.1	65	1.8	49	0	NE	918	0	0
22	10	Oct'19	2019	11:00	20.3	61	1.4	58	2.7	ENE	913	0	0
22	10	Oct'19	2019	12:00	20.6	59	0.5	55	1.8	NE	904	0	0
22	10	Oct'19	2019	13:00	20.8	55	0.9	82	1.8	E	903	0	0
22	10	Oct'19	2019	14:00	21.2	54	1.5	35	0.6	NE	907	0	0
22	10	Oct'19	2019	15:00	21.4	51	2.3	52	0.2	NE	909	0	0
22	10	Oct'19	2019	16:00	21.3	63	2.4	13	0.4	NNE	903	0	0
22	10	Oct'19	2019	17:00	21.1	62	2.8	23	1.1	NNE	907	0	0
22	10	Oct'19	2019	18:00	20.8	64	2.5	66	1.6	ENE	908	0	0
22	10	Oct'19	2019	19:00	20.6	65	2.6	82	0.5	E	902	0	0
22	10	Oct'19	2019	20:00	20.5	56	2.8	84	0.9	E	911	0	0
22	10	Oct'19	2019	21:00	20.2	54	2.1	45	0.8	NE	917	0	0
22	10	Oct'19	2019	22:00	20.1	63	2.3	81	0.9	E	918	0	0
22	10	Oct'19	2019	23:00	19.8	59	2.8	26	3.6	NNE	919	0	0
23	10	Oct'19	2019	00:00	19.6	65	2.1	19	1.8	NNE	928	0	0
23	10	Oct'19	2019	01:00	19.4	64	3.1	76	0.9	ENE	923	0	0
23	10	Oct'19	2019	02:00	19.2	57	1.3	38	0	NE	903	0	0
23	10	Oct'19	2019	03:00	19.1	64	1.4	58	2.7	ENE	901	0	0
23	10	Oct'19	2019	04:00	18.9	62	0.6	85	1.8	E	912	0	0
23	10	Oct'19	2019	05:00	18.8	59	1.5	12	3.2	NNE	911	0	0
23	10	Oct'19	2019	06:00	18.7	51	2.1	65	1.1	ENE	925	0	0
23	10	Oct'19	2019	07:00	19.1	63	3.8	15	1.4	NNE	926	0	0
23	10	Oct'19	2019	08:00	19.2	62	3.7	84	0.7	E	927	0	0
23	10	Oct'19	2019	09:00	19.6	65	3.3	76	0.7	ENE	920	0	0
23	10	Oct'19	2019	10:00	19.8	62	3.5	55	0.8	NE	921	0	0
23	10	Oct'19	2019	11:00	20.2	64	3.6	81	1.3	E	928	0	0
23	10	Oct'19	2019	12:00	20.6	61	3.9	41	2.2	NE	913	0	0
23	10	Oct'19	2019	13:00	20.8	63	3.7	49	0.6	NE	914	0	0
23	10	Oct'19	2019	14:00	21.3	62	2.1	48	1.5	NE	921	0	0
23	10	Oct'19	2019	15:00	21.5	61	2.6	35	1.6	NE	925	0	0
23	10	Oct'19	2019	16:00	21.6	64	2.8	61	0.4	ENE	903	0	0
23	10	Oct'19	2019	17:00	21.2	61	2.6	48	1.9	NE	908	0	0
23	10	Oct'19	2019	18:00	20.8	63	2.1	19	0	NNE	901	0	0
23	10	Oct'19	2019	19:00	20.6	62	2.9	52	0	NE	909	0	0
23	10	Oct'19	2019	20:00	20.4	52	2.4	81	0.7	E	911	0	0
23	10	Oct'19	2019	21:00	20.3	62	2.3	53	1.3	NE	925	0	0
23	10	Oct'19	2019	22:00	20.2	64	2.1	33	0.9	NNE	922	0	0
23	10	Oct'19	2019	23:00	19.9	54	3.2	59	0.9	ENE	930	0	0
24	10	Oct'19	2019	00:00	19.6	59	3.1	47	1.8	NE	921	0	0
24	10	Oct'19	2019	01:00	19.5	63	2.1	36	0.9	NE	921	0	0
24	10	Oct'19	2019	02:00	19.2	61	2.2	61	1.8	ENE	912	0	0
24	10	Oct'19	2019	03:00	19.1	65	2.3	66	2.7	ENE	927	0	0
24	10	Oct'19	2019	04:00	19.1	58	2.6	38	3.6	NE	903	0	0
24	10	Oct'19	2019	05:00	18.8	51	2.5	42	2.7	NE	908	0	0
24	10	Oct'19	2019	06:00	19.2	58	2.5	58	1.8	ENE	906	0	0
24	10	Oct'19	2019	07:00	19.3	53	2.9	57	0	ENE	923	0	0
24	10	Oct'19	2019	08:00	19.4	61	2.1	57	2.7	ENE	905	0	0
24	10	Oct'19	2019	09:00	19.7	65	2.6	79	1.8	E	908	0	0
24	10	Oct'19	2019	10:00	19.8	61	2.4	77	0	ENE	912	0	0
24	10	Oct'19	2019	11:00	20.2	65	1.9	57	0.9	ENE	923	0	0
24	10	Oct'19	2019	12:00	20.3	63	1.5	54	2.4	NE	901	0	0
24	10	Oct'19	2019	13:00	20.6	60	1.4	59	1.7	ENE	903	0	0
24	10	Oct'19	2019	14:00	20.8	63	1.6	57	2.2	ENE	921	0	0
24	10	Oct'19	2019	15:00	21.2	61	1.5	44	2.6	NE	911	0	0
24	10	Oct'19	2019	16:00	21.1	65	1.8	49	1.8	NE	918	0	0

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24	10	Oct'19	2019	18:00	20.6	63	2.3	85	1.6	E	905	0	0
24	10	Oct'19	2019	19:00	20.5	64	0.6	11	0.8	N	901	0	0
24	10	Oct'19	2019	20:00	20.3	58	0.5	56	0.5	NE	903	0	0
24	10	Oct'19	2019	21:00	20.2	63	1.8	50	1.1	NE	905	0	0
24	10	Oct'19	2019	22:00	19.9	59	1.4	82	0.9	E	912	0	0
24	10	Oct'19	2019	23:00	19.8	57	0.5	38	2.2	NE	913	0	0
25	10	Oct'19	2019	00:00	19.5	64	0.9	11	2.8	N	918	0	0
25	10	Oct'19	2019	01:00	19.3	63	2.3	46	3.3	NE	914	0	0
25	10	Oct'19	2019	02:00	19.1	65	2.1	20	1.8	NNE	919	0	0
25	10	Oct'19	2019	03:00	18.9	54	3.2	21	0	NNE	925	0	0
25	10	Oct'19	2019	04:00	18.7	51	3.1	13	1.2	NNE	928	0	0
25	10	Oct'19	2019	05:00	18.8	58	2.1	38	0.5	NE	923	0	0
25	10	Oct'19	2019	06:00	18.7	63	2.2	79	0.9	E	915	0	0
25	10	Oct'19	2019	07:00	18.9	62	2.3	66	0.8	ENE	927	0	0
25	10	Oct'19	2019	08:00	19.3	65	2.6	62	1.4	ENE	915	0	0
25	10	Oct'19	2019	09:00	19.5	58	2.5	59	2.1	ENE	908	0	0
25	10	Oct'19	2019	10:00	19.6	63	2.5	69	2.8	ENE	901	0	0
25	10	Oct'19	2019	11:00	19.8	65	2.9	66	1.6	ENE	912	0	0
25	10	Oct'19	2019	12:00	20.1	52	2.1	62	2.4	ENE	923	0	0
25	10	Oct'19	2019	13:00	20.3	65	2.6	30	1.7	NNE	901	0	0
25	10	Oct'19	2019	14:00	20.5	63	2.4	62	1.1	ENE	903	0	0
25	10	Oct'19	2019	15:00	20.6	64	1.9	24	0.6	NNE	921	0	0
25	10	Oct'19	2019	16:00	20.8	52	1.5	56	0.2	NE	911	0	0
25	10	Oct'19	2019	17:00	20.3	51	1.4	26	1.6	NNE	918	0	0
25	10	Oct'19	2019	18:00	20.1	57	1.6	27	0.8	NNE	917	0	0
25	10	Oct'19	2019	19:00	19.9	64	1.5	81	1.4	E	905	0	0
25	10	Oct'19	2019	20:00	19.8	65	1.8	53	0.9	NE	901	0	0
25	10	Oct'19	2019	21:00	19.6	63	1.6	31	1.8	NNE	903	0	0
25	10	Oct'19	2019	22:00	19.4	51	2.3	28	2.7	NNE	905	0	0
25	10	Oct'19	2019	23:00	19.3	53	0.6	25	0.9	NNE	912	0	0
26	10	Oct'19	2019	00:00	19.2	59	0.5	67	0.9	ENE	913	0	0
26	10	Oct'19	2019	01:00	19.1	58	1.8	58	1.8	ENE	918	0	0
26	10	Oct'19	2019	02:00	19.1	63	1.4	59	0.9	ENE	914	0.12	0
26	10	Oct'19	2019	03:00	18.9	62	0.5	55	1.8	NE	919	0	0
26	10	Oct'19	2019	04:00	18.8	53	0.9	82	1.8	E	925	0	0
26	10	Oct'19	2019	05:00	18.7	65	1.5	82	2.7	E	928	0	0
26	10	Oct'19	2019	06:00	18.7	63	2.3	82	2.2	E	921	0.11	0
26	10	Oct'19	2019	07:00	19.1	61	2.4	53	3.6	NE	902	0	0
26	10	Oct'19	2019	08:00	19.3	64	2.8	13	1.8	NNE	903	0	0
26	10	Oct'19	2019	09:00	19.7	59	2.5	23	2.7	NNE	924	0	0
26	10	Oct'19	2019	10:00	19.9	61	2.6	70	3.1	ENE	912	0	0
26	10	Oct'19	2019	11:00	20.3	65	2.8	34	0.9	NE	913	0	0
26	10	Oct'19	2019	12:00	20.6	63	2.1	58	1.6	ENE	902	0.13	0
26	10	Oct'19	2019	13:00	20.8	58	2.3	57	1.9	ENE	920	0	0
26	10	Oct'19	2019	14:00	21.2	57	2.8	33	1.1	NNE	922	0	0
26	10	Oct'19	2019	15:00	21.5	63	2.9	33	0.8	NNE	911	0	0
26	10	Oct'19	2019	16:00	21.8	63	3.1	89	0.1	E	921	0	0
26	10	Oct'19	2019	17:00	22.1	65	3.9	77	1.4	ENE	923	0.15	0
26	10	Oct'19	2019	18:00	21.9	61	3.7	57	0.5	ENE	901	0	0
26	10	Oct'19	2019	19:00	21.7	51	2.1	81	0.3	E	903	0	0
26	10	Oct'19	2019	20:00	21.4	65	2.6	67	0.7	ENE	909	0	0
26	10	Oct'19	2019	21:00	21.3	53	2.8	85	2.5	E	911	0	0
26	10	Oct'19	2019	22:00	21.1	63	2.6	31	2.7	NNE	923	0	0
26	10	Oct'19	2019	23:00	20.8	63	2.1	42	1.9	NE	927	0	0
27	10	Oct'19	2019	00:00	20.6	65	2.9	89	1.4	E	928	0	0
27	10	Oct'19	2019	01:00	20.4	63	2.4	57	2.2	ENE	921	0.11	0
27	10	Oct'19	2019	02:00	20.2	58	2.3	82	1.5	E	920	0	0
27	10	Oct'19	2019	03:00	20.1	51	2.1	51	1.1	NE	907	0	0
27	10	Oct'19	2019	04:00	19.9	53	3.2	65	1.6	ENE	911	0	0
27	10	Oct'19	2019	05:00	19.8	64	3.1	76	2.8	ENE	918	0.1	0
27	10	Oct'19	2019	06:00	19.7	61	2.1	84	1.5	E	909	0	0
27	10	Oct'19	2019	07:00	19.9	58	2.2	37	1.2	NE	903	0	0
27	10	Oct'19	2019	08:00	20.1	51	2.3	53	0	NE	901	0	0
27	10	Oct'19	2019	09:00	20.4	59	2.6	15	0	NNE	903	0.12	0
27	10	Oct'19	2019	10:00	20.5	62	2.5	25	0	NNE	908	0	0
27	10	Oct'19	2019	11:00	20.7	61	2.5	89	3.3	E	909	0	0
27	10	Oct'19	2019	12:00	20.9	62	2.9	84	1.3	E	913	0	0
27	10	Oct'19	2019	13:00	21.3	64	2.1	86	1.1	E	908	0	0
27	10	Oct'19	2019	14:00	21.5	62	2.6	75	0.8	ENE	902	0	0
27	10	Oct'19	2019	15:00	21.6	65	2.4	28	0.4	NNE	909	0	0
27	10	Oct'19	2019	16:00	21.8	58	1.9	22	1.9	NNE	911	0	0
27	10	Oct'19	2019	17:00	22.3	61	1.5	57	1	ENE	923	0	0
27	10	Oct'19	2019	18:00	22.2	63	1.4	58	1.1	ENE	922	0	0
27	10	Oct'19	2019	19:00	21.9	54	1.6	77	1.6	ENE	928	0	0
27	10	Oct'19	2019	20:00	21.6	51	1.5	66	1.4	ENE	901	0	0
27	10	Oct'19	2019	21:00	21.3	65	1.8	79	0.7	E	909	0	0

27	10	Oct'19	2019	22:00	21.1	64	1.6	89	0.3	E	904	0	0
27	10	Oct'19	2019	23:00	20.8	63	2.3	65	1.2	ENE	906	0	0
28	10	Oct'19	2019	00:00	20.7	55	2.1	59	0.5	ENE	907	0	0
28	10	Oct'19	2019	01:00	20.5	53	3.2	29	0.9	NNE	908	0	0
28	10	Oct'19	2019	02:00	20.3	54	3.1	66	1.6	ENE	912	0	0
28	10	Oct'19	2019	03:00	20.2	58	2.1	76	0.9	ENE	903	0	0
28	10	Oct'19	2019	04:00	20.3	59	2.2	50	0.9	NE	916	0	0
28	10	Oct'19	2019	05:00	20.5	51	2.3	49	0.9	NE	911	0	0
28	10	Oct'19	2019	06:00	20.6	56	2.6	58	2.7	ENE	918	0	0
28	10	Oct'19	2019	07:00	20.9	54	2.5	55	0.9	NE	903	0	0
28	10	Oct'19	2019	08:00	21.2	57	2.5	82	1.8	E	926	0	0
28	10	Oct'19	2019	09:00	21.3	55	2.9	35	1.8	NE	907	0	0
28	10	Oct'19	2019	10:00	21.5	65	2.1	52	0.9	NE	927	0	0
28	10	Oct'19	2019	11:00	21.6	56	2.6	13	1.4	NNE	928	0	0
28	10	Oct'19	2019	12:00	21.7	62	2.4	23	0.5	NNE	903	0	0
28	10	Oct'19	2019	13:00	21.8	60	1.9	66	0.3	ENE	901	0	0
28	10	Oct'19	2019	14:00	22.2	59	1.5	82	1.1	E	928	0	0
28	10	Oct'19	2019	15:00	22.5	53	1.4	84	0.6	E	906	0	0
28	10	Oct'19	2019	16:00	22.4	63	1.6	45	0.2	NE	923	0	0
28	10	Oct'19	2019	17:00	22.1	60	1.5	81	1.6	E	928	0	0
28	10	Oct'19	2019	18:00	21.6	63	1.8	26	0	NNE	901	0	0
28	10	Oct'19	2019	19:00	21.5	51	1.6	19	0	NNE	911	0	0
28	10	Oct'19	2019	20:00	21.3	50	2.3	76	0.5	ENE	928	0	0
28	10	Oct'19	2019	21:00	21.1	63	0.6	38	0.3	NE	927	0	0
28	10	Oct'19	2019	22:00	20.8	61	0.5	58	1.1	ENE	926	0	0
28	10	Oct'19	2019	23:00	20.6	63	1.8	85	0.8	E	921	0	0
28	10	Oct'19	2019	00:00	20.5	65	1.4	12	0.1	NNE	922	0	0
28	10	Oct'19	2019	01:00	20.3	58	0.5	65	1.4	ENE	902	0	0
28	10	Oct'19	2019	02:00	20.2	62	0.9	15	0.5	NNE	908	0	0
28	10	Oct'19	2019	03:00	19.9	63	1.5	84	1.3	E	906	0	0
28	10	Oct'19	2019	04:00	19.8	60	2.3	76	1.1	ENE	903	0	0
28	10	Oct'19	2019	05:00	20.1	65	2.4	55	0.8	NE	905	0.12	0
28	10	Oct'19	2019	06:00	20.4	64	2.8	81	0.4	E	908	0	0
28	10	Oct'19	2019	07:00	20.6	65	2.5	41	3.2	NE	911	0	0
28	10	Oct'19	2019	08:00	20.8	63	2.6	49	1.1	NE	918	0	0
28	10	Oct'19	2019	09:00	21.1	60	2.8	48	0.6	NE	913	0	0
28	10	Oct'19	2019	10:00	21.5	56	2.1	35	0.2	NE	921	0	0
28	10	Oct'19	2019	11:00	21.7	63	2.3	61	0.4	ENE	912	0	0
28	10	Oct'19	2019	12:00	21.9	59	2.8	48	0.9	NE	927	0	0
28	10	Oct'19	2019	13:00	22.4	56	2.1	19	0.9	NNE	903	0	0
28	10	Oct'19	2019	14:00	22.7	57	3.1	52	1.8	NE	908	0	0
28	10	Oct'19	2019	15:00	22.5	55	1.3	81	1.8	E	906	0.12	0
28	10	Oct'19	2019	16:00	22.2	54	1.4	53	0.9	NE	923	0	0
28	10	Oct'19	2019	17:00	21.8	59	0.6	33	1.8	NNE	905	0	0
28	10	Oct'19	2019	18:00	21.4	58	1.5	59	0.9	ENE	908	0	0
28	10	Oct'19	2019	19:00	21.1	55	2.1	47	1.8	NE	912	0	0
28	10	Oct'19	2019	20:00	20.6	60	3.8	36	1.8	NE	923	0	0
28	10	Oct'19	2019	21:00	20.4	59	3.7	61	3.6	ENE	901	0	0
28	10	Oct'19	2019	22:00	20.3	61	3.3	66	3.6	ENE	903	0	0
28	10	Oct'19	2019	23:00	20.1	59	3.5	38	1.8	NE	921	0	0
29	10	Oct'19	2019	00:00	19.9	58	3.6	42	1.8	NE	911	0	0
29	10	Oct'19	2019	01:00	19.8	62	3.9	58	2.7	ENE	918	0	0
29	10	Oct'19	2019	02:00	19.6	62	3.7	57	1.8	ENE	917	0	0
29	10	Oct'19	2019	03:00	19.4	63	2.1	57	2.7	ENE	905	0	0
29	10	Oct'19	2019	04:00	19.5	61	2.6	79	1.8	E	901	0	0
29	10	Oct'19	2019	05:00	19.7	62	2.8	77	1.8	ENE	903	0	0
29	10	Oct'19	2019	06:00	20.1	63	2.6	57	0.9	ENE	905	0	0
29	10	Oct'19	2019	07:00	20.3	58	2.1	54	0.9	NE	912	0	0
29	10	Oct'19	2019	08:00	20.5	59	2.9	59	1.8	ENE	913	0	0
29	10	Oct'19	2019	09:00	20.7	64	2.4	57	0.9	ENE	918	0	0
29	10	Oct'19	2019	10:00	20.9	65	2.3	44	1.8	NE	914	0	0
29	10	Oct'19	2019	11:00	21.1	61	2.1	49	2.7	NE	919	0	0
29	10	Oct'19	2019	12:00	21.3	59	3.2	24	3.6	NNE	925	0	0
29	10	Oct'19	2019	13:00	21.6	55	3.1	85	2.7	E	928	0	0
29	10	Oct'19	2019	14:00	21.9	54	2.1	11	1.8	N	921	0	0
29	10	Oct'19	2019	15:00	21.8	51	2.2	56	0	NE	902	0	0
29	10	Oct'19	2019	16:00	21.5	61	2.3	50	2.7	NE	903	0	0
29	10	Oct'19	2019	17:00	21.2	64	2.6	82	1.8	E	924	0	0
29	10	Oct'19	2019	18:00	20.8	62	2.5	38	0	NE	912	0	0
29	10	Oct'19	2019	19:00	20.6	63	2.5	11	0.9	N	913	0	0
29	10	Oct'19	2019	20:00	20.4	62	2.9	46	0.9	NE	902	0	0
29	10	Oct'19	2019	21:00	20.2	65	2.1	20	1.8	NNE	920	0	0
29	10	Oct'19	2019	22:00	19.6	61	2.6	21	2.7	NNE	922	0	0
29	10	Oct'19	2019	23:00	19.5	60	2.4	13	0.9	NNE	911	0	0
30	10	Oct'19	2019	00:00	19.2	64	1.9	38	0.9	NE	921	0	0
30	10	Oct'19	2019	01:00	19.1	63	1.5	79	1.8	E	923	0	0
30	10	Oct'19	2019	02:00	19.2	62	1.4	66	0.9	ENE	924	0	0

30	10	Oct'19	2019	03:00	19.1	64	1.6	62	1.8	ENE	928	0	0
30	10	Oct'19	2019	04:00	19.3	64	1.5	59	1.8	ENE	917	0	0
30	10	Oct'19	2019	05:00	19.5	61	1.8	69	2.7	ENE	923	0	0
30	10	Oct'19	2019	06:00	19.6	63	1.6	66	3.6	ENE	901	0	0
30	10	Oct'19	2019	07:00	19.9	64	2.3	62	1.8	ENE	908	0	0
30	10	Oct'19	2019	08:00	20.1	60	0.6	30	2.7	NNE	909	0	0
30	10	Oct'19	2019	09:00	20.3	65	0.5	62	0.9	ENE	902	0	0
30	10	Oct'19	2019	10:00	20.6	61	1.8	24	0.9	NNE	917	0	0
30	10	Oct'19	2019	11:00	20.8	63	1.4	56	0.9	NE	913	0	0
30	10	Oct'19	2019	12:00	21.2	62	0.5	26	0.9	NNE	928	0	0
30	10	Oct'19	2019	13:00	21.4	59	0.9	27	0.9	NNE	924	0	0
30	10	Oct'19	2019	14:00	21.3	51	2.3	81	2.7	E	921	0	0
30	10	Oct'19	2019	15:00	21.1	65	2.1	53	0.9	NE	920	0	0
30	10	Oct'19	2019	16:00	20.8	63	3.2	31	1.8	NNE	928	0	0
30	10	Oct'19	2019	17:00	20.6	63	3.1	28	1.8	NNE	915	0	0
30	10	Oct'19	2019	18:00	20.5	52	2.1	25	0.9	NNE	916	0	0
30	10	Oct'19	2019	19:00	20.2	58	2.2	67	0.9	ENE	924	0	0
30	10	Oct'19	2019	20:00	20.1	54	2.3	58	2.7	ENE	920	0	0
30	10	Oct'19	2019	21:00	19.8	64	2.6	59	0.9	ENE	922	0	0
30	10	Oct'19	2019	22:00	19.6	62	2.5	55	1.8	NE	928	0	0
30	10	Oct'19	2019	23:00	19.4	63	2.5	82	2.7	E	929	0	0
31	10	Oct'19	2019	00:00	19.2	61	2.9	82	3.6	E	910	0	0
31	10	Oct'19	2019	01:00	19.1	55	2.1	82	1.8	E	918	0	0
31	10	Oct'19	2019	02:00	18.9	53	2.6	53	1.8	NE	913	0	0
31	10	Oct'19	2019	03:00	18.8	54	2.4	13	2.7	NNE	904	0	0
31	10	Oct'19	2019	04:00	18.7	58	1.9	23	2.7	NNE	913	0	0
31	10	Oct'19	2019	05:00	19.1	59	1.5	70	0.9	ENE	903	0	0
31	10	Oct'19	2019	06:00	19.2	51	1.4	34	1.8	NE	904	0	0
31	10	Oct'19	2019	07:00	19.6	56	1.6	58	0.9	ENE	909	0	0
31	10	Oct'19	2019	08:00	19.8	54	1.5	57	0.9	ENE	911	0	0
31	10	Oct'19	2019	09:00	20.2	57	1.8	33	0.9	NNE	918	0	0
31	10	Oct'19	2019	10:00	20.6	55	1.6	33	1.8	NNE	913	0	0
31	10	Oct'19	2019	11:00	20.8	65	2.6	89	1.8	E	904	0	0
31	10	Oct'19	2019	12:00	21.3	56	2.1	55	0.9	NE	903	0	0
31	10	Oct'19	2019	13:00	21.5	62	0.6	81	0.9	E	907	0	0
31	10	Oct'19	2019	14:00	21.6	60	2.1	42	1.8	NE	909	0	0
31	10	Oct'19	2019	15:00	21.2	59	2.5	31	0.9	NNE	903	0	0
31	10	Oct'19	2019	16:00	20.8	53	3.2	81	2.5	E	907	0	0
31	10	Oct'19	2019	17:00	20.6	63	1.7	14	0.9	NNE	908	0	0
31	10	Oct'19	2019	18:00	20.4	60	1.4	53	1.8	NE	902	0	0
31	10	Oct'19	2019	19:00	20.3	63	2.5	54	1.9	NE	911	0	0
31	10	Oct'19	2019	20:00	20.2	51	2.9	46	0.7	NE	917	0	0
31	10	Oct'19	2019	21:00	19.9	50	2.1	56	2.2	NE	918	0	0
31	10	Oct'19	2019	22:00	19.6	63	3.1	39	0.3	NE	919	0	0
31	10	Oct'19	2019	23:00	19.5	61	2.9	48	0.3	NE	928	0	0
1	11	Nov'19	2019	00:00	18.4	63	2.4	53	1	NE	903	0	0
1	11	Nov'19	2019	01:00	18.3	65	2.3	64	1.6	ENE	907	0	0
1	11	Nov'19	2019	02:00	18.1	65	2.1	52	1.2	NE	909	0	0
1	11	Nov'19	2019	03:00	17.9	64	3.2	86	1.2	E	903	0	0
1	11	Nov'19	2019	04:00	17.8	61	3.1	81	2.1	E	907	0	0
1	11	Nov'19	2019	05:00	17.6	63	2.1	50	1.2	NE	908	0	0
1	11	Nov'19	2019	06:00	17.5	65	2.2	50	2.1	NE	902	0	0
1	11	Nov'19	2019	07:00	17.8	62	2.3	82	3	E	911	0	0
1	11	Nov'19	2019	08:00	18.5	61	2.6	50	3.9	NE	917	0	0
1	11	Nov'19	2019	09:00	18.6	63	2.5	50	3	NE	918	0	0
1	11	Nov'19	2019	10:00	18.9	64	2.5	86	2.1	E	919	0	0
1	11	Nov'19	2019	11:00	19.1	63	2.9	11	0.3	N	928	0	0
1	11	Nov'19	2019	12:00	19.4	65	2.1	86	3	E	923	0	0
1	11	Nov'19	2019	13:00	19.6	61	2.6	22	2.1	NNE	903	0	0
1	11	Nov'19	2019	14:00	19.8	62	2.4	53	0.3	NE	901	0	0
1	11	Nov'19	2019	15:00	19.9	63	1.9	82	1.2	E	912	0	0
1	11	Nov'19	2019	16:00	20.2	63	1.5	69	1.9	ENE	918	0	0
1	11	Nov'19	2019	17:00	20.1	62	1.4	65	1.2	ENE	917	0	0
1	11	Nov'19	2019	18:00	19.7	65	1.6	66	1.7	ENE	928	0	0
1	11	Nov'19	2019	19:00	19.5	65	2.3	19	2.1	NNE	923	0	0
1	11	Nov'19	2019	20:00	19.2	61	0.6	58	1.3	ENE	928	0	0
1	11	Nov'19	2019	21:00	18.8	63	0.5	76	1.5	ENE	901	0	0
1	11	Nov'19	2019	22:00	18.6	65	1.8	79	1.1	E	911	0	0
1	11	Nov'19	2019	23:00	18.4	63	1.4	89	0.3	E	928	0	0
2	11	Nov'19	2019	00:00	18.2	63	0.5	65	0	ENE	908	0	0
2	11	Nov'19	2019	01:00	18.1	64	0.9	59	0.6	ENE	901	0	0
2	11	Nov'19	2019	02:00	17.9	65	1.5	29	0.4	NNE	912	0	0
2	11	Nov'19	2019	03:00	17.6	62	2.3	66	1.7	ENE	901	0	0
2	11	Nov'19	2019	04:00	17.5	63	2.4	76	2.3	ENE	923	0	0
2	11	Nov'19	2019	05:00	17.4	65	2.8	50	2.8	NE	918	0	0
2	11	Nov'19	2019	06:00	17.8	65	2.5	49	1.3	NE	914	0	0
2	11	Nov'19	2019	07:00	18.1	62	2.6	58	0.7	ENE	907	0	0

2	11	Nov'19	2019	08:00	18.5	63	2.8	55	0.7	NE	909	0	0
2	11	Nov'19	2019	09:00	18.7	64	2.1	82	0	E	903	0	0
2	11	Nov'19	2019	10:00	19.2	61	2.3	35	0.4	NE	903	0	0
2	11	Nov'19	2019	11:00	19.5	65	2.8	52	0.3	NE	904	0	0
2	11	Nov'19	2019	12:00	19.8	63	2.1	13	0.9	NNE	911	0	0
2	11	Nov'19	2019	13:00	20.2	62	3.1	23	1.6	NNE	903	0	0
2	11	Nov'19	2019	14:00	20.6	65	1.3	66	2.3	ENE	905	0	0
2	11	Nov'19	2019	15:00	20.8	62	1.4	82	1.1	E	912	0	0
2	11	Nov'19	2019	16:00	21.3	61	0.6	84	1.9	E	913	0	0
2	11	Nov'19	2019	17:00	20.9	61	1.5	45	1.2	NE	918	0	0
2	11	Nov'19	2019	18:00	20.6	65	2.1	81	0.6	E	914	0	0
2	11	Nov'19	2019	19:00	20.4	62	3.8	26	0.1	NNE	919	0	0
2	11	Nov'19	2019	20:00	19.9	63	3.7	19	0.3	NNE	925	0	0
2	11	Nov'19	2019	21:00	19.7	65	3.3	76	1.1	ENE	928	0	0
2	11	Nov'19	2019	22:00	19.4	65	3.5	38	0.3	NE	923	0	0
2	11	Nov'19	2019	23:00	19.2	62	3.6	49	0.9	NE	915	0	0
3	11	Nov'19	2019	00:00	18.8	63	3.9	58	0.4	ENE	927	0	0
3	11	Nov'19	2019	01:00	18.6	65	3.7	55	1.3	NE	915	0	0
3	11	Nov'19	2019	02:00	18.5	63	2.1	82	2.2	E	908	0	0
3	11	Nov'19	2019	03:00	18.3	65	2.6	35	0.4	NE	901	0	0
3	11	Nov'19	2019	04:00	18.1	64	2.8	13	0.4	NNE	912	0	0
3	11	Nov'19	2019	05:00	17.9	61	2.6	38	1.3	NE	923	0	0
3	11	Nov'19	2019	06:00	18.2	63	2.1	79	0.7	E	901	0	0
3	11	Nov'19	2019	07:00	18.6	62	2.9	66	1.6	ENE	903	0	0
3	11	Nov'19	2019	08:00	18.9	65	2.4	62	1.6	ENE	921	0	0
3	11	Nov'19	2019	09:00	19.3	65	2.3	64	2.5	ENE	911	0	0
3	11	Nov'19	2019	10:00	19.5	63	2.1	11	2	N	918	0	0
3	11	Nov'19	2019	11:00	19.6	64	3.2	46	3.4	NE	917	0	0
3	11	Nov'19	2019	12:00	19.7	63	3.1	20	1.6	NNE	928	0	0
3	11	Nov'19	2019	13:00	19.8	65	2.1	50	2.5	NE	923	0	0
3	11	Nov'19	2019	14:00	20.1	62	2.2	67	2.9	ENE	915	0	0
3	11	Nov'19	2019	15:00	20.6	64	2.3	13	0.7	NNE	927	0	0
3	11	Nov'19	2019	16:00	20.9	63	2.6	18	1.4	NNE	915	0	0
3	11	Nov'19	2019	17:00	20.5	64	2.5	85	1.7	E	908	0	0
3	11	Nov'19	2019	18:00	20.2	65	2.5	11	0.9	N	901	0	0
3	11	Nov'19	2019	19:00	19.7	63	2.9	56	0.6	NE	914	0	0
3	11	Nov'19	2019	20:00	19.4	65	2.1	50	0.8	NE	919	0	0
3	11	Nov'19	2019	21:00	19.2	65	2.6	82	2.1	E	925	0	0
3	11	Nov'19	2019	22:00	18.8	64	2.4	38	1.2	NE	928	0	0
3	11	Nov'19	2019	23:00	18.6	61	1.9	11	1	N	923	0	0
4	11	Nov'19	2019	00:00	18.5	63	1.5	46	1.4	NE	915	0	0
4	11	Nov'19	2019	01:00	18.3	65	1.4	20	3.2	NNE	927	0	0
4	11	Nov'19	2019	02:00	18.1	62	1.6	21	3.4	NNE	915	0	0
4	11	Nov'19	2019	03:00	17.8	61	1.5	13	2.6	NNE	908	0	0
4	11	Nov'19	2019	04:00	17.6	63	1.8	38	2.1	NE	901	0	0
4	11	Nov'19	2019	05:00	17.4	64	1.6	79	2.9	E	912	0	0
4	11	Nov'19	2019	06:00	17.9	63	2.3	66	2.2	ENE	901	0	0
4	11	Nov'19	2019	07:00	18.2	65	0.6	62	1.8	ENE	923	0	0
4	11	Nov'19	2019	08:00	18.3	61	0.5	59	2.3	ENE	918	0	0
4	11	Nov'19	2019	09:00	18.7	62	1.8	69	3.5	ENE	914	0	0
4	11	Nov'19	2019	10:00	18.9	63	1.4	66	2.2	ENE	919	0	0
4	11	Nov'19	2019	11:00	19.4	63	0.5	62	1.9	ENE	908	0	0
4	11	Nov'19	2019	12:00	19.7	62	0.9	30	0.7	NNE	901	0	0
4	11	Nov'19	2019	13:00	19.9	65	2.2	62	0.7	ENE	912	0	0
4	11	Nov'19	2019	14:00	20.3	65	2.3	24	0.7	NNE	923	0	0
4	11	Nov'19	2019	15:00	20.4	61	2.6	56	4	NE	901	0	0
4	11	Nov'19	2019	16:00	20.5	63	2.5	26	2	NNE	903	0	0
4	11	Nov'19	2019	17:00	20.2	65	2.5	27	1.8	NNE	921	0	0
4	11	Nov'19	2019	18:00	19.9	63	2.9	81	1.5	E	911	0	0
4	11	Nov'19	2019	19:00	19.4	63	2.1	53	1.1	NE	918	0	0
4	11	Nov'19	2019	20:00	19.2	64	2.6	31	2.6	NNE	917	0	0
4	11	Nov'19	2019	21:00	19.1	65	2.4	28	1.7	NNE	928	0	0
4	11	Nov'19	2019	22:00	18.9	62	1.9	25	0.7	NNE	923	0	0
4	11	Nov'19	2019	23:00	18.7	63	1.5	67	1.2	ENE	915	0	0
5	11	Nov'19	2019	00:00	18.6	65	1.4	58	1	ENE	909	0	0
5	11	Nov'19	2019	01:00	18.4	65	1.6	59	0.3	ENE	903	0	0
5	11	Nov'19	2019	02:00	18.2	62	1.5	55	0.2	NE	901	0	0
5	11	Nov'19	2019	03:00	17.9	63	1.8	82	0.8	E	903	0	0
5	11	Nov'19	2019	04:00	17.8	64	1.6	82	0.1	E	921	0	0
5	11	Nov'19	2019	05:00	17.7	61	2.3	82	0.5	E	911	0	0
5	11	Nov'19	2019	06:00	18.1	65	0.6	53	1.2	NE	918	0	0
5	11	Nov'19	2019	07:00	18.5	63	0.5	13	0.5	NNE	917	0	0
5	11	Nov'19	2019	08:00	18.7	62	1.8	23	0.5	NNE	905	0	0
5	11	Nov'19	2019	09:00	18.9	65	0.6	70	0.5	ENE	901	0	0
5	11	Nov'19	2019	10:00	19.3	62	0.5	34	2.3	NE	928	0	0
5	11	Nov'19	2019	11:00	19.5	61	1.8	58	0.5	ENE	917	0	0
5	11	Nov'19	2019	12:00	19.6	61	1.4	57	1.4	ENE	923	0	0

5	11	Nov'19	2019	13:00	19.8	65	0.5	33	1.4	NNE	901	0	0
5	11	Nov'19	2019	14:00	20.1	62	0.9	33	0.5	NNE	908	0	0
5	11	Nov'19	2019	15:00	20.3	63	2.3	89	1	E	909	0	0
5	11	Nov'19	2019	16:00	20.5	65	2.1	77	0.1	ENE	902	0	0
5	11	Nov'19	2019	17:00	20.6	65	3.2	57	0.5	ENE	922	0	0
5	11	Nov'19	2019	18:00	20.8	62	3.1	81	0.7	E	911	0	0
5	11	Nov'19	2019	19:00	20.3	63	2.1	67	0.2	ENE	921	0	0
5	11	Nov'19	2019	20:00	20.1	65	2.2	85	1.1	E	923	0	0
5	11	Nov'19	2019	21:00	19.9	63	2.3	31	1.2	NNE	924	0	0
5	11	Nov'19	2019	22:00	19.8	65	2.6	42	1.4	NE	928	0	0
5	11	Nov'19	2019	23:00	19.6	64	2.5	89	0.6	E	917	0	0
6	11	Nov'19	2019	00:00	19.4	61	1.9	57	0.1	ENE	923	0	0
6	11	Nov'19	2019	01:00	19.3	63	1.5	82	0.9	E	901	0	0
6	11	Nov'19	2019	02:00	19.2	62	1.4	51	0.7	NE	908	0	0
6	11	Nov'19	2019	03:00	19.1	65	1.6	65	0.4	ENE	909	0	0
6	11	Nov'19	2019	04:00	19.1	65	2.6	76	0.8	ENE	902	0	0
6	11	Nov'19	2019	05:00	18.9	63	2.5	84	1	E	917	0	0
6	11	Nov'19	2019	06:00	18.8	64	2.5	37	0.1	NE	913	0	0
6	11	Nov'19	2019	07:00	18.7	63	2.9	53	0.9	NE	928	0	0
6	11	Nov'19	2019	08:00	18.7	65	2.1	15	0.7	NNE	924	0	0
6	11	Nov'19	2019	09:00	19.1	62	2.6	25	0.4	NNE	921	0	0
6	11	Nov'19	2019	10:00	19.3	64	2.4	89	0	E	920	0	0
6	11	Nov'19	2019	11:00	19.7	63	1.9	84	2.8	E	928	0	0
6	11	Nov'19	2019	12:00	19.9	64	1.5	86	0.7	E	915	0	0
6	11	Nov'19	2019	13:00	20.3	65	1.4	21	0.2	NNE	916	0	0
6	11	Nov'19	2019	14:00	20.6	59	1.6	28	0.6	NNE	924	0	0
6	11	Nov'19	2019	15:00	20.8	56	1.5	22	0	NNE	920	0	0
6	11	Nov'19	2019	16:00	21.2	57	1.8	57	0.5	ENE	922	0	0
6	11	Nov'19	2019	17:00	20.7	55	1.6	58	0.5	ENE	928	0	0
6	11	Nov'19	2019	18:00	20.4	59	2.3	77	1.4	ENE	929	0	0
6	11	Nov'19	2019	19:00	20.1	58	2.1	66	1.4	ENE	910	0	0
6	11	Nov'19	2019	20:00	19.8	55	3.2	79	0.5	E	918	0	0
6	11	Nov'19	2019	21:00	19.6	60	3.1	89	1.4	E	913	0	0
6	11	Nov'19	2019	22:00	19.4	59	2.1	65	0.5	ENE	907	0	0
6	11	Nov'19	2019	23:00	19.2	61	2.2	59	1.4	ENE	909	0	0
7	11	Nov'19	2019	00:00	18.9	59	2.3	29	1.4	NNE	903	0	0
7	11	Nov'19	2019	01:00	18.7	58	2.6	66	3.2	ENE	903	0	0
7	11	Nov'19	2019	02:00	18.4	62	2.5	76	3.2	ENE	904	0	0
7	11	Nov'19	2019	03:00	18.2	62	2.5	50	1.4	NE	909	0	0
7	11	Nov'19	2019	04:00	17.9	63	2.9	49	1.4	NE	911	0	0
7	11	Nov'19	2019	05:00	17.8	61	2.1	58	2.3	ENE	918	0	0
7	11	Nov'19	2019	06:00	17.6	62	2.6	55	1.4	NE	924	0	0
7	11	Nov'19	2019	07:00	18.1	63	2.4	82	3.5	E	920	0	0
7	11	Nov'19	2019	08:00	18.7	58	1.9	35	2.6	NE	922	0	0
7	11	Nov'19	2019	09:00	18.8	59	1.5	52	2.6	NE	928	0	0
7	11	Nov'19	2019	10:00	18.9	64	1.4	13	1.7	NNE	913	0	0
7	11	Nov'19	2019	11:00	19.1	65	1.6	23	1.7	NNE	904	0	0
7	11	Nov'19	2019	12:00	19.2	61	1.5	66	2.6	ENE	904	0	0
7	11	Nov'19	2019	13:00	19.6	59	1.8	82	1.7	E	913	0	0
7	11	Nov'19	2019	14:00	19.7	55	1.6	84	2.6	E	903	0	0
7	11	Nov'19	2019	15:00	19.8	56	2.3	45	3.5	NE	904	0	0
7	11	Nov'19	2019	16:00	19.9	55	0.6	81	4.4	E	909	0	0
7	11	Nov'19	2019	17:00	19.6	58	0.5	26	3.5	NNE	911	0	0
7	11	Nov'19	2019	18:00	19.5	64	1.8	19	2.6	NNE	918	0	0
7	11	Nov'19	2019	19:00	19.2	62	1.4	76	0.8	ENE	913	0	0
7	11	Nov'19	2019	20:00	19.1	63	0.5	38	3.5	NE	904	0	0
7	11	Nov'19	2019	21:00	18.6	61	0.9	58	2.6	ENE	903	0	0
7	11	Nov'19	2019	22:00	18.5	55	1.5	85	0.8	E	907	0	0
7	11	Nov'19	2019	23:00	18.3	58	2.3	12	1.7	NNE	909	0	0
8	11	Nov'19	2019	00:00	18.2	59	2.4	65	1.7	ENE	903	0	0
8	11	Nov'19	2019	01:00	18.1	56	2.8	15	2.6	NNE	907	0	0
8	11	Nov'19	2019	02:00	17.9	57	2.5	84	3.5	E	908	0	0
8	11	Nov'19	2019	03:00	17.6	55	2.6	76	1.7	ENE	902	0	0
8	11	Nov'19	2019	04:00	17.4	65	2.8	55	1.7	NE	911	0	0
8	11	Nov'19	2019	05:00	17.3	56	2.5	81	2.6	E	917	0	0
8	11	Nov'19	2019	06:00	17.8	62	2.5	41	1.7	NE	918	0	0
8	11	Nov'19	2019	07:00	18.4	60	2.9	49	2.1	NE	919	0	0
8	11	Nov'19	2019	08:00	18.6	59	2.1	48	2.1	NE	928	0	0
8	11	Nov'19	2019	09:00	18.9	63	2.6	35	3	NE	913	0	0
8	11	Nov'19	2019	10:00	19.4	60	2.4	61	3.9	ENE	903	0	0
8	11	Nov'19	2019	11:00	19.6	63	1.9	48	2.1	NE	904	0	0
8	11	Nov'19	2019	12:00	19.9	63	1.5	19	3	NNE	909	0	0
8	11	Nov'19	2019	13:00	20.4	61	1.4	52	1.2	NE	911	0	0
8	11	Nov'19	2019	14:00	20.8	63	1.6	81	1.2	E	918	0	0
8	11	Nov'19	2019	15:00	21.3	65	1.5	53	1.2	NE	913	0	0
8	11	Nov'19	2019	16:00	21.6	58	1.8	33	1.2	NNE	928	0	0
8	11	Nov'19	2019	17:00	21.5	62	1.6	59	1.2	ENE	903	0	0

8	11	Nov'19	2019	18:00	21.2	63	2.3	47	3	NE	901	0	0
8	11	Nov'19	2019	19:00	21.1	60	0.6	36	1.2	NE	928	0	0
8	11	Nov'19	2019	20:00	20.8	65	0.5	61	2.1	ENE	906	0	0
8	11	Nov'19	2019	21:00	20.6	64	1.8	66	2.1	ENE	923	0	0
8	11	Nov'19	2019	22:00	20.5	65	1.4	38	1.2	NE	928	0	0
8	11	Nov'19	2019	23:00	20.2	63	0.5	42	1.2	NE	901	0	0
9	11	Nov'19	2019	00:00	20.1	60	0.9	58	3	ENE	911	0	0
9	11	Nov'19	2019	01:00	19.6	56	2.3	57	1.2	ENE	928	0	0
9	11	Nov'19	2019	02:00	19.4	63	2.1	57	2.1	ENE	927	0	0
9	11	Nov'19	2019	03:00	19.2	59	3.2	79	3	E	926	0	0
9	11	Nov'19	2019	04:00	19.1	56	3.1	77	3.5	ENE	921	0	0
9	11	Nov'19	2019	05:00	19.5	57	2.1	57	1.7	ENE	922	0	0
9	11	Nov'19	2019	06:00	19.8	55	2.2	54	1.7	NE	902	0	0
9	11	Nov'19	2019	07:00	20.1	59	2.3	59	2.6	ENE	908	0	0
9	11	Nov'19	2019	08:00	20.4	58	2.6	57	2.6	ENE	906	0	0
9	11	Nov'19	2019	09:00	20.6	55	2.5	44	0.8	NE	903	0	0
9	11	Nov'19	2019	10:00	20.8	60	2.5	49	1.7	NE	905	0	0
9	11	Nov'19	2019	11:00	21.1	59	2.9	24	0.8	NNE	908	0	0
9	11	Nov'19	2019	12:00	21.5	61	2.1	85	0.8	E	911	0	0
9	11	Nov'19	2019	13:00	21.7	59	2.6	11	0.8	N	913	0	0
9	11	Nov'19	2019	14:00	21.9	58	2.4	56	1.7	NE	904	0	0
9	11	Nov'19	2019	15:00	22.4	62	1.9	50	1.7	NE	913	0	0
9	11	Nov'19	2019	16:00	22.7	62	1.5	82	0.8	E	903	0	0
9	11	Nov'19	2019	17:00	22.5	63	1.4	38	0.8	NE	904	0	0
9	11	Nov'19	2019	18:00	22.2	61	1.6	11	1.7	N	909	0	0
9	11	Nov'19	2019	19:00	21.8	62	1.5	46	0.8	NE	911	0	0
9	11	Nov'19	2019	20:00	21.4	63	1.8	20	2.5	NNE	918	0	0
9	11	Nov'19	2019	21:00	21.1	58	1.6	21	0.9	NNE	913	0	0
9	11	Nov'19	2019	22:00	20.6	59	2.3	13	1.8	NNE	904	0	0
9	11	Nov'19	2019	23:00	20.4	64	0.6	38	1.9	NE	903	0	0
10	11	Nov'19	2019	00:00	20.3	65	0.5	79	0.7	E	907	0	0
10	11	Nov'19	2019	01:00	20.1	61	1.8	66	2.2	ENE	909	0	0
10	11	Nov'19	2019	02:00	19.9	59	1.4	11	0.3	N	903	0	0
10	11	Nov'19	2019	03:00	19.8	55	0.5	86	0.3	E	901	0	0
10	11	Nov'19	2019	04:00	19.6	63	0.5	21	1	NNE	903	0	0
10	11	Nov'19	2019	05:00	19.4	62	1.8	54	1.6	NE	921	0	0
10	11	Nov'19	2019	06:00	19.5	64	1.4	90	1.2	E	911	0	0
10	11	Nov'19	2019	07:00	19.7	65	0.5	35	1.2	NE	918	0	0
10	11	Nov'19	2019	08:00	20.1	56	0.9	61	2.1	ENE	917	0	0
10	11	Nov'19	2019	09:00	20.3	63	1.5	70	1.2	ENE	905	0	0
10	11	Nov'19	2019	10:00	20.5	59	2.3	63	2.1	ENE	901	0	0
10	11	Nov'19	2019	11:00	20.7	65	2.4	77	3	ENE	928	0	0
10	11	Nov'19	2019	12:00	20.9	64	2.8	70	3.9	ENE	917	0	0
10	11	Nov'19	2019	13:00	21.1	57	2.5	57	3	ENE	923	0	0
10	11	Nov'19	2019	14:00	21.3	64	2.6	57	2.1	ENE	901	0	0
10	11	Nov'19	2019	15:00	21.6	62	2.8	10	0.3	N	908	0	0
10	11	Nov'19	2019	16:00	21.9	59	2.1	85	3	E	909	0	0
10	11	Nov'19	2019	17:00	21.8	63	2.3	35	2.1	NE	902	0	0
10	11	Nov'19	2019	18:00	21.5	62	2.8	16	0.3	NNE	917	0	0
10	11	Nov'19	2019	19:00	21.2	65	2.9	36	1.2	NE	913	0	0
10	11	Nov'19	2019	20:00	20.8	62	3.1	66	2.7	ENE	928	0	0
10	11	Nov'19	2019	21:00	20.6	64	3.5	70	2	ENE	924	0	0
10	11	Nov'19	2019	22:00	20.4	61	3.6	36	2.5	NE	921	0	0
10	11	Nov'19	2019	23:00	20.2	63	3.9	36	2.9	NE	920	0	0
11	11	Nov'19	2019	00:00	19.6	62	3.7	81	2.1	E	928	0	0
11	11	Nov'19	2019	01:00	19.5	61	2.1	66	2.3	ENE	915	0	0
11	11	Nov'19	2019	02:00	19.2	64	2.6	60	1.9	ENE	916	0	0
11	11	Nov'19	2019	03:00	19.1	61	2.8	55	1.1	NE	924	0	0
11	11	Nov'19	2019	04:00	19.2	63	2.6	58	0.8	ENE	906	0	0
11	11	Nov'19	2019	05:00	19.1	62	2.1	30	1.4	NNE	923	0	0
11	11	Nov'19	2019	06:00	19.3	62	2.9	62	1.2	ENE	905	0	0
11	11	Nov'19	2019	07:00	19.5	64	2.1	59	2.5	ENE	908	0	0
11	11	Nov'19	2019	08:00	19.6	59	3.8	69	3.1	ENE	912	0	0
11	11	Nov'19	2019	09:00	19.9	63	3.7	66	3.6	ENE	923	0	0
11	11	Nov'19	2019	10:00	20.1	61	3.3	62	2.1	ENE	901	0	0
11	11	Nov'19	2019	11:00	20.3	65	3.1	30	0.3	NNE	903	0	0
11	11	Nov'19	2019	12:00	20.6	58	3.5	62	1.5	ENE	921	0	0
11	11	Nov'19	2019	13:00	20.8	58	2.3	24	0.8	NNE	911	0	0
11	11	Nov'19	2019	14:00	21.2	61	2.1	56	1.2	NE	918	0	0
11	11	Nov'19	2019	15:00	21.4	65	3.2	26	1.1	NNE	917	0	0
11	11	Nov'19	2019	16:00	21.3	61	3.1	27	1.7	NNE	905	0	0
11	11	Nov'19	2019	17:00	21.1	65	2.1	81	2.4	E	901	0	0
11	11	Nov'19	2019	18:00	20.8	63	2.2	53	3.1	NE	903	0	0
11	11	Nov'19	2019	19:00	20.6	60	2.3	31	1.9	NNE	905	0	0
11	11	Nov'19	2019	20:00	20.5	63	2.6	28	2.7	NNE	912	0	0
11	11	Nov'19	2019	21:00	20.2	61	2.5	25	2	NNE	913	0	0
11	11	Nov'19	2019	22:00	20.1	65	2.5	67	1.4	ENE	918	0	0

11	11	Nov'19	2019	23:00	19.8	62	2.9	58	0.9	ENE	914	0	0
12	11	Nov'19	2019	00:00	19.6	63	2.1	59	0.5	ENE	919	0	0
12	11	Nov'19	2019	01:00	19.4	64	2.6	55	1.9	NE	925	0	0
12	11	Nov'19	2019	02:00	19.2	58	2.4	82	1.1	E	928	0	0
12	11	Nov'19	2019	03:00	19.1	63	1.9	82	1.7	E	923	0	0
12	11	Nov'19	2019	04:00	18.9	59	1.5	82	1.2	E	915	0	0
12	11	Nov'19	2019	05:00	18.8	57	1.4	53	2.1	NE	927	0	0
12	11	Nov'19	2019	06:00	18.7	64	1.6	13	3	NNE	915	0	0
12	11	Nov'19	2019	07:00	19.1	63	1.5	23	1.2	NNE	908	0	0
12	11	Nov'19	2019	08:00	19.2	65	1.8	70	1.2	ENE	901	0	0
12	11	Nov'19	2019	09:00	19.6	58	1.6	34	2.1	NE	912	0	0
12	11	Nov'19	2019	10:00	19.8	63	2.3	58	1.2	ENE	923	0	0
12	11	Nov'19	2019	11:00	20.2	62	0.6	57	2.1	ENE	901	0	0
12	11	Nov'19	2019	12:00	20.6	65	0.5	33	2.1	NNE	903	0	0
12	11	Nov'19	2019	13:00	20.8	58	1.8	33	3	NNE	921	0	0
12	11	Nov'19	2019	14:00	21.3	63	1.4	89	2.5	E	911	0	0
12	11	Nov'19	2019	15:00	21.5	65	0.5	55	3.9	NE	918	0	0
12	11	Nov'19	2019	16:00	21.6	65	0.9	81	2.1	E	917	0	0
12	11	Nov'19	2019	17:00	21.2	63	1.5	42	3	NE	905	0	0
12	11	Nov'19	2019	18:00	20.8	64	2.3	31	3.4	NNE	901	0	0
12	11	Nov'19	2019	19:00	20.6	57	2.4	81	1.2	E	903	0	0
12	11	Nov'19	2019	20:00	20.4	64	2.8	14	1.9	NNE	905	0	0
12	11	Nov'19	2019	21:00	20.3	65	2.5	53	2.2	NE	912	0	0
12	11	Nov'19	2019	22:00	20.2	63	2.6	54	1.4	NE	913	0	0
12	11	Nov'19	2019	23:00	19.9	59	2.8	46	1.1	NE	918	0	0
13	11	Nov'19	2019	00:00	19.6	58	2.1	56	0.4	NE	914	0	0
13	11	Nov'19	2019	01:00	19.5	63	2.3	39	1.7	NE	919	0	0
13	11	Nov'19	2019	02:00	19.4	62	2.8	48	0.8	NE	925	0	0
13	11	Nov'19	2019	03:00	19.3	65	2.9	60	0.6	ENE	928	0	0
13	11	Nov'19	2019	04:00	19.1	63	3.1	55	1	NE	921	0	0
13	11	Nov'19	2019	05:00	18.6	61	3.5	58	2.8	ENE	902	0	0
13	11	Nov'19	2019	06:00	18.7	64	3.6	30	3	NNE	903	0	0
13	11	Nov'19	2019	07:00	18.9	59	3.9	62	2.2	ENE	924	0	0
13	11	Nov'19	2019	08:00	19.4	61	3.7	59	1.7	ENE	912	0	0
13	11	Nov'19	2019	09:00	19.5	65	2.1	69	2.5	ENE	913	0	0
13	11	Nov'19	2019	10:00	19.7	63	2.6	66	1.8	ENE	902	0	0
13	11	Nov'19	2019	11:00	20.1	58	2.8	62	1.4	ENE	920	0	0
13	11	Nov'19	2019	12:00	20.3	57	2.6	59	1.9	ENE	922	0	0
13	11	Nov'19	2019	13:00	20.5	63	2.1	69	3.1	ENE	911	0	0
13	11	Nov'19	2019	14:00	20.7	63	2.9	66	1.8	ENE	921	0	0
13	11	Nov'19	2019	15:00	20.9	65	2.4	62	1.5	ENE	923	0	0
13	11	Nov'19	2019	16:00	21.1	61	2.3	30	0.3	NNE	924	0	0
13	11	Nov'19	2019	17:00	20.8	65	2.1	62	0.3	ENE	928	0	0
13	11	Nov'19	2019	18:00	20.5	63	3.2	24	0.3	NNE	917	0	0
13	11	Nov'19	2019	19:00	20.2	63	3.1	81	3.6	E	923	0	0
13	11	Nov'19	2019	20:00	19.9	65	2.1	26	1.6	NNE	901	0	0
13	11	Nov'19	2019	21:00	19.4	63	2.2	76	1.4	ENE	908	0	0
13	11	Nov'19	2019	22:00	19.2	58	2.3	70	1.1	ENE	909	0	0
13	11	Nov'19	2019	23:00	19.1	64	2.6	36	0.7	NE	902	0	0
14	11	Nov'19	2019	00:00	18.7	61	2.5	85	2.2	E	917	0	0
14	11	Nov'19	2019	01:00	18.6	58	2.5	25	1.3	NNE	913	0	0
14	11	Nov'19	2019	02:00	18.3	59	2.9	84	1.4	E	928	0	0
14	11	Nov'19	2019	03:00	17.9	62	2.1	22	1.9	NNE	924	0	0
14	11	Nov'19	2019	04:00	17.8	61	2.6	58	1.7	ENE	921	0	0
14	11	Nov'19	2019	05:00	17.7	62	2.4	77	1	ENE	920	0	0
14	11	Nov'19	2019	06:00	17.5	64	1.9	79	0.6	E	928	0	0
14	11	Nov'19	2019	07:00	17.6	62	1.5	89	1.5	E	915	0	0
14	11	Nov'19	2019	08:00	17.9	65	1.4	65	0.8	ENE	916	0	0
14	11	Nov'19	2019	09:00	18.4	58	1.6	59	1.2	ENE	924	0	0
14	11	Nov'19	2019	10:00	18.6	61	1.5	29	1.9	NNE	920	0	0
14	11	Nov'19	2019	11:00	18.9	63	1.8	66	1.2	ENE	922	0	0
14	11	Nov'19	2019	12:00	19.4	65	1.6	76	1.2	ENE	928	0	0
14	11	Nov'19	2019	13:00	19.7	64	2.3	13	1.2	NNE	929	0	0
14	11	Nov'19	2019	14:00	19.8	63	2.1	84	3	E	910	0	0
14	11	Nov'19	2019	15:00	20.1	55	3.2	45	1.2	NE	918	0	0
14	11	Nov'19	2019	16:00	20.3	58	3.1	81	2.1	E	913	0	0
14	11	Nov'19	2019	17:00	20.2	59	2.1	26	2.1	NNE	904	0	0
14	11	Nov'19	2019	18:00	19.9	56	2.2	76	1.2	ENE	913	0	0
14	11	Nov'19	2019	19:00	19.8	57	2.3	38	1.7	NE	903	0	0
14	11	Nov'19	2019	20:00	19.6	55	2.6	58	0.8	ENE	904	0	0
14	11	Nov'19	2019	21:00	19.4	65	2.5	85	0.6	E	909	0	0
14	11	Nov'19	2019	22:00	19.2	56	2.5	12	1.4	NNE	911	0	0
14	11	Nov'19	2019	23:00	19.1	62	2.9	65	0.9	ENE	918	0	0
15	11	Nov'19	2019	00:00	18.9	60	2.1	15	0.5	NNE	913	0	0
15	11	Nov'19	2019	01:00	18.8	59	2.6	84	1.9	E	904	0	0
15	11	Nov'19	2019	02:00	18.7	63	2.4	58	0.3	ENE	903	0	0
15	11	Nov'19	2019	03:00	19.1	60	1.9	79	0.3	E	907	0	0

15	11	Nov'19	2019	04:00	19.2	63	1.5	77	0.8	ENE	909	0	0
15	11	Nov'19	2019	05:00	19.6	63	1.4	57	0.6	ENE	903	0	0
15	11	Nov'19	2019	06:00	19.8	61	1.6	59	1.4	ENE	907	0	0
15	11	Nov'19	2019	07:00	19.9	63	1.5	57	1.1	ENE	908	0	0
15	11	Nov'19	2019	08:00	20.3	65	1.8	44	0.4	NE	902	0	0
15	11	Nov'19	2019	09:00	20.6	58	1.6	24	1.7	NNE	911	0	0
15	11	Nov'19	2019	10:00	20.7	62	2.3	85	0.8	E	917	0	0
15	11	Nov'19	2019	11:00	20.9	63	0.6	11	1.6	N	918	0	0
15	11	Nov'19	2019	12:00	21.1	60	0.5	56	1.4	NE	919	0	0
15	11	Nov'19	2019	13:00	21.3	65	1.8	21	1.1	NNE	928	0	0
15	11	Nov'19	2019	14:00	21.4	64	1.4	13	0.7	NNE	923	0	0
15	11	Nov'19	2019	15:00	21.6	65	0.5	38	3.5	NE	903	0	0
15	11	Nov'19	2019	16:00	21.8	63	0.9	42	1.4	NE	901	0	0
15	11	Nov'19	2019	17:00	21.7	60	1.5	89	0.9	E	912	0	0
15	11	Nov'19	2019	18:00	21.4	56	2.3	57	0.5	ENE	928	0	0
15	11	Nov'19	2019	19:00	21.1	63	2.4	82	0.7	E	921	0	0
15	11	Nov'19	2019	20:00	20.6	59	2.8	51	1.2	NE	902	0	0
15	11	Nov'19	2019	21:00	20.3	56	2.5	65	1.2	ENE	903	0	0
15	11	Nov'19	2019	22:00	19.9	57	2.6	76	2.1	ENE	924	0	0
15	11	Nov'19	2019	23:00	19.6	55	2.8	84	2.1	E	912	0	0
16	11	Nov'19	2019	00:00	19.4	59	2.1	37	1.2	NE	913	0	0
16	11	Nov'19	2019	01:00	19.2	58	2.3	53	2.1	NE	902	0	0
16	11	Nov'19	2019	02:00	19.1	55	2.8	15	1.2	NNE	920	0	0
16	11	Nov'19	2019	03:00	18.8	60	2.1	25	2.1	NNE	922	0	0
16	11	Nov'19	2019	04:00	18.6	59	3.1	89	2.1	E	911	0	0
16	11	Nov'19	2019	05:00	18.4	61	1.3	84	3.9	E	921	0	0
16	11	Nov'19	2019	06:00	18.5	59	1.4	86	3.9	E	923	0	0
16	11	Nov'19	2019	07:00	18.7	58	0.6	75	2.1	ENE	924	0	0
16	11	Nov'19	2019	08:00	18.9	62	1.5	28	2.1	NNE	928	0	0
16	11	Nov'19	2019	09:00	19.2	62	2.1	22	3	NNE	917	0	0
16	11	Nov'19	2019	10:00	19.3	63	3.8	57	2.1	ENE	923	0	0
16	11	Nov'19	2019	11:00	19.8	61	3.7	58	3	ENE	911	0	0
16	11	Nov'19	2019	12:00	19.9	62	3.3	77	2.1	ENE	921	0	0
16	11	Nov'19	2019	13:00	20.3	63	3.5	66	2.1	ENE	923	0	0
16	11	Nov'19	2019	14:00	20.4	58	3.6	79	1.2	E	924	0	0
16	11	Nov'19	2019	15:00	20.6	59	3.9	89	1.2	E	928	0	0
16	11	Nov'19	2019	16:00	20.5	64	3.7	65	2.1	ENE	917	0	0
16	11	Nov'19	2019	17:00	20.2	65	2.1	59	1.2	ENE	923	0	0
16	11	Nov'19	2019	18:00	19.9	61	2.6	29	2.1	NNE	901	0	0
16	11	Nov'19	2019	19:00	19.4	59	2.8	66	3	ENE	908	0	0
16	11	Nov'19	2019	20:00	19.2	55	2.6	76	3.9	ENE	909	0	0
16	11	Nov'19	2019	21:00	19.1	61	2.1	50	3	NE	902	0	0
16	11	Nov'19	2019	22:00	18.4	64	2.9	49	2.1	NE	917	0	0
16	11	Nov'19	2019	23:00	18.1	62	2.4	58	0.3	ENE	913	0	0
17	11	Nov'19	2019	00:00	17.9	63	2.3	55	3	NE	928	0	0
17	11	Nov'19	2019	01:00	17.5	62	2.1	82	2.1	E	908	0	0
17	11	Nov'19	2019	02:00	17.2	65	3.2	35	0.3	NE	906	0	0
17	11	Nov'19	2019	03:00	17.1	61	3.1	52	1.2	NE	923	0	0
17	11	Nov'19	2019	04:00	16.9	60	2.1	13	1.2	NNE	905	0	0
17	11	Nov'19	2019	05:00	16.8	64	2.2	23	2.1	NNE	908	0	0
17	11	Nov'19	2019	06:00	17.3	63	2.3	66	3	ENE	912	0	0
17	11	Nov'19	2019	07:00	17.8	62	2.6	82	1.2	E	923	0	0
17	11	Nov'19	2019	08:00	18.2	64	2.5	84	1.2	E	901	0	0
17	11	Nov'19	2019	09:00	18.6	64	2.5	45	2.1	NE	903	0	0
17	11	Nov'19	2019	10:00	18.8	61	2.9	81	1.2	E	921	0	0
17	11	Nov'19	2019	11:00	19.4	63	2.1	26	2.1	NNE	928	0	0
17	11	Nov'19	2019	12:00	19.8	64	2.6	19	2.1	NNE	924	0	0
17	11	Nov'19	2019	13:00	20.3	60	2.4	76	3	ENE	921	0	0
17	11	Nov'19	2019	14:00	20.6	65	1.9	38	3.9	NE	920	0	0
17	11	Nov'19	2019	15:00	20.8	61	1.5	58	2.1	ENE	928	0	0
17	11	Nov'19	2019	16:00	20.7	63	1.4	85	3	E	915	0	0
17	11	Nov'19	2019	17:00	20.4	62	1.6	12	1.2	NNE	916	0	0
17	11	Nov'19	2019	18:00	19.9	59	1.5	65	1.2	ENE	924	0	0
17	11	Nov'19	2019	19:00	19.7	65	1.8	15	1.2	NNE	920	0	0
17	11	Nov'19	2019	20:00	19.4	63	1.6	84	1.2	E	922	0	0
17	11	Nov'19	2019	21:00	19.2	63	2.3	76	1.2	ENE	928	0	0
17	11	Nov'19	2019	22:00	18.8	58	0.6	55	3	NE	929	0	0
17	11	Nov'19	2019	23:00	18.6	64	0.5	81	1.2	E	910	0	0
18	11	Nov'19	2019	00:00	18.3	62	1.8	41	2.1	NE	918	0	0
18	11	Nov'19	2019	01:00	18.1	63	1.4	49	2.1	NE	913	0	0
18	11	Nov'19	2019	02:00	17.9	61	0.5	48	1.2	NE	904	0	0
18	11	Nov'19	2019	03:00	17.6	55	0.9	35	1.2	NE	913	0	0
18	11	Nov'19	2019	04:00	17.4	58	2.3	61	3	ENE	903	0	0
18	11	Nov'19	2019	05:00	17.2	59	2.1	48	1.2	NE	904	0	0
18	11	Nov'19	2019	06:00	17.3	56	3.2	19	2.1	NNE	909	0	0
18	11	Nov'19	2019	07:00	17.7	57	3.1	52	3	NE	911	0	0
18	11	Nov'19	2019	08:00	18.1	55	2.1	81	3.9	E	918	0	0

18	11	Nov'19	2019	09:00	18.2	65	2.2	53	2.1	NE	913	0	0
18	11	Nov'19	2019	10:00	18.6	56	2.3	33	2.1	NNE	904	0	0
18	11	Nov'19	2019	11:00	18.9	62	2.6	59	3	ENE	903	0	0
18	11	Nov'19	2019	12:00	19.1	60	2.5	47	3	NE	907	0	0
18	11	Nov'19	2019	13:00	19.2	59	2.5	36	1.2	NE	909	0	0
18	11	Nov'19	2019	14:00	19.5	63	2.9	61	2.1	ENE	903	0	0
18	11	Nov'19	2019	15:00	19.7	60	2.1	66	1.2	ENE	907	0	0
18	11	Nov'19	2019	16:00	19.8	63	2.6	38	1.2	NE	908	0	0
18	11	Nov'19	2019	17:00	19.4	63	2.4	42	1.2	NE	902	0	0
18	11	Nov'19	2019	18:00	19.1	61	1.9	58	2.1	ENE	911	0	0
18	11	Nov'19	2019	19:00	18.8	62	1.5	57	2.1	ENE	917	0	0
18	11	Nov'19	2019	20:00	18.5	64	1.4	57	1.2	ENE	918	0	0
18	11	Nov'19	2019	21:00	18.2	56	1.6	79	1.2	E	919	0	0
18	11	Nov'19	2019	22:00	17.9	58	1.5	77	2.1	ENE	928	0	0
18	11	Nov'19	2019	23:00	17.8	59	1.8	57	1.2	ENE	923	0	0
19	11	Nov'19	2019	00:00	17.6	55	1.6	54	4.5	NE	903	0	0
19	11	Nov'19	2019	01:00	17.4	58	2.3	59	2.7	ENE	901	0	0
19	11	Nov'19	2019	02:00	17.3	59	0.6	57	4.5	ENE	912	0	0
19	11	Nov'19	2019	03:00	17.1	58	0.5	44	3.6	NE	911	0	0
19	11	Nov'19	2019	04:00	16.8	65	1.8	49	4.5	NE	925	0	0
19	11	Nov'19	2019	05:00	16.5	62	1.4	24	2.7	NNE	926	0	0
19	11	Nov'19	2019	06:00	16.7	63	0.5	85	3.6	E	927	0	0
19	11	Nov'19	2019	07:00	17.3	60	0.9	11	1.8	N	920	0	0
19	11	Nov'19	2019	08:00	17.6	64	1.5	56	5.4	NE	921	0	0
19	11	Nov'19	2019	09:00	17.9	61	2.3	50	2.7	NE	928	0	0
19	11	Nov'19	2019	10:00	18.2	59	2.4	82	0	E	913	0	0
19	11	Nov'19	2019	11:00	18.6	58	2.8	38	4.5	NE	914	0	0
19	11	Nov'19	2019	12:00	18.8	58	2.5	11	2.7	N	921	0	0
19	11	Nov'19	2019	13:00	19.2	57	2.6	46	1.8	NE	925	0	0
19	11	Nov'19	2019	14:00	19.5	55	2.8	20	0	NNE	903	0	0
19	11	Nov'19	2019	15:00	19.6	59	2.1	21	2.7	NNE	908	0	0
19	11	Nov'19	2019	16:00	19.3	58	2.3	13	0.9	NNE	901	0	0
19	11	Nov'19	2019	17:00	19.1	55	2.8	38	0	NE	909	0	0
19	11	Nov'19	2019	18:00	18.8	60	2.9	79	0.9	E	911	0	0
19	11	Nov'19	2019	19:00	18.6	59	3.1	66	2.7	ENE	925	0	0
19	11	Nov'19	2019	20:00	18.4	61	3.9	62	1.8	ENE	922	0	0
19	11	Nov'19	2019	21:00	18.1	59	3.7	59	4.5	ENE	930	0	0
19	11	Nov'19	2019	22:00	17.9	58	2.1	69	2.7	ENE	921	0	0
19	11	Nov'19	2019	23:00	17.8	62	2.6	66	1.8	ENE	921	0	0
20	11	Nov'19	2019	00:00	17.6	62	2.8	62	0.9	ENE	912	0	0
20	11	Nov'19	2019	01:00	17.4	63	2.6	30	3.6	NNE	927	0	0
20	11	Nov'19	2019	02:00	17.3	61	2.1	62	1.8	ENE	903	0	0
20	11	Nov'19	2019	03:00	17.2	62	2.9	24	0	NNE	908	0	0
20	11	Nov'19	2019	04:00	16.9	63	2.4	56	0	NE	906	0	0
20	11	Nov'19	2019	05:00	16.8	58	2.3	26	0	NNE	923	0	0
20	11	Nov'19	2019	06:00	16.7	59	2.1	27	0	NNE	905	0	0
20	11	Nov'19	2019	07:00	17.1	64	3.2	81	0.9	E	908	0	0
20	11	Nov'19	2019	08:00	17.5	65	3.1	53	4.5	NE	912	0	0
20	11	Nov'19	2019	09:00	18.3	61	2.1	31	2.7	NNE	923	0	0
20	11	Nov'19	2019	10:00	18.6	59	2.2	28	0	NNE	901	0	0
20	11	Nov'19	2019	11:00	18.8	55	2.3	25	1.8	NNE	903	0	0
20	11	Nov'19	2019	12:00	19.1	63	2.6	67	2.7	ENE	921	0	0
20	11	Nov'19	2019	13:00	19.3	62	2.5	58	3.6	ENE	911	0	0
20	11	Nov'19	2019	14:00	19.5	64	2.5	59	1.8	ENE	918	0	0
20	11	Nov'19	2019	15:00	19.7	65	2.9	55	0.9	NE	917	0	0
20	11	Nov'19	2019	16:00	19.6	56	2.1	82	5.4	E	905	0	0
20	11	Nov'19	2019	17:00	19.4	63	2.6	82	3.6	E	901	0	0
20	11	Nov'19	2019	18:00	19.2	59	2.4	82	0.9	E	903	0	0
20	11	Nov'19	2019	19:00	18.9	65	1.9	53	2.7	NE	905	0	0
20	11	Nov'19	2019	20:00	18.4	64	1.5	13	2.7	NNE	912	0	0
20	11	Nov'19	2019	21:00	18.3	57	1.4	23	6.3	NNE	913	0	0
20	11	Nov'19	2019	22:00	18.2	64	1.6	70	2.1	ENE	918	0	0
20	11	Nov'19	2019	23:00	18.1	62	1.5	34	1.2	NE	914	0	0
21	11	Nov'19	2019	00:00	17.8	59	1.8	58	2.1	ENE	919	0	0
21	11	Nov'19	2019	01:00	17.6	63	1.6	57	1.2	ENE	925	0	0
21	11	Nov'19	2019	02:00	17.4	62	2.3	33	2.1	NNE	928	0	0
21	11	Nov'19	2019	03:00	17.3	65	2.1	33	2.1	NNE	923	0	0
21	11	Nov'19	2019	04:00	17.1	62	3.2	89	3.9	E	915	0	0
21	11	Nov'19	2019	05:00	16.9	64	3.1	55	3.9	NE	927	0	0
21	11	Nov'19	2019	06:00	16.8	61	2.1	81	2.1	E	915	0	0
21	11	Nov'19	2019	07:00	17.2	63	2.2	42	2.1	NE	908	0	0
21	11	Nov'19	2019	08:00	17.6	62	2.3	31	3	NNE	901	0	0
21	11	Nov'19	2019	09:00	17.8	61	2.6	81	2.1	E	912	0	0
21	11	Nov'19	2019	10:00	18.3	64	2.5	14	3	NNE	923	0	0
21	11	Nov'19	2019	11:00	18.6	61	2.5	53	2.1	NE	901	0	0
21	11	Nov'19	2019	12:00	18.9	63	2.9	54	2.1	NE	903	0	0
21	11	Nov'19	2019	13:00	18.9	62	2.1	46	1.2	NE	921	0	0

21	11	Nov'19	2019	14:00	19.1	62	2.6	56	1.2	NE	911	0	0
21	11	Nov'19	2019	15:00	19.2	64	2.4	39	2.1	NE	918	0	0
21	11	Nov'19	2019	16:00	19.6	59	1.9	48	1.2	NE	917	0	0
21	11	Nov'19	2019	17:00	19.7	63	1.5	64	2.1	ENE	905	0	0
21	11	Nov'19	2019	18:00	19.8	61	1.4	52	3	NE	901	0	0
21	11	Nov'19	2019	19:00	19.9	65	1.6	81	3.9	E	903	0	0
21	11	Nov'19	2019	20:00	19.6	58	1.5	50	3	NE	905	0	0
21	11	Nov'19	2019	21:00	19.5	58	1.8	22	2.1	NNE	912	0	0
21	11	Nov'19	2019	22:00	19.2	61	1.6	82	3	E	913	0	0
21	11	Nov'19	2019	23:00	19.1	65	2.3	69	2.1	ENE	918	0	0
22	11	Nov'19	2019	00:00	18.6	61	0.6	65	1.2	ENE	914	0	0
22	11	Nov'19	2019	01:00	18.5	65	0.5	66	1.2	ENE	919	0	0
22	11	Nov'19	2019	02:00	18.3	63	1.8	19	2.1	NNE	925	0	0
22	11	Nov'19	2019	03:00	18.2	60	1.4	76	3	ENE	928	0	0
22	11	Nov'19	2019	04:00	18.1	63	0.5	79	1.2	E	921	0	0
22	11	Nov'19	2019	05:00	17.9	61	0.9	89	1.2	E	902	0	0
22	11	Nov'19	2019	06:00	17.6	65	1.5	65	2.1	ENE	903	0	0
22	11	Nov'19	2019	07:00	17.4	62	2.3	59	1.2	ENE	924	0	0
22	11	Nov'19	2019	08:00	17.3	63	2.4	29	2.1	NNE	912	0	0
22	11	Nov'19	2019	09:00	17.8	64	2.8	66	2.1	ENE	913	0	0
22	11	Nov'19	2019	10:00	18.4	58	2.5	76	3	ENE	902	0	0
22	11	Nov'19	2019	11:00	18.6	63	2.6	50	3.9	NE	920	0	0
22	11	Nov'19	2019	12:00	18.9	59	2.8	49	2.1	NE	922	0	0
22	11	Nov'19	2019	13:00	19.4	57	2.1	28	3	NNE	911	0	0
22	11	Nov'19	2019	14:00	19.6	64	2.3	53	1.2	NE	921	0	0
22	11	Nov'19	2019	15:00	19.9	63	2.8	33	1.2	NNE	923	0	0
22	11	Nov'19	2019	16:00	20.4	65	2.1	59	1.2	ENE	901	0	0
22	11	Nov'19	2019	17:00	20.8	58	3.1	47	1.2	NE	903	0	0
22	11	Nov'19	2019	18:00	21.3	63	1.3	36	1.2	NE	909	0	0
22	11	Nov'19	2019	19:00	21.6	62	1.4	61	3	ENE	911	0	0
22	11	Nov'19	2019	20:00	21.5	65	0.6	66	1.2	ENE	923	0	0
22	11	Nov'19	2019	21:00	21.2	58	1.5	38	2.1	NE	927	0	0
22	11	Nov'19	2019	22:00	21.1	63	2.1	42	2.1	NE	928	0	0
22	11	Nov'19	2019	23:00	20.8	65	3.8	58	1.2	ENE	921	0	0
23	11	Nov'19	2019	00:00	20.6	65	3.7	57	1.2	ENE	920	0	0
23	11	Nov'19	2019	01:00	20.5	63	3.3	57	3	ENE	907	0	0
23	11	Nov'19	2019	02:00	20.2	64	3.5	79	1.2	E	911	0	0
23	11	Nov'19	2019	03:00	20.1	57	3.6	77	2.1	ENE	918	0	0
23	11	Nov'19	2019	04:00	19.6	64	3.9	57	3	ENE	909	0	0
23	11	Nov'19	2019	05:00	19.4	65	3.7	54	3.9	NE	903	0	0
23	11	Nov'19	2019	06:00	19.2	63	2.1	59	2.1	ENE	901	0	0
23	11	Nov'19	2019	07:00	19.1	59	2.6	57	2.1	ENE	903	0	0
23	11	Nov'19	2019	08:00	19.5	58	2.8	44	3	NE	908	0	0
23	11	Nov'19	2019	09:00	19.8	63	2.6	49	3	NE	909	0	0
23	11	Nov'19	2019	10:00	20.1	62	2.1	24	1.2	NNE	913	0	0
23	11	Nov'19	2019	11:00	20.4	65	2.9	85	2.1	E	908	0	0
23	11	Nov'19	2019	12:00	20.6	63	2.4	11	1.2	N	902	0	0
23	11	Nov'19	2019	13:00	20.8	61	2.3	56	1.2	NE	909	0	0
23	11	Nov'19	2019	14:00	21.1	64	2.1	50	1.2	NE	911	0	0
23	11	Nov'19	2019	15:00	21.5	59	3.2	82	2.1	E	923	0	0
23	11	Nov'19	2019	16:00	21.7	61	3.1	38	2.1	NE	922	0	0
23	11	Nov'19	2019	17:00	21.9	65	2.1	11	1.2	N	928	0	0
23	11	Nov'19	2019	18:00	22.4	63	2.2	46	1.2	NE	901	0	0
23	11	Nov'19	2019	19:00	22.7	58	2.3	20	2.1	NNE	909	0	0
23	11	Nov'19	2019	20:00	22.5	57	2.6	21	1.2	NNE	904	0	0
23	11	Nov'19	2019	21:00	22.2	63	2.5	13	1.2	NNE	906	0	0
23	11	Nov'19	2019	22:00	21.8	63	2.5	38	2.1	NE	907	0	0
23	11	Nov'19	2019	23:00	21.4	65	2.9	79	3	E	908	0	0
24	11	Nov'19	2019	00:00	21.1	61	2.1	66	3	ENE	912	0	0
24	11	Nov'19	2019	01:00	20.6	65	2.6	62	3.9	ENE	903	0	0
24	11	Nov'19	2019	02:00	20.4	63	2.4	59	1.2	ENE	916	0	0
24	11	Nov'19	2019	03:00	20.3	63	1.9	69	3	ENE	911	0	0
24	11	Nov'19	2019	04:00	20.1	65	1.5	66	2.1	ENE	918	0	0
24	11	Nov'19	2019	05:00	19.9	63	1.4	62	1.2	ENE	903	0	0
24	11	Nov'19	2019	06:00	19.8	58	1.6	30	1.2	NNE	926	0	0
24	11	Nov'19	2019	07:00	19.6	64	1.5	62	2.1	ENE	907	0	0
24	11	Nov'19	2019	08:00	19.4	61	1.8	24	2.1	NNE	927	0	0
24	11	Nov'19	2019	09:00	19.5	58	1.6	56	2.1	NE	928	0	0
24	11	Nov'19	2019	10:00	19.7	59	2.3	26	1.2	NNE	903	0	0
24	11	Nov'19	2019	11:00	20.1	62	0.6	27	1.2	NNE	901	0	0
24	11	Nov'19	2019	12:00	20.3	61	0.5	81	1.2	E	928	0	0
24	11	Nov'19	2019	13:00	20.5	62	1.8	53	2.1	NE	906	0	0
24	11	Nov'19	2019	14:00	20.7	64	1.4	31	1.2	NNE	923	0	0
24	11	Nov'19	2019	15:00	20.9	62	0.5	28	3.9	NNE	928	0	0
24	11	Nov'19	2019	16:00	21.1	65	0.9	25	3	NNE	901	0	0
24	11	Nov'19	2019	17:00	21.3	58	2.3	67	2.1	ENE	911	0	0
24	11	Nov'19	2019	18:00	21.6	61	2.1	58	3	ENE	928	0	0

24	11	Nov'19	2019	19:00	21.9	63	3.2	59	1.2	ENE	927	0	0
24	11	Nov'19	2019	20:00	21.8	65	3.1	55	1.2	NE	926	0	0
24	11	Nov'19	2019	21:00	21.5	64	2.1	82	1.2	E	921	0	0
24	11	Nov'19	2019	22:00	21.2	63	2.2	82	2.1	E	922	0	0
24	11	Nov'19	2019	23:00	20.8	55	2.3	82	1.2	E	902	0	0
25	11	Nov'19	2019	00:00	20.6	58	2.6	53	1.2	NE	908	0	0
25	11	Nov'19	2019	01:00	20.4	59	2.5	13	2.1	NNE	906	0	0
25	11	Nov'19	2019	02:00	20.2	56	2.5	23	1.2	NNE	903	0	0
25	11	Nov'19	2019	03:00	19.6	57	2.9	70	1.2	ENE	905	0	0
25	11	Nov'19	2019	04:00	19.5	55	2.1	34	1.2	NE	908	0	0
25	11	Nov'19	2019	05:00	19.2	65	2.6	58	3	ENE	911	0	0
25	11	Nov'19	2019	06:00	19.1	56	2.4	57	2.1	ENE	918	0	0
25	11	Nov'19	2019	07:00	19.2	62	1.9	33	2.1	NNE	913	0	0
25	11	Nov'19	2019	08:00	19.1	60	1.5	33	1.2	NNE	921	0	0
25	11	Nov'19	2019	09:00	19.3	59	1.4	89	2.1	E	912	0	0
25	11	Nov'19	2019	10:00	19.5	63	1.6	77	2.1	ENE	927	0	0
25	11	Nov'19	2019	11:00	19.6	60	1.5	57	1.2	ENE	903	0	0
25	11	Nov'19	2019	12:00	19.9	63	1.8	81	1.2	E	908	0	0
25	11	Nov'19	2019	13:00	20.1	63	1.6	67	1.2	ENE	906	0	0
25	11	Nov'19	2019	14:00	20.3	61	2.6	85	1.2	E	923	0	0
25	11	Nov'19	2019	15:00	20.6	63	2.1	31	1.2	NNE	905	0	0
25	11	Nov'19	2019	16:00	20.8	65	0.6	42	1.2	NE	908	0	0
25	11	Nov'19	2019	17:00	21.2	58	2.1	89	1.2	E	912	0	0
25	11	Nov'19	2019	18:00	21.4	62	2.5	57	1.2	ENE	923	0	0
25	11	Nov'19	2019	19:00	21.3	63	3.2	82	2.1	E	901	0	0
25	11	Nov'19	2019	20:00	21.1	60	1.7	51	2.1	NE	903	0	0
25	11	Nov'19	2019	21:00	20.8	65	1.4	65	2.1	ENE	921	0	0
25	11	Nov'19	2019	22:00	20.6	64	2.5	76	1.2	ENE	911	0	0
25	11	Nov'19	2019	23:00	20.5	65	2.9	84	1.2	E	918	0	0
26	11	Nov'19	2019	00:00	20.2	63	2.1	37	3	NE	917	0	0
26	11	Nov'19	2019	01:00	20.1	60	3.1	53	2.1	NE	905	0	0
26	11	Nov'19	2019	02:00	19.8	56	2.9	15	3.9	NNE	901	0	0
26	11	Nov'19	2019	03:00	19.6	63	2.3	25	2.1	NNE	903	0	0
26	11	Nov'19	2019	04:00	19.4	59	0.6	89	1.2	E	905	0	0
26	11	Nov'19	2019	05:00	19.2	56	0.5	84	3	E	912	0	0
26	11	Nov'19	2019	06:00	19.1	57	1.8	86	1.2	E	913	0	0
26	11	Nov'19	2019	07:00	18.9	55	1.4	75	2.1	ENE	918	0	0
26	11	Nov'19	2019	08:00	18.8	59	0.5	28	1.2	NNE	914	0	0
26	11	Nov'19	2019	09:00	18.7	58	0.9	22	1.2	NNE	919	0	0
26	11	Nov'19	2019	10:00	19.1	55	1.5	57	2.1	ENE	925	0	0
26	11	Nov'19	2019	11:00	19.2	60	2.3	58	1.2	ENE	928	0	0
26	11	Nov'19	2019	12:00	19.6	59	2.4	60	2.1	ENE	921	0	0
26	11	Nov'19	2019	13:00	19.8	61	2.8	55	1.2	NE	902	0	0
26	11	Nov'19	2019	14:00	20.2	59	2.5	58	2.1	ENE	903	0	0
26	11	Nov'19	2019	15:00	20.6	58	2.6	30	1.2	NNE	924	0	0
26	11	Nov'19	2019	16:00	20.8	62	2.8	38	1.2	NE	912	0	0
26	11	Nov'19	2019	17:00	21.3	62	2.1	35	2.1	NE	917	0	0
26	11	Nov'19	2019	18:00	21.5	63	2.3	39	2.1	NE	905	0	0
26	11	Nov'19	2019	19:00	21.6	61	2.8	34	3.9	NE	901	0	0
26	11	Nov'19	2019	20:00	21.2	62	2.1	55	2.1	NE	903	0	0
26	11	Nov'19	2019	21:00	20.8	63	3.1	65	3	ENE	905	0	0
26	11	Nov'19	2019	22:00	20.6	58	1.3	55	2.1	NE	912	0	0
26	11	Nov'19	2019	23:00	20.4	59	1.4	34	2.1	NE	913	0	0
27	11	Nov'19	2019	00:00	20.3	64	0.6	59	2.1	ENE	918	0	0
27	11	Nov'19	2019	01:00	20.2	65	1.5	20	1.2	NNE	914	0	0
27	11	Nov'19	2019	02:00	19.9	61	2.1	35	2.1	NE	919	0	0
27	11	Nov'19	2019	03:00	19.6	59	3.8	44	1.2	NE	925	0	0
27	11	Nov'19	2019	04:00	19.5	55	3.7	18	2.1	NNE	928	0	0
27	11	Nov'19	2019	05:00	19.4	61	3.3	18	1.2	NNE	921	0	0
27	11	Nov'19	2019	06:00	19.3	64	3.5	11	1.2	N	902	0	0
27	11	Nov'19	2019	07:00	19.1	62	3.6	36	1.2	NE	903	0	0
27	11	Nov'19	2019	08:00	18.6	63	3.9	90	1.2	E	924	0	0
27	11	Nov'19	2019	09:00	18.7	62	3.7	77	2.1	ENE	912	0	0
27	11	Nov'19	2019	10:00	18.9	65	2.1	85	1.2	E	913	0	0
27	11	Nov'19	2019	11:00	19.4	61	2.3	60	2.1	ENE	902	0	0
27	11	Nov'19	2019	12:00	19.5	60	2.6	81	1.2	E	920	0	0
27	11	Nov'19	2019	13:00	19.7	64	2.5	67	1.2	ENE	922	0	0
27	11	Nov'19	2019	14:00	20.1	63	2.5	85	3	E	911	0	0
27	11	Nov'19	2019	15:00	20.3	62	2.9	60	2.1	ENE	921	0	0
27	11	Nov'19	2019	16:00	20.5	64	2.1	28	1.2	NNE	923	0	0
27	11	Nov'19	2019	17:00	20.7	64	2.6	60	1.2	ENE	901	0	0
27	11	Nov'19	2019	18:00	20.9	61	2.4	45	1.2	NE	903	0	0
27	11	Nov'19	2019	19:00	21.1	63	1.9	25	1.2	NNE	909	0	0
27	11	Nov'19	2019	20:00	20.8	64	1.5	51	3.9	NE	911	0	0
27	11	Nov'19	2019	21:00	20.5	60	1.4	24	1.2	NNE	923	0	0
27	11	Nov'19	2019	22:00	20.2	65	1.6	38	1.2	NE	927	0	0

27	11	Nov'19	2019	23:00	19.9	61	1.5	25	1.2	NNE	928	0	0
28	11	Nov'19	2019	00:00	19.4	63	1.8	79	2.1	E	921	0	0
28	11	Nov'19	2019	01:00	19.2	62	1.6	86	2.1	E	920	0	0
28	11	Nov'19	2019	02:00	19.1	59	2.3	19	2.1	NNE	907	0	0
28	11	Nov'19	2019	03:00	18.8	65	0.6	26	1.2	NNE	911	0	0
28	11	Nov'19	2019	04:00	18.7	63	0.5	18	3.9	NNE	918	0	0
28	11	Nov'19	2019	05:00	18.6	63	1.8	65	2.1	ENE	909	0	0
28	11	Nov'19	2019	06:00	18.9	58	1.4	38	3	NE	903	0	0
28	11	Nov'19	2019	07:00	19.1	64	0.5	52	1.2	NE	901	0	0
28	11	Nov'19	2019	08:00	19.3	62	0.9	86	1.2	E	903	0	0
28	11	Nov'19	2019	09:00	19.4	63	1.5	81	1.2	E	908	0	0
28	11	Nov'19	2019	10:00	19.6	61	2.3	50	1.2	NE	909	0	0
28	11	Nov'19	2019	11:00	19.7	55	2.4	50	1.2	NE	913	0	0
28	11	Nov'19	2019	12:00	20.1	58	2.8	82	1.2	E	908	0	0
28	11	Nov'19	2019	13:00	20.2	59	2.5	50	1.2	NE	902	0	0
28	11	Nov'19	2019	14:00	20.3	56	2.6	50	1.2	NE	909	0	0
28	11	Nov'19	2019	15:00	20.6	57	2.8	81	1.2	E	911	0	0
28	11	Nov'19	2019	16:00	20.5	55	2.1	26	1.2	NNE	927	0	0
28	11	Nov'19	2019	17:00	20.2	65	2.3	19	3	NNE	915	0	0
28	11	Nov'19	2019	18:00	19.1	56	2.8	76	2.1	ENE	908	0	0
28	11	Nov'19	2019	19:00	18.6	62	2.9	38	3	NE	901	0	0
28	11	Nov'19	2019	20:00	18.5	60	3.1	58	2.1	ENE	912	0	0
28	11	Nov'19	2019	21:00	18.3	59	3.5	85	3	E	923	0	0
28	11	Nov'19	2019	22:00	18.2	63	3.6	12	1.2	NNE	901	0	0
28	11	Nov'19	2019	23:00	18.1	60	3.9	65	2.1	ENE	903	0	0
29	11	Nov'19	2019	00:00	17.9	63	3.7	15	2.1	NNE	921	0	0
29	11	Nov'19	2019	01:00	17.6	63	2.1	84	3	E	911	0	0
29	11	Nov'19	2019	02:00	17.4	61	2.6	76	3	ENE	918	0	0
29	11	Nov'19	2019	03:00	17.3	62	2.8	55	3	NE	917	0	0
29	11	Nov'19	2019	04:00	17.8	64	2.6	81	3	E	905	0	0
29	11	Nov'19	2019	05:00	18.4	56	2.1	41	3	NE	901	0	0
29	11	Nov'19	2019	06:00	18.6	58	2.9	49	1.2	NE	921	0	0
29	11	Nov'19	2019	07:00	18.9	59	2.4	48	2.1	NE	922	0	0
29	11	Nov'19	2019	08:00	19.4	55	2.3	35	3	NE	902	0	0
29	11	Nov'19	2019	09:00	19.6	58	2.1	61	3	ENE	908	0	0
29	11	Nov'19	2019	10:00	19.9	59	3.2	48	2.1	NE	906	0	0
29	11	Nov'19	2019	11:00	20.4	58	3.1	19	2.1	NNE	903	0	0
29	11	Nov'19	2019	12:00	20.8	65	2.1	52	1.2	NE	905	0	0
29	11	Nov'19	2019	13:00	20.7	62	2.2	81	1.2	E	908	0	0
29	11	Nov'19	2019	14:00	20.8	63	2.3	53	2.1	NE	911	0	0
29	11	Nov'19	2019	15:00	20.9	60	2.6	33	2.1	NNE	918	0	0
29	11	Nov'19	2019	16:00	20.6	64	2.5	59	3	ENE	913	0	0
29	11	Nov'19	2019	17:00	20.4	61	2.5	47	2.1	NE	921	0	0
29	11	Nov'19	2019	18:00	20.2	59	2.9	36	3.9	NE	912	0	0
29	11	Nov'19	2019	19:00	19.8	58	2.1	61	1.2	ENE	927	0	0
29	11	Nov'19	2019	20:00	19.4	58	2.6	66	2.1	ENE	903	0	0
29	11	Nov'19	2019	21:00	19.1	57	2.4	38	2.1	NE	908	0	0
29	11	Nov'19	2019	22:00	18.7	65	1.9	42	2.1	NE	906	0	0
29	11	Nov'19	2019	23:00	18.6	63	1.5	58	2.1	ENE	923	0	0
30	11	Nov'19	2019	00:00	18.3	61	1.4	57	2.1	ENE	905	0	0
30	11	Nov'19	2019	01:00	18.1	60	1.6	57	2.1	ENE	908	0	0
30	11	Nov'19	2019	02:00	17.8	58	1.5	79	1.2	E	912	0	0
30	11	Nov'19	2019	03:00	17.7	59	1.8	77	3.9	ENE	923	0	0
30	11	Nov'19	2019	04:00	17.5	56	1.6	57	2.1	ENE	901	0	0
30	11	Nov'19	2019	05:00	17.4	55	2.3	54	2.1	NE	903	0	0
30	11	Nov'19	2019	06:00	17.9	57	2.1	59	1.2	ENE	918	0	0
30	11	Nov'19	2019	07:00	18.1	65	3.2	57	1.2	ENE	917	0	0
30	11	Nov'19	2019	08:00	18.4	63	3.1	44	1.2	NE	905	0	0
30	11	Nov'19	2019	09:00	18.9	61	2.1	49	1.2	NE	901	0	0
30	11	Nov'19	2019	10:00	19.4	57	2.2	24	3	NNE	903	0	0
30	11	Nov'19	2019	11:00	19.8	62	2.3	85	1.2	E	905	0	0
30	11	Nov'19	2019	12:00	20.2	63	2.6	11	1.2	N	912	0	3
30	11	Nov'19	2019	13:00	20.6	65	2.5	56	3.9	NE	913	0	1
30	11	Nov'19	2019	14:00	20.7	61	2.5	50	1.2	NE	918	1.6	3
30	11	Nov'19	2019	15:00	20.8	63	2.9	82	1.2	E	914	1.2	8
30	11	Nov'19	2019	16:00	20.5	60	2.1	38	2.1	NE	919	1.2	7
30	11	Nov'19	2019	17:00	20.1	61	2.6	11	2.1	N	925	1	9
30	11	Nov'19	2019	18:00	19.8	63	2.4	46	2.1	NE	925	1.3	5
30	11	Nov'19	2019	19:00	19.4	56	1.9	20	1.2	NNE	930	1.2	4
30	11	Nov'19	2019	20:00	19.3	59	1.5	21	1.2	NNE	914	0	7
30	11	Nov'19	2019	21:00	19.1	58	1.4	13	1.2	NNE	906	0	4
30	11	Nov'19	2019	22:00	18.7	55	1.6	38	1.2	NE	907	0	0
30	11	Nov'19	2019	23:00	18.5	59	1.5	79	1.2	E	911	0	0
30	11	Nov'19	2019	22:00	18.2	58	1.8	66	1.2	ENE	906	0	0
30	11	Nov'19	2019	23:00	18.1	65	1.6	62	1.2	ENE	902	0	0
1	12	Dec'19	2019	00:00	17.9	63.2	0.6	58	2.1	ENE	912	0	0
1	12	Dec'19	2019	01:00	17.5	64.2	0.8	66	2.1	ENE	915	0	0

1	12	Dec'19	2019	02:00	17.2	64.5	0.9	85	2.1	E	912	0	0
1	12	Dec'19	2019	03:00	17.1	63.2	0.4	36	1.2	NE	914	0	0
1	12	Dec'19	2019	04:00	16.9	59.6	0.5	4	1.2	N	916	0	0
1	12	Dec'19	2019	05:00	16.8	58.3	0.8	86	2.1	E	919	0	0
1	12	Dec'19	2019	06:00	17.3	52.4	3.5	50	1.2	NE	924	0	0
1	12	Dec'19	2019	07:00	17.8	53.6	2.5	70	2.1	ENE	920	0	0
1	12	Dec'19	2019	08:00	18.2	52.3	3.5	30	2.1	NNE	921	0	0
1	12	Dec'19	2019	09:00	18.6	51.9	0.9	9	3.9	N	922	0	0
1	12	Dec'19	2019	10:00	18.8	50.3	1.6	66	1.2	ENE	923	0	0
1	12	Dec'19	2019	11:00	19.4	48.1	1.2	86	2.1	E	922	0	0
1	12	Dec'19	2019	12:00	19.8	47.1	0.8	4	2.1	N	923	0	0
1	12	Dec'19	2019	13:00	20.3	48.9	1.6	59	2.1	ENE	926	0	0
1	12	Dec'19	2019	14:00	20.6	46.8	1.9	65	1.2	ENE	926	0	0
1	12	Dec'19	2019	15:00	20.8	45.2	2.1	76	1.2	ENE	927	0	0
1	12	Dec'19	2019	16:00	20.7	47.6	1.9	66	2.1	ENE	928	0	0
1	12	Dec'19	2019	17:00	20.4	46.9	2.4	28	3	NNE	923	0	0
1	12	Dec'19	2019	18:00	19.9	49.8	2.8	46	1.2	NE	923	0	0
1	12	Dec'19	2019	19:00	19.7	54.3	0.9	36	2.1	NE	918	0	0
1	12	Dec'19	2019	20:00	19.4	53.6	0.8	69	1.2	ENE	912	0	0
1	12	Dec'19	2019	21:00	19.2	56.9	2.7	58	1.2	ENE	912	0	0
1	12	Dec'19	2019	22:00	18.8	58	3.5	55	1.2	NE	911	0	0
1	12	Dec'19	2019	23:00	18.6	58.9	4.5	76	1.2	ENE	913	0	0
2	12	Dec'19	2019	00:00	18.3	63.2	1.8	56	1.2	NE	912	0	0
2	12	Dec'19	2019	01:00	18.1	64.2	1.8	58	1.2	ENE	912	0	0
2	12	Dec'19	2019	02:00	17.9	64.5	0.6	66	2.1	ENE	914	0	0
2	12	Dec'19	2019	03:00	17.6	63.2	0.8	85	2.1	E	916	0	0
2	12	Dec'19	2019	04:00	17.4	59.6	0.9	36	1.2	NE	919	0	0
2	12	Dec'19	2019	05:00	17.2	58.3	0.4	4	2.1	N	924	0	0
2	12	Dec'19	2019	06:00	17.3	52.4	0.5	86	3	E	920	0	0
2	12	Dec'19	2019	07:00	17.7	53.6	0.8	50	2.1	NE	921	0	0
2	12	Dec'19	2019	08:00	18.1	52.3	3.5	70	2.1	ENE	922	0	0
2	12	Dec'19	2019	09:00	18.2	51.9	2.5	30	2.1	NNE	923	0	0
2	12	Dec'19	2019	10:00	18.6	50.3	3.5	9	2.1	N	922	0	0
2	12	Dec'19	2019	11:00	18.9	48.1	0.9	66	3.9	ENE	923	0	0
2	12	Dec'19	2019	12:00	19.1	47.1	1.6	86	3.9	E	926	0	0
2	12	Dec'19	2019	13:00	19.2	48.9	1.2	4	1.2	N	926	0	0
2	12	Dec'19	2019	14:00	19.5	46.8	0.8	59	2.1	ENE	927	0	0
2	12	Dec'19	2019	15:00	19.7	45.2	1.6	65	2.1	ENE	928	0	0
2	12	Dec'19	2019	16:00	19.8	47.6	1.9	76	1.2	ENE	923	0	0
2	12	Dec'19	2019	17:00	19.4	46.9	2.1	66	1.2	ENE	923	0	0
2	12	Dec'19	2019	18:00	19.1	49.8	1.9	28	2.1	NNE	918	0	0
2	12	Dec'19	2019	19:00	18.8	54.3	2.4	46	3	NE	924	0	0
2	12	Dec'19	2019	20:00	18.5	53.6	2.8	36	3	NE	916	0	0
2	12	Dec'19	2019	21:00	18.2	56.9	0.9	69	3	ENE	914	0	0
2	12	Dec'19	2019	22:00	17.9	58	0.8	4	3.9	N	913	0	0
2	12	Dec'19	2019	23:00	17.8	58.9	2.7	55	2.1	NE	914	0	0
3	12	Dec'19	2019	00:00	17.6	63.2	3.5	58	1.2	ENE	912	0	0
3	12	Dec'19	2019	01:00	17.4	64.2	4.5	66	3	ENE	915	0	0
3	12	Dec'19	2019	02:00	17.3	64.5	1.8	85	2.1	E	912	0	0
3	12	Dec'19	2019	03:00	17.1	63.2	0.5	36	1.2	NE	914	0	0
3	12	Dec'19	2019	04:00	16.8	59.6	0.8	4	1.2	N	916	0	0
3	12	Dec'19	2019	05:00	16.5	58.3	3.5	86	4.3	E	919	0	0
3	12	Dec'19	2019	06:00	16.7	52.4	2.5	50	1.3	NE	924	0	0
3	12	Dec'19	2019	07:00	17.3	53.6	3.5	70	2.3	ENE	920	0	0
3	12	Dec'19	2019	08:00	17.6	52.3	0.9	30	2.3	NNE	921	0	0
3	12	Dec'19	2019	09:00	17.9	51.9	1.6	9	3.3	N	922	0	0
3	12	Dec'19	2019	10:00	18.2	50.3	1.2	66	4.3	ENE	923	0	0
3	12	Dec'19	2019	11:00	18.6	48.1	0.8	86	1.3	E	922	0	0
3	12	Dec'19	2019	12:00	18.8	47.1	1.6	4	4.3	N	923	0	0
3	12	Dec'19	2019	13:00	19.2	48.9	1.9	59	1.3	ENE	926	0	0
3	12	Dec'19	2019	14:00	19.5	46.8	2.1	65	2.3	ENE	926	0	0
3	12	Dec'19	2019	15:00	19.6	45.2	1.9	76	3.3	ENE	927	0	0
3	12	Dec'19	2019	16:00	19.3	47.6	2.4	66	3.3	ENE	928	0	0
3	12	Dec'19	2019	17:00	19.1	46.9	2.8	28	4.3	NNE	923	0	0
3	12	Dec'19	2019	18:00	18.8	49.8	0.9	46	1.3	NE	923	0	0
3	12	Dec'19	2019	19:00	18.6	54.3	0.8	36	2.3	NE	918	0	0
3	12	Dec'19	2019	20:00	18.4	53.6	2.7	69	2.3	ENE	912	0	0
3	12	Dec'19	2019	21:00	18.1	56.9	3.5	4	3.3	N	912	0	0
3	12	Dec'19	2019	22:00	17.9	58	0.5	55	4.3	NE	911	0	0
3	12	Dec'19	2019	23:00	17.8	58.9	0.8	76	1.3	ENE	913	0	0
4	12	Dec'19	2019	00:00	17.6	63.2	3.5	56	4.3	NE	912	0	0
4	12	Dec'19	2019	01:00	17.4	64.2	2.5	58	1.3	ENE	912	0	0
4	12	Dec'19	2019	02:00	17.3	64.5	3.5	66	2.3	ENE	914	0	0
4	12	Dec'19	2019	03:00	17.2	63.2	0.9	85	3.3	E	916	0	0
4	12	Dec'19	2019	04:00	16.9	59.6	1.6	36	3.3	NE	919	0	0
4	12	Dec'19	2019	05:00	16.8	58.3	1.2	58	4.3	ENE	924	0	0
4	12	Dec'19	2019	06:00	16.7	52.4	0.8	86	1.3	E	920	0	0

4	12	Dec'19	2019	07:00	17.1	53.6	1.6	50	2.3	NE	921	0	0
4	12	Dec'19	2019	08:00	17.5	52.3	1.9	70	4	ENE	922	0	0
4	12	Dec'19	2019	09:00	18.3	51.9	2.1	30	1	NNE	923	0	0
4	12	Dec'19	2019	10:00	18.6	50.3	1.9	9	8	N	922	0	0
4	12	Dec'19	2019	11:00	18.8	48.1	2.4	66	5	ENE	923	0	0
4	12	Dec'19	2019	12:00	19.1	47.1	2.8	86	2	E	926	0	0
4	12	Dec'19	2019	13:00	19.3	48.9	0.9	58	9	ENE	926	0	0
4	12	Dec'19	2019	14:00	19.5	46.8	0.8	59	6	ENE	927	0	0
4	12	Dec'19	2019	15:00	19.7	45.2	2.7	65	2.6	ENE	928	0	0
4	12	Dec'19	2019	16:00	19.6	47.6	3.5	76	2.6	ENE	923	0	0
4	12	Dec'19	2019	17:00	19.4	46.9	0.5	66	2.6	ENE	923	0	0
4	12	Dec'19	2019	18:00	19.2	49.8	0.8	28	2.6	NNE	918	0	0
4	12	Dec'19	2019	19:00	18.9	54.3	3.5	46	2.6	NE	924	0	0
4	12	Dec'19	2019	20:00	18.4	53.6	2.5	36	2.3	NE	916	0	0
4	12	Dec'19	2019	21:00	18.3	56.9	3.5	69	2.3	ENE	914	0	0
4	12	Dec'19	2019	22:00	18.2	58	0.9	58	2.3	ENE	913	0	0
4	12	Dec'19	2019	23:00	18.1	58.9	1.6	55	3.2	NE	914	0	0
5	12	Dec'19	2019	00:00	17.8	63.2	1.2	58	3.2	ENE	912	0	0
5	12	Dec'19	2019	01:00	17.6	64.2	0.8	66	3.2	ENE	915	0	0
5	12	Dec'19	2019	02:00	17.4	64.5	1.6	85	3.5	E	912	0	0
5	12	Dec'19	2019	03:00	17.3	63.2	1.9	36	3.5	NE	914	0	0
5	12	Dec'19	2019	04:00	17.1	59.6	2.1	58	3.5	ENE	916	0	0
5	12	Dec'19	2019	05:00	16.9	58.3	1.9	86	3.5	E	919	0	0
5	12	Dec'19	2019	06:00	16.8	52.4	2.4	50	1.5	NE	924	0	0
5	12	Dec'19	2019	07:00	17.2	53.6	2.8	70	2.5	ENE	920	0	0
5	12	Dec'19	2019	08:00	17.6	52.3	0.9	30	2.5	NNE	921	0	0
5	12	Dec'19	2019	09:00	17.8	51.9	0.8	9	2.5	N	922	0	0
5	12	Dec'19	2019	10:00	18.3	50.3	2.7	66	1.5	ENE	923	0	0
5	12	Dec'19	2019	11:00	18.6	48.1	3.5	86	1.1	E	922	0	0
5	12	Dec'19	2019	12:00	18.9	47.1	0.5	4	1.1	N	923	0	0
5	12	Dec'19	2019	13:00	18.9	48.9	0.8	59	2.1	ENE	926	0	0
5	12	Dec'19	2019	14:00	19.1	46.8	3.5	65	2.1	ENE	926	0	0
5	12	Dec'19	2019	15:00	19.2	45.2	2.5	76	2.1	ENE	927	0	0
5	12	Dec'19	2019	16:00	19.6	47.6	3.5	66	0.1	ENE	928	0	0
5	12	Dec'19	2019	17:00	19.7	46.9	0.9	28	1.6	NNE	923	0	0
5	12	Dec'19	2019	18:00	19.8	49.8	1.6	46	1.6	NE	923	0	0
5	12	Dec'19	2019	19:00	19.9	54.3	1.2	36	1.6	NE	918	0	0
5	12	Dec'19	2019	20:00	19.6	53.6	0.8	69	0.5	ENE	912	0	0
5	12	Dec'19	2019	21:00	19.5	56.9	1.6	4	0.5	N	912	0	0
5	12	Dec'19	2019	22:00	19.2	58	1.9	55	0.5	NE	911	0	0
5	12	Dec'19	2019	23:00	19.1	58.9	2.1	76	0.1	ENE	913	0	0
6	12	Dec'19	2019	00:00	18.6	63.2	1.9	56	1.2	NE	912	0	0
6	12	Dec'19	2019	01:00	18.5	64.2	2.4	58	2.5	ENE	912	0	0
6	12	Dec'19	2019	02:00	18.3	64.5	2.8	66	2.8	ENE	914	0	0
6	12	Dec'19	2019	03:00	18.2	63.2	0.9	85	3.5	E	916	0	0
6	12	Dec'19	2019	04:00	18.1	59.6	0.8	36	2.2	NE	919	0	0
6	12	Dec'19	2019	05:00	17.9	58.3	2.7	58	2.5	ENE	924	0	0
6	12	Dec'19	2019	06:00	17.6	52.4	3.5	86	3.1	E	920	0	0
6	12	Dec'19	2019	07:00	17.4	53.6	0.5	50	3.5	NE	921	0	0
6	12	Dec'19	2019	08:00	17.3	52.3	0.8	70	2.5	ENE	922	0	0
6	12	Dec'19	2019	09:00	17.8	51.9	3.5	30	3.4	NNE	923	0	0
6	12	Dec'19	2019	10:00	18.4	50.3	2.5	9	2.2	N	922	0	0
6	12	Dec'19	2019	11:00	18.6	48.1	3.5	66	1.2	ENE	923	0	0
6	12	Dec'19	2019	12:00	18.9	47.1	0.9	86	1.2	E	926	0	0
6	12	Dec'19	2019	13:00	19.4	48.9	1.6	4	1.2	N	926	0	0
6	12	Dec'19	2019	14:00	19.6	46.8	1.2	59	2.5	ENE	927	0	0
6	12	Dec'19	2019	15:00	19.9	45.2	0.8	65	2.5	ENE	928	0	0
6	12	Dec'19	2019	16:00	20.4	47.6	1.6	76	2.5	ENE	923	0	0
6	12	Dec'19	2019	17:00	20.8	46.9	1.9	66	3.5	ENE	923	0	0
6	12	Dec'19	2019	18:00	21.3	49.8	2.1	28	2.5	NNE	918	0	0
6	12	Dec'19	2019	19:00	21.6	54.3	1.9	46	2.5	NE	924	0	0
6	12	Dec'19	2019	20:00	21.5	53.6	2.4	36	2.5	NE	916	0	0
6	12	Dec'19	2019	21:00	21.2	56.9	2.8	69	1.5	ENE	914	0	0
6	12	Dec'19	2019	22:00	21.1	58	0.9	4	1.5	N	913	0	0
6	12	Dec'19	2019	23:00	20.8	58.9	0.8	55	0.1	NE	914	0	0
7	12	Dec'19	2019	00:00	20.6	63.2	2.7	58	0.3	ENE	912	0	0
7	12	Dec'19	2019	01:00	20.5	64.2	3.5	66	2.2	ENE	915	0	0
7	12	Dec'19	2019	02:00	20.2	64.5	0.5	85	2.2	E	912	0	0
7	12	Dec'19	2019	03:00	20.1	63.2	0.8	36	2.2	NE	914	0	0
7	12	Dec'19	2019	04:00	19.6	59.6	3.5	4	3.5	N	916	0	0
7	12	Dec'19	2019	05:00	19.4	58.3	2.5	86	3.5	E	919	0	0
7	12	Dec'19	2019	06:00	19.2	52.4	3.5	50	2.3	NE	924	0	0
7	12	Dec'19	2019	07:00	19.1	53.6	0.9	70	3.2	ENE	920	0	0
7	12	Dec'19	2019	08:00	19.5	52.3	1.6	30	3.2	NNE	921	0	0
7	12	Dec'19	2019	09:00	19.8	51.9	1.2	9	3.2	N	922	0	0
7	12	Dec'19	2019	10:00	20.1	50.3	0.8	66	2.5	ENE	923	0	0
7	12	Dec'19	2019	11:00	20.4	48.1	1.6	86	2.5	E	922	0	0

7	12	Dec'19	2019	12:00	20.6	47.1	1.9	4	2.5	N	923	0	0
7	12	Dec'19	2019	13:00	20.8	48.9	2.1	59	2.8	ENE	926	0	0
7	12	Dec'19	2019	14:00	21.1	46.8	1.9	65	2.5	ENE	926	0	0
7	12	Dec'19	2019	15:00	21.5	45.2	2.4	76	2.4	ENE	927	0	0
7	12	Dec'19	2019	16:00	21.7	47.6	2.8	66	1.5	ENE	928	0	0
7	12	Dec'19	2019	17:00	21.9	46.9	0.9	28	1.5	NNE	923	0	0
7	12	Dec'19	2019	18:00	22.4	49.8	0.8	46	0.5	NE	923	0	0
7	12	Dec'19	2019	19:00	22.7	54.3	2.7	36	0.1	NE	918	0	0
7	12	Dec'19	2019	20:00	22.5	53.6	3.5	69	0.3	ENE	912	0	0
7	12	Dec'19	2019	21:00	22.2	56.9	0.5	4	1.2	N	912	0	0
7	12	Dec'19	2019	22:00	21.8	58	0.8	55	1.2	NE	911	0	0
7	12	Dec'19	2019	23:00	21.4	58.9	3.5	76	2.2	ENE	913	0	0
8	12	Dec'19	2019	00:00	21.1	63.2	2.5	56	2.8	NE	912	0	0
8	12	Dec'19	2019	01:00	20.6	64.2	3.5	58	3.4	ENE	912	0	0
8	12	Dec'19	2019	02:00	20.4	64.5	0.9	66	2.3	ENE	914	0	0
8	12	Dec'19	2019	03:00	20.3	63.2	1.6	85	3.2	E	916	0	0
8	12	Dec'19	2019	04:00	20.1	59.6	1.2	36	3.2	NE	919	0	0
8	12	Dec'19	2019	05:00	19.9	58.3	0.8	4	2.2	N	924	0	0
8	12	Dec'19	2019	06:00	19.8	52.4	1.6	86	2.5	E	920	0	0
8	12	Dec'19	2019	07:00	19.6	53.6	1.9	50	2.5	NE	921	0	0
8	12	Dec'19	2019	08:00	19.4	52.3	2.1	70	2.5	ENE	922	0	0
8	12	Dec'19	2019	09:00	19.5	51.9	1.9	30	4.5	NNE	923	0	0
8	12	Dec'19	2019	10:00	19.7	50.3	2.4	9	1.5	N	922	0	0
8	12	Dec'19	2019	11:00	20.1	48.1	2.8	66	2.4	ENE	923	0	0
8	12	Dec'19	2019	12:00	20.3	47.1	0.9	86	0.5	E	926	0	0
8	12	Dec'19	2019	13:00	20.5	48.9	0.8	4	0.5	N	926	0	0
8	12	Dec'19	2019	14:00	20.7	46.8	2.7	59	1.5	ENE	927	0	0
8	12	Dec'19	2019	15:00	20.9	45.2	3.5	65	1.1	ENE	928	0	0
8	12	Dec'19	2019	16:00	21.1	47.6	0.5	76	1.3	ENE	923	0	0
8	12	Dec'19	2019	17:00	21.3	46.9	0.8	66	2.2	ENE	923	0	0
8	12	Dec'19	2019	18:00	21.6	49.8	3.5	28	2.2	NNE	918	0	0
8	12	Dec'19	2019	19:00	21.9	54.3	2.5	46	2.2	NE	924	0	0
8	12	Dec'19	2019	20:00	21.8	53.6	3.5	36	2.5	NE	916	0	0
8	12	Dec'19	2019	21:00	21.5	56.9	0.9	69	2.5	ENE	914	0	0
8	12	Dec'19	2019	22:00	21.2	58	1.6	4	0.3	N	913	0	0
8	12	Dec'19	2019	23:00	20.8	58.9	1.2	55	1.2	NE	914	0	0
9	12	Dec'19	2019	00:00	20.6	63.2	0.8	58	4.2	ENE	912	0	0
9	12	Dec'19	2019	01:00	20.4	64.2	1.6	66	3.2	ENE	915	0	0
9	12	Dec'19	2019	02:00	20.2	64.5	1.9	85	2.5	E	912	0	0
9	12	Dec'19	2019	03:00	19.6	63.2	2.1	36	2.5	NE	914	0	0
9	12	Dec'19	2019	04:00	19.5	59.6	1.9	4	3.5	N	916	0	0
9	12	Dec'19	2019	05:00	19.2	58.3	2.4	86	3.5	E	919	0	0
9	12	Dec'19	2019	06:00	19.1	52.4	2.8	50	2.5	NE	924	0	0
9	12	Dec'19	2019	07:00	19.2	53.6	0.9	70	2.5	ENE	920	0	0
9	12	Dec'19	2019	08:00	19.1	52.3	0.8	30	2.5	NNE	921	0	0
9	12	Dec'19	2019	09:00	19.3	51.9	2.7	9	1.5	N	922	0	0
9	12	Dec'19	2019	10:00	19.5	50.3	3.5	66	1.5	ENE	923	0	0
9	12	Dec'19	2019	11:00	19.6	48.1	0.5	86	1.1	E	922	0	0
9	12	Dec'19	2019	12:00	19.9	47.1	0.8	4	1.3	N	923	0	0
9	12	Dec'19	2019	13:00	20.1	48.9	3.5	59	3.2	ENE	926	0	0
9	12	Dec'19	2019	14:00	20.3	46.8	2.5	65	2.2	ENE	926	0	0
9	12	Dec'19	2019	15:00	20.6	45.2	3.5	76	5.2	ENE	927	0	0
9	12	Dec'19	2019	16:00	20.8	47.6	0.9	66	3.4	ENE	928	0	0
9	12	Dec'19	2019	17:00	21.2	46.9	1.6	28	2.8	NNE	923	0	0
9	12	Dec'19	2019	18:00	21.4	49.8	1.2	46	2.3	NE	923	0	0
9	12	Dec'19	2019	19:00	21.3	54.3	0.8	36	1.2	NE	918	0	0
9	12	Dec'19	2019	20:00	21.1	53.6	1.6	69	1.2	ENE	912	0	0
9	12	Dec'19	2019	21:00	20.8	56.9	1.9	4	1.2	N	912	0	0
9	12	Dec'19	2019	22:00	20.6	58	2.1	55	1.5	NE	911	0	0
9	12	Dec'19	2019	23:00	20.5	58.9	1.9	76	2.5	ENE	913	0	0
10	12	Dec'19	2019	00:00	20.2	63.2	2.4	56	2.5	NE	912	0	0
10	12	Dec'19	2019	01:00	20.1	64.2	2.8	58	2.8	ENE	912	0	0
10	12	Dec'19	2019	02:00	19.8	64.5	0.9	66	4.5	ENE	914	0	0
10	12	Dec'19	2019	03:00	19.6	63.2	0.8	85	3.5	E	916	0	0
10	12	Dec'19	2019	04:00	19.4	59.6	2.7	36	0.5	NE	919	0	0
10	12	Dec'19	2019	05:00	19.2	58.3	3.5	58	1.5	ENE	924	0	0
10	12	Dec'19	2019	06:00	19.1	52.4	0.5	86	0.5	E	920	0	0
10	12	Dec'19	2019	07:00	18.9	53.6	0.8	50	2.1	NE	921	0	0
10	12	Dec'19	2019	08:00	18.8	52.3	3.5	70	1.3	ENE	922	0	0
10	12	Dec'19	2019	09:00	18.7	51.9	2.5	30	4.2	NNE	923	0	0
10	12	Dec'19	2019	10:00	19.1	50.3	3.5	9	5.2	N	922	0	0
10	12	Dec'19	2019	11:00	19.2	48.1	0.9	66	2.2	ENE	923	0	0
10	12	Dec'19	2019	12:00	19.6	47.1	1.6	86	1.5	E	926	0	0
10	12	Dec'19	2019	13:00	19.8	48.9	1.2	4	1.5	N	926	0	0
10	12	Dec'19	2019	14:00	20.2	46.8	0.8	59	1.3	ENE	927	0	0
10	12	Dec'19	2019	15:00	20.6	45.2	1.6	65	2.2	ENE	928	0	0
10	12	Dec'19	2019	16:00	20.8	47.6	1.9	76	2.2	ENE	923	0	0

10	12	Dec'19	2019	17:00	21.3	46.9	2.1	66	2.2	ENE	923	0	0
10	12	Dec'19	2019	18:00	21.5	49.8	1.9	28	2.5	NNE	918	0	0
10	12	Dec'19	2019	19:00	21.6	54.3	2.4	46	2.5	NE	924	0	0
10	12	Dec'19	2019	20:00	21.2	53.6	2.8	36	2.5	NE	916	0	0
10	12	Dec'19	2019	21:00	20.8	56.9	0.9	69	2.5	ENE	914	0	0
10	12	Dec'19	2019	22:00	20.6	58	0.8	4	0.5	N	913	0	0
10	12	Dec'19	2019	23:00	20.4	58.9	2.7	55	0.5	NE	914	0	0
11	12	Dec'19	2019	00:00	20.3	63.2	3.5	58	2.5	ENE	912	0	0
11	12	Dec'19	2019	01:00	20.2	64.2	0.5	66	1.5	ENE	915	0	0
11	12	Dec'19	2019	02:00	19.9	64.5	0.8	85	1.5	E	912	0	0
11	12	Dec'19	2019	03:00	19.6	63.2	3.5	36	1.1	NE	914	0	0
11	12	Dec'19	2019	04:00	19.5	59.6	2.5	4	1.3	N	916	0	0
11	12	Dec'19	2019	05:00	19.4	58.3	3.5	86	3.2	E	919	0	0
11	12	Dec'19	2019	06:00	19.3	52.4	0.9	50	3.2	NE	924	0	0
11	12	Dec'19	2019	07:00	19.1	53.6	1.6	70	3.2	ENE	920	0	0
11	12	Dec'19	2019	08:00	18.6	52.3	1.2	30	3.5	NNE	921	0	0
11	12	Dec'19	2019	09:00	18.7	51.9	0.8	9	3.5	N	922	0	0
11	12	Dec'19	2019	10:00	18.9	50.3	1.6	66	2.3	ENE	923	0	0
11	12	Dec'19	2019	11:00	19.4	48.1	1.9	86	3.2	E	922	0	0
11	12	Dec'19	2019	12:00	19.5	47.1	2.1	4	3.2	N	923	0	0
11	12	Dec'19	2019	13:00	19.7	48.9	1.9	59	3.2	ENE	926	0	0
11	12	Dec'19	2019	14:00	20.1	46.8	2.4	65	2.5	ENE	926	0	0
11	12	Dec'19	2019	15:00	20.3	45.2	2.8	76	2.5	ENE	927	0	0
11	12	Dec'19	2019	16:00	20.6	47.6	0.9	66	2.5	ENE	928	0	0
11	12	Dec'19	2019	17:00	20.4	46.9	0.8	28	1.5	NNE	923	0	0
11	12	Dec'19	2019	18:00	19.9	49.8	2.7	46	1.5	NE	923	0	0
11	12	Dec'19	2019	19:00	19.7	54.3	3.5	36	0.5	NE	918	0	0
11	12	Dec'19	2019	20:00	19.4	53.6	0.5	69	1.5	ENE	912	0	0
11	12	Dec'19	2019	21:00	19.2	56.9	0.8	4	1.5	N	912	0	0
11	12	Dec'19	2019	22:00	18.8	58	3.5	55	1.5	NE	911	0	0
11	12	Dec'19	2019	23:00	18.6	58.9	2.5	76	1.1	ENE	913	0	0
12	12	Dec'19	2019	00:00	18.5	63.2	3.5	56	1.3	NE	912	0	0
12	12	Dec'19	2019	01:00	18.3	64.2	0.9	58	3.2	ENE	912	0	0
12	12	Dec'19	2019	02:00	18.1	64.5	1.6	66	3.2	ENE	914	0	0
12	12	Dec'19	2019	03:00	17.9	63.2	1.2	85	3.2	E	916	0	0
12	12	Dec'19	2019	04:00	18.2	59.6	0.8	36	3.5	NE	919	0	0
12	12	Dec'19	2019	05:00	18.6	58.3	1.6	4	3.5	N	924	0	0
12	12	Dec'19	2019	06:00	18.9	52.4	1.9	86	2.3	E	920	0	0
12	12	Dec'19	2019	07:00	19.3	53.6	2.1	50	3.2	NE	921	0	0
12	12	Dec'19	2019	08:00	19.5	52.3	1.9	70	3.2	ENE	922	0	0
12	12	Dec'19	2019	09:00	19.6	51.9	2.4	30	3.2	NNE	923	0	0
12	12	Dec'19	2019	10:00	19.7	50.3	2.8	9	3.5	N	922	0	0
12	12	Dec'19	2019	11:00	19.8	48.1	0.9	66	3.5	ENE	923	0	0
12	12	Dec'19	2019	12:00	20.1	47.1	0.8	86	2.5	E	926	0	0
12	12	Dec'19	2019	13:00	20.6	48.9	2.7	4	2.5	N	926	0	0
12	12	Dec'19	2019	14:00	20.9	46.8	3.5	59	1.5	ENE	927	0	0
12	12	Dec'19	2019	15:00	20.5	45.2	0.5	65	0.5	ENE	928	0	0
12	12	Dec'19	2019	16:00	20.2	47.6	0.8	76	2.5	ENE	923	0	0
12	12	Dec'19	2019	17:00	19.7	46.9	3.5	66	4.5	ENE	923	0	0
12	12	Dec'19	2019	18:00	19.4	49.8	2.5	28	2.4	NNE	918	0	0
12	12	Dec'19	2019	19:00	19.2	54.3	3.5	46	2	NE	924	0	0
12	12	Dec'19	2019	20:00	18.8	53.6	0.9	36	2.2	NE	916	0	0
12	12	Dec'19	2019	21:00	18.6	56.9	1.6	69	4.2	ENE	914	0	0
12	12	Dec'19	2019	22:00	18.5	58	1.2	4	2.2	N	913	0	0
12	12	Dec'19	2019	23:00	18.3	58.9	0.8	55	2.2	NE	914	0	0
13	12	Dec'19	2019	00:00	18.1	63.2	1.6	58	2.5	ENE	912	0	0
13	12	Dec'19	2019	01:00	17.8	64.2	1.9	66	3.5	ENE	915	0	0
13	12	Dec'19	2019	02:00	17.6	64.5	2.1	85	2.3	E	912	0	0
13	12	Dec'19	2019	03:00	17.4	63.2	1.9	36	2.5	NE	914	0	0
13	12	Dec'19	2019	04:00	17.9	59.6	2.4	4	2.5	N	916	0	0
13	12	Dec'19	2019	05:00	18.2	58.3	2.8	86	2.5	E	919	0	0
13	12	Dec'19	2019	06:00	18.3	52.4	0.9	50	2.8	NE	924	0	0
13	12	Dec'19	2019	07:00	18.7	53.6	0.8	70	2.8	ENE	920	0	0
13	12	Dec'19	2019	08:00	18.9	52.3	2.7	30	2.8	NNE	921	0	0
13	12	Dec'19	2019	09:00	19.4	51.9	3.5	9	2.8	N	922	0	0
13	12	Dec'19	2019	10:00	19.7	50.3	0.5	66	1.8	ENE	923	0	0
13	12	Dec'19	2019	11:00	19.9	48.1	0.8	86	1.8	E	922	0	0
13	12	Dec'19	2019	12:00	20.3	47.1	3.5	4	1.8	N	923	0	0
13	12	Dec'19	2019	13:00	20.4	48.9	2.5	59	2.5	ENE	926	0	0
13	12	Dec'19	2019	14:00	20.5	46.8	3.5	65	2.5	ENE	926	0	0
13	12	Dec'19	2019	15:00	20.2	45.2	0.9	76	1.1	ENE	927	0	0
13	12	Dec'19	2019	16:00	19.9	47.6	1.6	66	1.3	ENE	928	0	0
13	12	Dec'19	2019	17:00	19.4	46.9	1.2	28	2.2	NNE	923	0	0
13	12	Dec'19	2019	18:00	19.2	49.8	0.8	46	2.2	NE	923	0	0
13	12	Dec'19	2019	19:00	19.1	54.3	1.6	36	2.2	NE	918	0	0
13	12	Dec'19	2019	20:00	18.9	53.6	1.9	69	2.5	ENE	912	0	0
13	12	Dec'19	2019	21:00	18.7	56.9	2.1	4	2.5	N	912	0	0

13	12	Dec'19	2019	22:00	18.6	58	1.9	55	1.3	NE	911	0	0
13	12	Dec'19	2019	23:00	18.4	58.9	2.4	76	2.2	ENE	913	0	0
14	12	Dec'19	2019	00:00	18.2	63.2	2.8	56	2.2	NE	912	0	0
14	12	Dec'19	2019	01:00	17.9	64.2	0.9	58	2.2	ENE	912	0	0
14	12	Dec'19	2019	02:00	17.8	64.5	0.8	66	2.5	ENE	914	0	0
14	12	Dec'19	2019	03:00	17.7	63.2	2.7	85	2.5	E	916	0	0
14	12	Dec'19	2019	04:00	18.1	59.6	3.5	36	2.5	NE	919	0	0
14	12	Dec'19	2019	05:00	18.5	58.3	0.5	4	3.5	N	924	0	0
14	12	Dec'19	2019	06:00	18.7	52.4	0.8	86	2.5	E	920	0	0
14	12	Dec'19	2019	07:00	18.9	53.6	3.5	50	2.5	NE	921	0	0
14	12	Dec'19	2019	08:00	19.3	52.3	2.5	70	1.5	ENE	922	0	0
14	12	Dec'19	2019	09:00	19.5	51.9	3.5	30	1.5	NNE	923	0	0
14	12	Dec'19	2019	10:00	19.6	50.3	0.9	9	1.5	N	922	0	0
14	12	Dec'19	2019	11:00	19.8	48.1	1.6	66	1.1	ENE	923	0	0
14	12	Dec'19	2019	12:00	20.1	47.1	1.2	86	2.3	E	926	0	0
14	12	Dec'19	2019	13:00	20.3	48.9	0.8	4	3.2	N	926	0	0
14	12	Dec'19	2019	14:00	20.5	46.8	1.6	59	1.2	ENE	927	0	0
14	12	Dec'19	2019	15:00	20.6	45.2	1.9	65	2.2	ENE	928	0	0
14	12	Dec'19	2019	16:00	20.8	47.6	2.1	76	2.5	ENE	923	0	0
14	12	Dec'19	2019	17:00	20.3	46.9	1.9	66	2.5	ENE	923	0	0
14	12	Dec'19	2019	18:00	20.1	49.8	2.4	28	1.3	NNE	918	0	0
14	12	Dec'19	2019	19:00	19.9	54.3	2.8	46	2.2	NE	924	0	0
14	12	Dec'19	2019	20:00	19.8	53.6	0.9	36	2.2	NE	916	0	0
14	12	Dec'19	2019	21:00	19.6	56.9	0.8	69	2.2	ENE	914	0	0
14	12	Dec'19	2019	22:00	19.4	58	2.7	4	1.5	N	913	0	0
14	12	Dec'19	2019	23:00	19.3	58.9	3.5	55	1.5	NE	914	0	0
15	12	Dec'19	2019	00:00	19.2	63.2	0.5	58	2.8	ENE	912	0	0
15	12	Dec'19	2019	01:00	19.1	64.2	0.8	66	1.5	ENE	915	0	0
15	12	Dec'19	2019	02:00	19.1	64.5	3.5	85	1.5	E	912	0	0
15	12	Dec'19	2019	03:00	18.9	63.2	2.5	36	1.5	NE	914	0	0
15	12	Dec'19	2019	04:00	18.8	59.6	3.5	4	2.5	N	916	0	0
15	12	Dec'19	2019	05:00	18.7	58.3	0.9	86	2.5	E	919	0	0
15	12	Dec'19	2019	06:00	18.7	52.4	1.6	50	2.5	NE	924	0	0
15	12	Dec'19	2019	07:00	19.1	53.6	1.2	70	2.1	ENE	920	0	0
15	12	Dec'19	2019	08:00	19.3	52.3	0.8	30	1.3	NNE	921	0	0
15	12	Dec'19	2019	09:00	19.7	51.9	1.6	9	2.2	N	922	0	0
15	12	Dec'19	2019	10:00	19.9	50.3	1.9	66	2.2	ENE	923	0	0
15	12	Dec'19	2019	11:00	20.3	48.1	2.1	86	2.2	E	922	0	0
15	12	Dec'19	2019	12:00	20.6	47.1	1.9	4	2.5	N	923	0	0
15	12	Dec'19	2019	13:00	20.8	48.9	2.4	59	4.5	ENE	926	0	0
15	12	Dec'19	2019	14:00	21.2	46.8	2.8	65	2.3	ENE	926	0	0
15	12	Dec'19	2019	15:00	20.7	45.2	0.9	76	0.3	ENE	927	0	0
15	12	Dec'19	2019	16:00	20.4	47.6	0.8	66	1.2	ENE	928	0	0
15	12	Dec'19	2019	17:00	20.1	46.9	2.7	28	2.2	NNE	923	0	0
15	12	Dec'19	2019	18:00	19.8	49.8	3.5	46	2.2	NE	923	0	0
15	12	Dec'19	2019	19:00	19.6	54.3	0.5	36	1.5	NE	918	0	0
15	12	Dec'19	2019	20:00	19.4	53.6	0.8	69	1.5	ENE	912	0	0
15	12	Dec'19	2019	21:00	19.2	56.9	3.5	4	1.5	N	912	0	0
15	12	Dec'19	2019	22:00	18.9	58	2.5	55	1.5	NE	911	0	0
15	12	Dec'19	2019	23:00	18.7	58.9	3.5	76	0.5	ENE	913	0	0
16	12	Dec'19	2019	00:00	18.4	63.2	0.9	56	0.5	NE	912	0	0
16	12	Dec'19	2019	01:00	18.2	64.2	1.6	58	0.5	ENE	912	0	0
16	12	Dec'19	2019	02:00	17.9	64.5	1.2	66	1.5	ENE	914	0	0
16	12	Dec'19	2019	03:00	17.8	63.2	0.8	85	1.5	E	916	0	0
16	12	Dec'19	2019	04:00	17.6	59.6	1.6	36	1.1	NE	919	0	0
16	12	Dec'19	2019	05:00	18.1	58.3	1.9	4	2.3	N	924	0	0
16	12	Dec'19	2019	06:00	18.7	52.4	2.1	86	2.5	E	920	0	0
16	12	Dec'19	2019	07:00	18.8	53.6	1.9	50	2.2	NE	921	0	0
16	12	Dec'19	2019	08:00	18.9	52.3	2.4	70	1.2	ENE	922	0	0
16	12	Dec'19	2019	09:00	19.1	51.9	2.8	30	1.5	NNE	923	0	0
16	12	Dec'19	2019	10:00	19.2	50.3	0.9	9	1.5	N	922	0	0
16	12	Dec'19	2019	11:00	19.6	48.1	0.8	66	0.3	ENE	923	0	0
16	12	Dec'19	2019	12:00	19.7	47.1	2.7	86	2.2	E	926	0	0
16	12	Dec'19	2019	13:00	19.8	48.9	3.5	4	2.2	N	926	0	0
16	12	Dec'19	2019	14:00	19.9	46.8	0.5	59	3.2	ENE	927	0	0
16	12	Dec'19	2019	15:00	19.6	45.2	0.8	65	3.5	ENE	928	0	0
16	12	Dec'19	2019	16:00	19.5	47.6	3.5	76	3.5	ENE	923	0	0
16	12	Dec'19	2019	17:00	19.2	46.9	2.5	66	3.5	ENE	923	0	0
16	12	Dec'19	2019	18:00	19.1	49.8	3.5	28	3.5	NNE	918	0	0
16	12	Dec'19	2019	19:00	18.6	54.3	0.9	46	2.5	NE	924	0	0
16	12	Dec'19	2019	20:00	18.5	53.6	1.6	36	1.5	NE	916	0	0
16	12	Dec'19	2019	21:00	18.3	56.9	1.2	69	1.5	ENE	914	0	0
16	12	Dec'19	2019	22:00	18.2	58	0.8	4	1.5	N	913	0	0
16	12	Dec'19	2019	23:00	18.1	58.9	1.6	55	0.5	NE	914	0	0
17	12	Dec'19	2019	00:00	17.9	63.2	1.9	58	1.1	ENE	912	0	0
17	12	Dec'19	2019	01:00	17.6	64.2	2.1	66	3.3	ENE	915	0	0
17	12	Dec'19	2019	02:00	17.4	64.5	1.9	85	1.2	E	912	0	0

17	12	Dec'19	2019	03:00	17.3	63.2	2.4	36	2.2	NE	914	0	0
17	12	Dec'19	2019	04:00	17.8	59.6	2.8	4	2.2	N	916	0	0
17	12	Dec'19	2019	05:00	18.4	58.3	0.9	86	3.5	E	919	0	0
17	12	Dec'19	2019	06:00	18.6	52.4	0.8	50	3.5	NE	924	0	0
17	12	Dec'19	2019	07:00	18.9	53.6	2.7	70	2.3	ENE	920	0	0
17	12	Dec'19	2019	08:00	19.4	52.3	3.5	30	3.2	NNE	921	0	0
17	12	Dec'19	2019	09:00	19.6	51.9	0.5	9	3.2	N	922	0	0
17	12	Dec'19	2019	10:00	19.9	50.3	0.8	66	2.2	ENE	923	0	0
17	12	Dec'19	2019	11:00	20.4	48.1	3.5	86	2.5	E	922	0	0
17	12	Dec'19	2019	12:00	20.8	47.1	2.5	4	2.5	N	923	0	0
17	12	Dec'19	2019	13:00	21.3	48.9	3.5	59	2.5	ENE	926	0	0
17	12	Dec'19	2019	14:00	21.6	46.8	0.9	65	1.5	ENE	926	0	0
17	12	Dec'19	2019	15:00	21.5	45.2	1.6	76	4.5	ENE	927	0	0
17	12	Dec'19	2019	16:00	21.2	47.6	1.2	66	4.5	ENE	928	0	0
17	12	Dec'19	2019	17:00	21.1	46.9	0.8	28	2.5	NNE	923	0	0
17	12	Dec'19	2019	18:00	20.8	49.8	1.6	46	2.4	NE	923	0	0
17	12	Dec'19	2019	19:00	20.6	54.3	1.9	36	2.5	NE	918	0	0
17	12	Dec'19	2019	20:00	20.5	53.6	2.1	69	2	ENE	912	0	0
17	12	Dec'19	2019	21:00	20.2	56.9	1.9	4	3.3	N	912	0	0
17	12	Dec'19	2019	22:00	20.1	58	2.4	55	2.2	NE	911	0	0
17	12	Dec'19	2019	23:00	19.6	58.9	2.8	76	3.2	ENE	913	0	0
18	12	Dec'19	2019	00:00	19.4	63.2	0.9	56	2.2	NE	912	0	0
18	12	Dec'19	2019	01:00	19.2	64.2	0.8	58	2.5	ENE	912	0	0
18	12	Dec'19	2019	02:00	19.1	64.5	2.7	66	2.5	ENE	914	0	0
18	12	Dec'19	2019	03:00	19.5	63.2	3.5	85	1.3	E	916	0	0
18	12	Dec'19	2019	04:00	19.8	59.6	0.5	36	2.2	NE	919	0	0
18	12	Dec'19	2019	05:00	20.1	58.3	0.8	4	3.2	N	924	0	0
18	12	Dec'19	2019	06:00	20.4	52.4	3.5	86	3.2	E	920	0	0
18	12	Dec'19	2019	07:00	20.6	53.6	2.5	50	3.5	NE	921	0	0
18	12	Dec'19	2019	08:00	20.8	52.3	3.5	70	3.5	ENE	922	0	0
18	12	Dec'19	2019	09:00	21.1	51.9	0.9	30	3.5	NNE	923	0	0
18	12	Dec'19	2019	10:00	21.5	50.3	1.6	9	3.5	N	922	0	0
18	12	Dec'19	2019	11:00	21.7	48.1	1.2	66	2.5	ENE	923	0	0
18	12	Dec'19	2019	12:00	21.9	47.1	0.8	86	1.5	E	926	0	0
18	12	Dec'19	2019	13:00	22.4	48.9	1.6	4	1.5	N	926	0	0
18	12	Dec'19	2019	14:00	22.7	46.8	1.9	59	1.5	ENE	927	0	0
18	12	Dec'19	2019	15:00	22.5	45.2	2.1	65	1.5	ENE	928	0	0
18	12	Dec'19	2019	16:00	22.2	47.6	1.9	76	4.1	ENE	923	0	0
18	12	Dec'19	2019	17:00	21.8	46.9	2.4	66	1.6	ENE	923	0	0
18	12	Dec'19	2019	18:00	21.4	49.8	2.8	28	2.5	NNE	918	0	0
18	12	Dec'19	2019	19:00	21.1	54.3	0.9	46	3.2	NE	924	0	0
18	12	Dec'19	2019	20:00	20.6	53.6	0.8	36	4.2	NE	916	0	0
18	12	Dec'19	2019	21:00	20.4	56.9	2.7	69	3.5	ENE	914	0	0
18	12	Dec'19	2019	22:00	20.3	58	3.5	4	2.5	N	913	0	0
18	12	Dec'19	2019	23:00	20.1	58.9	0.5	55	1.3	NE	914	0	0
19	12	Dec'19	2019	00:00	19.9	63.2	0.8	58	3.2	ENE	912	0	0
19	12	Dec'19	2019	01:00	19.8	64.2	3.5	66	2.5	ENE	915	0	0
19	12	Dec'19	2019	02:00	19.6	64.5	2.5	85	2.5	E	912	0	0
19	12	Dec'19	2019	03:00	19.4	63.2	3.5	36	2.8	NE	914	0	0
19	12	Dec'19	2019	04:00	19.5	59.6	0.9	4	3.4	N	916	0	0
19	12	Dec'19	2019	05:00	19.7	58.3	1.6	86	3.4	E	919	0	0
19	12	Dec'19	2019	06:00	20.1	52.4	1.2	50	3.4	NE	924	0	0
19	12	Dec'19	2019	07:00	20.3	53.6	0.8	70	2.4	ENE	920	0	0
19	12	Dec'19	2019	08:00	20.5	52.3	1.6	30	2.4	NNE	921	0	0
19	12	Dec'19	2019	09:00	20.7	51.9	1.9	9	2.4	N	922	0	0
19	12	Dec'19	2019	10:00	20.9	50.3	2.1	66	1.8	ENE	923	0	0
19	12	Dec'19	2019	11:00	21.1	48.1	1.9	86	2.5	E	922	0	0
19	12	Dec'19	2019	12:00	21.3	47.1	2.4	4	2.1	N	923	0	0
19	12	Dec'19	2019	13:00	21.6	48.9	2.8	59	2.3	ENE	926	0	0
19	12	Dec'19	2019	14:00	21.9	46.8	0.9	65	3.2	ENE	926	0	0
19	12	Dec'19	2019	15:00	21.8	45.2	0.8	76	2.2	ENE	927	0	0
19	12	Dec'19	2019	16:00	21.5	47.6	2.7	66	2.5	ENE	928	0	0
19	12	Dec'19	2019	17:00	21.2	46.9	3.5	28	2.8	NNE	923	0	0
19	12	Dec'19	2019	18:00	20.8	49.8	0.5	46	2.8	NE	923	0	0
19	12	Dec'19	2019	19:00	20.6	54.3	0.8	36	1.6	NE	918	0	0
19	12	Dec'19	2019	20:00	20.4	53.6	3.5	69	2.5	ENE	912	0	0
19	12	Dec'19	2019	21:00	20.2	56.9	2.5	4	2.5	N	912	0	0
19	12	Dec'19	2019	22:00	19.6	58	3.5	55	3.2	NE	911	0	0
19	12	Dec'19	2019	23:00	19.5	58.9	0.9	76	3.5	ENE	913	0	0
20	12	Dec'19	2019	00:00	19.2	63.2	1.6	56	3.5	NE	912	0	0
20	12	Dec'19	2019	01:00	19.1	64.2	1.2	58	2.5	ENE	912	0	0
20	12	Dec'19	2019	02:00	19.2	64.5	0.8	66	2.5	ENE	914	0	0
20	12	Dec'19	2019	03:00	19.1	63.2	1.6	85	1.5	E	916	0	0
20	12	Dec'19	2019	04:00	19.3	59.6	1.9	36	1.5	NE	919	0	0
20	12	Dec'19	2019	05:00	19.5	58.3	2.1	4	2.5	N	924	0	0
20	12	Dec'19	2019	06:00	19.6	52.4	1.9	86	1.8	E	920	0	0
20	12	Dec'19	2019	07:00	19.9	53.6	2.4	50	2.5	NE	921	0	0

20	12	Dec'19	2019	08:00	20.1	52.3	2.8	70	1.1	ENE	922	0	0
20	12	Dec'19	2019	09:00	20.3	51.9	0.9	30	1.3	NNE	923	0	0
20	12	Dec'19	2019	10:00	20.6	50.3	0.8	9	1.2	N	922	0	0
20	12	Dec'19	2019	11:00	20.8	48.1	2.7	66	5.2	ENE	923	0	0
20	12	Dec'19	2019	12:00	21.2	47.1	3.5	86	1.2	E	926	0	0
20	12	Dec'19	2019	13:00	21.4	48.9	0.5	4	5.5	N	926	0	0
20	12	Dec'19	2019	14:00	21.3	46.8	0.8	59	2.5	ENE	927	0	0
20	12	Dec'19	2019	15:00	21.1	45.2	3.5	65	1.3	ENE	928	0	0
20	12	Dec'19	2019	16:00	20.8	47.6	2.5	76	2.2	ENE	923	0	0
20	12	Dec'19	2019	17:00	20.6	46.9	3.5	66	2.2	ENE	923	0	0
20	12	Dec'19	2019	18:00	20.5	49.8	0.9	28	2.2	NNE	918	0	0
20	12	Dec'19	2019	19:00	20.2	54.3	1.6	46	2.5	NE	924	0	0
20	12	Dec'19	2019	20:00	20.1	53.6	1.2	36	2.5	NE	916	0	0
20	12	Dec'19	2019	21:00	19.8	56.9	0.8	69	2.5	ENE	914	0	0
20	12	Dec'19	2019	22:00	19.6	58	1.6	4	4.5	N	913	0	0
20	12	Dec'19	2019	23:00	19.4	58.9	1.9	55	4.5	NE	914	0	0
21	12	Dec'19	2019	00:00	19.2	63.2	2.1	58	2.5	ENE	912	0	0
21	12	Dec'19	2019	01:00	19.1	64.2	1.9	66	0.5	ENE	915	0	0
21	12	Dec'19	2019	02:00	18.9	64.5	2.4	85	0.5	E	912	0	0
21	12	Dec'19	2019	03:00	18.8	63.2	2.8	36	0.5	NE	914	0	0
21	12	Dec'19	2019	04:00	18.7	59.6	0.9	4	0.1	N	916	0	0
21	12	Dec'19	2019	05:00	19.1	58.3	0.8	86	0.3	E	919	0	0
21	12	Dec'19	2019	06:00	19.2	52.4	2.7	50	2.2	NE	924	0	0
21	12	Dec'19	2019	07:00	19.6	53.6	3.5	70	1.2	ENE	920	0	0
21	12	Dec'19	2019	08:00	19.8	52.3	0.5	30	1.2	NNE	921	0	0
21	12	Dec'19	2019	09:00	20.2	51.9	0.8	9	1.5	N	922	0	0
21	12	Dec'19	2019	10:00	20.6	50.3	3.5	66	1.5	ENE	923	0	0
21	12	Dec'19	2019	11:00	20.8	48.1	2.5	86	2.3	E	922	0	0
21	12	Dec'19	2019	12:00	21.3	47.1	3.5	4	2.2	N	923	0	0
21	12	Dec'19	2019	13:00	21.5	48.9	0.9	59	2.2	ENE	926	0	0
21	12	Dec'19	2019	14:00	21.6	46.8	1.6	65	2.2	ENE	926	0	0
21	12	Dec'19	2019	15:00	21.2	45.2	1.2	76	3.5	ENE	927	0	0
21	12	Dec'19	2019	16:00	20.8	47.6	0.8	66	3.5	ENE	928	0	0
21	12	Dec'19	2019	17:00	20.6	46.9	1.6	28	3.5	NNE	923	0	0
21	12	Dec'19	2019	18:00	20.4	49.8	1.9	46	3.5	NE	923	0	0
21	12	Dec'19	2019	19:00	20.3	54.3	2.1	36	2.5	NE	918	0	0
21	12	Dec'19	2019	20:00	20.2	53.6	1.9	69	2.5	ENE	912	0	0
21	12	Dec'19	2019	21:00	19.9	56.9	2.4	4	2.5	N	912	0	0
21	12	Dec'19	2019	22:00	19.6	58	2.8	55	2.5	NE	911	0	0
21	12	Dec'19	2019	23:00	19.5	58.9	0.9	76	1.5	ENE	913	0	0
22	12	Dec'19	2019	00:00	19.4	63.2	0.8	56	1.1	NE	912	0	0
22	12	Dec'19	2019	01:00	19.3	64.2	2.7	58	1.3	ENE	912	0	0
22	12	Dec'19	2019	02:00	19.1	64.5	3.5	66	2.2	ENE	914	0	0
22	12	Dec'19	2019	03:00	18.6	63.2	0.5	85	1.2	E	916	0	0
22	12	Dec'19	2019	04:00	18.7	59.6	0.8	36	2.2	NE	919	0	0
22	12	Dec'19	2019	05:00	18.9	58.3	3.5	4	3.5	N	924	0	0
22	12	Dec'19	2019	06:00	19.4	52.4	2.5	86	3.4	E	920	0	0
22	12	Dec'19	2019	07:00	19.5	53.6	3.5	50	4.3	NE	921	0	0
22	12	Dec'19	2019	08:00	19.7	52.3	0.9	70	3.2	ENE	922	0	0
22	12	Dec'19	2019	09:00	20.1	51.9	1.6	30	3.2	NNE	923	0	0
22	12	Dec'19	2019	10:00	20.3	50.3	1.2	9	3.2	N	922	0	0
22	12	Dec'19	2019	11:00	20.5	48.1	0.8	66	2.5	ENE	923	0	0
22	12	Dec'19	2019	12:00	20.7	47.1	1.6	86	1.5	E	926	0	0
22	12	Dec'19	2019	13:00	20.9	48.9	1.9	4	2.5	N	926	0	0
22	12	Dec'19	2019	14:00	21.1	46.8	2.1	59	2.5	ENE	927	0	0
22	12	Dec'19	2019	15:00	20.8	45.2	1.9	65	1.5	ENE	928	0	0
22	12	Dec'19	2019	16:00	20.5	47.6	2.4	76	0.5	ENE	923	0	0
22	12	Dec'19	2019	17:00	20.2	46.9	2.8	66	1.5	ENE	923	0	0
22	12	Dec'19	2019	18:00	19.9	49.8	0.9	28	1.5	NNE	918	0	0
22	12	Dec'19	2019	19:00	19.4	54.3	0.8	46	1.5	NE	924	0	0
22	12	Dec'19	2019	20:00	19.2	53.6	2.7	36	2.1	NE	916	0	0
22	12	Dec'19	2019	21:00	19.1	56.9	3.5	69	4.3	ENE	914	0	0
22	12	Dec'19	2019	22:00	18.7	58	0.5	4	3.2	N	913	0	0
22	12	Dec'19	2019	23:00	18.6	58.9	0.8	55	1.2	NE	914	0	0
23	12	Dec'19	2019	00:00	18.3	63.2	3.5	58	1.2	ENE	912	0	0
23	12	Dec'19	2019	01:00	17.9	64.2	2.5	66	1.5	ENE	915	0	0
23	12	Dec'19	2019	02:00	17.8	64.5	3.5	85	2.5	E	912	0	0
23	12	Dec'19	2019	03:00	17.7	63.2	0.9	36	1.3	NE	914	0	0
23	12	Dec'19	2019	04:00	17.5	59.6	1.6	4	2.2	N	916	0	0
23	12	Dec'19	2019	05:00	17.6	58.3	1.2	86	2.2	E	919	0	0
23	12	Dec'19	2019	06:00	17.9	52.4	0.8	50	2.2	NE	924	0	0
23	12	Dec'19	2019	07:00	18.4	53.6	1.6	70	2.5	ENE	920	0	0
23	12	Dec'19	2019	08:00	18.6	52.3	1.9	30	2.5	NNE	921	0	0
23	12	Dec'19	2019	09:00	18.9	51.9	2.1	9	1.5	N	922	0	0
23	12	Dec'19	2019	10:00	19.4	50.3	1.9	66	1.5	ENE	923	0	0
23	12	Dec'19	2019	11:00	19.7	48.1	2.4	86	1.8	E	922	0	0
23	12	Dec'19	2019	12:00	19.8	47.1	2.8	4	2.5	N	923	0	0

23	12	Dec'19	2019	13:00	20.1	48.9	0.9	59	1.5	ENE	926	0	0
23	12	Dec'19	2019	14:00	20.3	46.8	0.8	65	1.5	ENE	926	0	0
23	12	Dec'19	2019	15:00	20.2	45.2	2.7	76	2.5	ENE	927	0	0
23	12	Dec'19	2019	16:00	19.9	47.6	3.5	66	2.1	ENE	928	0	0
23	12	Dec'19	2019	17:00	19.8	46.9	0.5	28	2.3	NNE	923	0	0
23	12	Dec'19	2019	18:00	19.6	49.8	0.8	46	3.2	NE	923	0	0
23	12	Dec'19	2019	19:00	19.4	54.3	3.5	36	3.2	NE	918	0	0
23	12	Dec'19	2019	20:00	19.2	53.6	2.5	69	3.2	ENE	912	0	0
23	12	Dec'19	2019	21:00	19.1	56.9	3.5	4	2.5	N	912	0	0
23	12	Dec'19	2019	22:00	18.9	58	0.9	55	2.5	NE	911	0	0
23	12	Dec'19	2019	23:00	18.8	58.9	1.6	76	1.3	ENE	913	0	0
24	12	Dec'19	2019	00:00	18.7	63.2	1.2	56	1.2	NE	912	0	0
24	12	Dec'19	2019	01:00	19.1	64.2	0.8	58	4.2	ENE	912	0	0
24	12	Dec'19	2019	02:00	19.2	64.5	1.6	66	2.2	ENE	914	0	0
24	12	Dec'19	2019	03:00	19.6	63.2	1.9	85	1.5	E	916	0	0
24	12	Dec'19	2019	04:00	19.8	59.6	2.1	36	1.5	NE	919	0	0
24	12	Dec'19	2019	05:00	19.9	58.3	1.9	4	1.5	N	924	0	0
24	12	Dec'19	2019	06:00	20.3	52.4	2.4	86	1.5	E	920	0	0
24	12	Dec'19	2019	07:00	20.6	53.6	2.8	50	0.5	NE	921	0	0
24	12	Dec'19	2019	08:00	20.7	52.3	0.9	70	0.5	ENE	922	0	0
24	12	Dec'19	2019	09:00	21.3	51.9	0.8	30	0.5	NNE	923	0	0
24	12	Dec'19	2019	10:00	21.6	50.3	2.7	9	0.5	N	922	0	0
24	12	Dec'19	2019	11:00	21.5	48.1	3.5	66	1.5	ENE	923	0	0
24	12	Dec'19	2019	12:00	21.2	47.1	0.5	86	4.1	E	926	0	0
24	12	Dec'19	2019	13:00	21.1	48.9	0.8	4	4.3	N	926	0	0
24	12	Dec'19	2019	14:00	20.8	46.8	3.5	59	5.2	ENE	927	0	0
24	12	Dec'19	2019	15:00	20.6	45.2	2.5	65	4.2	ENE	928	0	0
24	12	Dec'19	2019	16:00	20.5	47.6	3.5	76	1.2	ENE	923	0	0
24	12	Dec'19	2019	17:00	20.2	46.9	0.9	66	2.5	ENE	923	0	0
24	12	Dec'19	2019	18:00	20.1	49.8	1.6	28	1.5	NNE	918	0	0
24	12	Dec'19	2019	19:00	19.6	54.3	1.2	46	2.3	NE	924	0	0
24	12	Dec'19	2019	20:00	19.4	53.6	0.8	36	0.3	NE	916	0	0
24	12	Dec'19	2019	21:00	19.2	56.9	1.6	69	3.2	ENE	914	0	0
24	12	Dec'19	2019	22:00	19.1	58	1.9	4	5.2	N	913	0	0
24	12	Dec'19	2019	23:00	19.5	58.9	2.1	55	2.2	NE	914	0	0
25	12	Dec'19	2019	00:00	19.8	63.2	1.9	58	1.5	ENE	912	0	0
25	12	Dec'19	2019	01:00	20.1	64.2	2.4	66	1.5	ENE	915	0	0
25	12	Dec'19	2019	02:00	20.4	64.5	2.8	85	1.5	E	912	0	0
25	12	Dec'19	2019	03:00	20.6	63.2	0.9	36	2.5	NE	914	0	0
25	12	Dec'19	2019	04:00	20.8	59.6	0.8	4	1.5	N	916	0	0
25	12	Dec'19	2019	05:00	21.1	58.3	2.7	86	1.5	E	919	0	0
25	12	Dec'19	2019	06:00	21.5	52.4	3.5	50	1.5	NE	924	0	0
25	12	Dec'19	2019	07:00	21.7	53.6	0.5	70	1.5	ENE	920	0	0
25	12	Dec'19	2019	08:00	21.9	52.3	0.8	30	1.5	NNE	921	0	0
25	12	Dec'19	2019	09:00	22.4	51.9	3.5	9	1.1	N	922	0	0
25	12	Dec'19	2019	10:00	22.7	50.3	2.5	66	0.3	ENE	923	0	0
25	12	Dec'19	2019	11:00	22.5	48.1	3.5	86	2.2	E	922	0	0
25	12	Dec'19	2019	12:00	22.2	47.1	0.9	4	2.2	N	923	0	0
25	12	Dec'19	2019	13:00	21.8	48.9	1.6	59	2.2	ENE	926	0	0
25	12	Dec'19	2019	14:00	21.4	46.8	1.2	65	2.5	ENE	926	0	0
25	12	Dec'19	2019	15:00	21.1	45.2	0.8	76	3.5	ENE	927	0	0
25	12	Dec'19	2019	16:00	20.6	47.6	1.6	66	2.3	ENE	928	0	0
25	12	Dec'19	2019	17:00	20.4	46.9	1.9	28	3.2	NNE	923	0	0
25	12	Dec'19	2019	18:00	20.3	49.8	2.1	46	3.2	NE	923	0	0
25	12	Dec'19	2019	19:00	20.1	54.3	1.9	36	3.2	NE	918	0	0
25	12	Dec'19	2019	20:00	19.9	53.6	2.4	69	2.5	ENE	912	0	0
25	12	Dec'19	2019	21:00	19.8	56.9	2.8	4	2.5	N	912	0	0
25	12	Dec'19	2019	22:00	19.6	58	0.9	55	2.5	NE	911	0	0
25	12	Dec'19	2019	23:00	19.4	58.9	0.8	76	2.5	ENE	913	0	0
26	12	Dec'19	2019	00:00	19.5	63.2	2.7	56	1.5	NE	912	0	0
26	12	Dec'19	2019	01:00	19.7	64.2	3.5	58	2.5	ENE	912	0	0
26	12	Dec'19	2019	02:00	20.1	64.5	3.5	66	0.5	ENE	914	0	0
26	12	Dec'19	2019	03:00	20.3	63.2	0.5	85	0.5	E	916	0	0
26	12	Dec'19	2019	04:00	20.5	59.6	0.8	36	0.5	NE	919	0	0
26	12	Dec'19	2019	05:00	20.7	58.3	3.5	4	0.1	N	924	0	0
26	12	Dec'19	2019	06:00	20.9	52.4	2.5	86	0.3	E	920	0	0
26	12	Dec'19	2019	07:00	21.1	53.6	3.5	50	1.2	NE	921	0	0
26	12	Dec'19	2019	08:00	21.3	52.3	0.9	70	1.2	ENE	922	0	0
26	12	Dec'19	2019	09:00	21.6	51.9	1.6	30	1.2	NNE	923	0	0
26	12	Dec'19	2019	10:00	21.9	50.3	1.2	9	2.5	N	922	0	0
26	12	Dec'19	2019	11:00	21.8	48.1	0.8	66	2.8	ENE	923	0	0
26	12	Dec'19	2019	12:00	21.5	47.1	1.6	86	1.6	E	926	0	0
26	12	Dec'19	2019	13:00	21.2	48.9	1.9	4	1.2	N	926	0	0
26	12	Dec'19	2019	14:00	20.8	46.8	2.1	59	3.1	ENE	927	0	0
26	12	Dec'19	2019	15:00	20.6	45.2	1.9	65	3.1	ENE	928	0	0
26	12	Dec'19	2019	16:00	20.4	47.6	2.4	76	3.5	ENE	923	0	0
26	12	Dec'19	2019	17:00	20.2	46.9	2.8	66	1.5	ENE	923	0	0

26	12	Dec'19	2019	18:00	19.6	49.8	0.9	28	5.5	NNE	918	0	0
26	12	Dec'19	2019	19:00	19.5	54.3	0.8	46	3.4	NE	924	0	0
26	12	Dec'19	2019	20:00	19.2	53.6	2.7	36	1.8	NE	916	0	0
26	12	Dec'19	2019	21:00	19.1	56.9	3.5	69	2.5	ENE	914	0	0
26	12	Dec'19	2019	22:00	19.2	58	3.5	4	0.5	N	913	0	0
26	12	Dec'19	2019	23:00	19.1	58.9	0.5	55	1.5	NE	914	0	0
27	12	Dec'19	2019	00:00	19.3	63.2	0.8	58	1.5	ENE	912	0	0
27	12	Dec'19	2019	01:00	19.5	64.2	3.5	66	1.1	ENE	915	0	0
27	12	Dec'19	2019	02:00	19.6	64.5	2.5	85	1.3	E	912	0	0
27	12	Dec'19	2019	03:00	19.9	63.2	3.5	36	2.2	NE	914	0	0
27	12	Dec'19	2019	04:00	20.1	59.6	0.9	4	2.2	N	916	0	0
27	12	Dec'19	2019	05:00	20.3	58.3	1.6	86	3.2	E	919	0	0
27	12	Dec'19	2019	06:00	20.6	52.4	1.2	50	3.5	NE	924	0	0
27	12	Dec'19	2019	07:00	20.8	53.6	0.8	70	3.5	ENE	920	0	0
27	12	Dec'19	2019	08:00	21.2	52.3	1.6	30	1.3	NNE	921	0	0
27	12	Dec'19	2019	09:00	21.4	51.9	1.9	9	2.2	N	922	0	0
27	12	Dec'19	2019	10:00	21.3	50.3	2.1	66	1.2	ENE	923	0	0
27	12	Dec'19	2019	11:00	21.1	48.1	1.9	86	1.2	E	922	0	0
27	12	Dec'19	2019	12:00	20.8	47.1	2.4	4	2.8	N	923	0	0
27	12	Dec'19	2019	13:00	20.6	48.9	2.8	59	2.5	ENE	926	0	0
27	12	Dec'19	2019	14:00	20.5	46.8	0.9	65	3.5	ENE	926	0	0
27	12	Dec'19	2019	15:00	20.2	45.2	0.8	76	2.5	ENE	927	0	0
27	12	Dec'19	2019	16:00	20.1	47.6	2.7	66	1.5	ENE	928	0	0
27	12	Dec'19	2019	17:00	19.8	46.9	3.5	28	1.5	NNE	923	0	0
27	12	Dec'19	2019	18:00	19.6	49.8	3.5	46	1.5	NE	923	0	0
27	12	Dec'19	2019	19:00	19.4	54.3	0.5	36	1.5	NE	918	0	0
27	12	Dec'19	2019	20:00	19.2	53.6	0.8	69	1.5	ENE	912	0	0
27	12	Dec'19	2019	21:00	19.1	56.9	3.5	4	1.1	N	912	0	0
27	12	Dec'19	2019	22:00	18.9	58	2.5	55	1.3	NE	911	0	0
27	12	Dec'19	2019	23:00	18.8	58.9	3.5	76	2.2	ENE	913	0	0
28	12	Dec'19	2019	00:00	18.7	63.2	0.9	56	2.2	NE	912	0	0
28	12	Dec'19	2019	01:00	19.1	64.2	1.6	58	1.2	ENE	912	0	0
28	12	Dec'19	2019	02:00	19.2	64.5	1.2	66	2.5	ENE	914	0	0
28	12	Dec'19	2019	03:00	19.6	63.2	0.8	85	3.5	E	916	0	0
28	12	Dec'19	2019	04:00	19.8	59.6	1.6	36	1.6	NE	919	0	0
28	12	Dec'19	2019	05:00	20.2	58.3	1.9	4	2.5	N	924	0	0
28	12	Dec'19	2019	06:00	20.6	52.4	2.1	86	2.2	E	920	0	0
28	12	Dec'19	2019	07:00	20.8	53.6	1.9	50	2.5	NE	921	0	0
28	12	Dec'19	2019	08:00	21.3	52.3	2.4	70	3.4	ENE	922	0	0
28	12	Dec'19	2019	09:00	21.5	51.9	2.8	30	2.8	NNE	923	0	0
28	12	Dec'19	2019	10:00	21.6	50.3	0.9	9	2.8	N	922	0	0
28	12	Dec'19	2019	11:00	21.2	48.1	0.8	66	3.4	ENE	923	0	0
28	12	Dec'19	2019	12:00	20.8	47.1	2.7	86	3.5	E	926	0	0
28	12	Dec'19	2019	13:00	20.6	48.9	3.5	4	1.5	N	926	0	0
28	12	Dec'19	2019	14:00	20.4	46.8	3.5	59	0.5	ENE	927	0	0
28	12	Dec'19	2019	15:00	20.3	45.2	0.5	65	1.5	ENE	928	0	0
28	12	Dec'19	2019	16:00	20.1	47.6	0.8	76	1.5	ENE	923	0	0
28	12	Dec'19	2019	17:00	19.9	46.9	3.5	66	0.1	ENE	923	0	0
28	12	Dec'19	2019	18:00	19.4	49.8	2.5	28	1.3	NNE	918	0	0
28	12	Dec'19	2019	19:00	19.2	54.3	3.5	46	3.2	NE	924	0	0
28	12	Dec'19	2019	20:00	18.8	53.6	0.9	36	3.2	NE	916	0	0
28	12	Dec'19	2019	21:00	18.6	56.9	1.6	69	4.2	ENE	914	0	0
28	12	Dec'19	2019	22:00	18.1	58	1.2	4	1.5	N	913	0	0
28	12	Dec'19	2019	23:00	17.2	58.9	0.8	55	1.5	NE	914	0	0
29	12	Dec'19	2019	00:00	17.1	63.2	1.6	58	1.3	ENE	912	0	0
29	12	Dec'19	2019	01:00	16.2	64.2	1.9	66	2.2	ENE	915	0	0
29	12	Dec'19	2019	02:00	16.1	64.5	2.1	85	2.2	E	912	0	0
29	12	Dec'19	2019	03:00	15.2	63.2	1.9	36	3.2	NE	914	0	0
29	12	Dec'19	2019	04:00	15.1	59.6	2.4	4	3.5	N	916	0	0
29	12	Dec'19	2019	05:00	14.8	58.3	2.8	86	4.5	E	919	0	0
29	12	Dec'19	2019	06:00	14.6	52.4	0.9	50	4.5	NE	924	0	0
29	12	Dec'19	2019	07:00	14.7	53.6	0.8	70	4.5	ENE	920	0	0
29	12	Dec'19	2019	08:00	17.9	52.3	2.7	30	2.5	NNE	921	0	0
29	12	Dec'19	2019	09:00	15.2	51.9	3.5	9	2.5	N	922	0	0
29	12	Dec'19	2019	10:00	15.3	50.3	3.5	66	2.5	ENE	923	0	0
29	12	Dec'19	2019	11:00	15.6	48.1	0.5	86	1.5	E	922	0	0
29	12	Dec'19	2019	12:00	15.8	47.1	0.8	4	1.5	N	923	0	0
29	12	Dec'19	2019	13:00	16.4	48.9	3.5	59	0.1	ENE	926	0	0
29	12	Dec'19	2019	14:00	16.7	46.8	2.5	65	2.3	ENE	926	0	0
29	12	Dec'19	2019	15:00	16.9	45.2	3.5	76	5.2	ENE	927	0	0
29	12	Dec'19	2019	16:00	17.2	47.6	0.9	66	2.2	ENE	928	0	0
29	12	Dec'19	2019	17:00	17.1	46.9	1.6	28	2.2	NNE	923	0	0
29	12	Dec'19	2019	18:00	16.8	49.8	1.2	46	3.5	NE	923	0	0
29	12	Dec'19	2019	19:00	16.7	54.3	0.8	36	2.5	NE	918	0	0
29	12	Dec'19	2019	20:00	16.5	53.6	1.6	69	1.3	ENE	912	0	0
29	12	Dec'19	2019	21:00	16.4	56.9	1.9	4	2.2	N	912	0	0
29	12	Dec'19	2019	22:00	16.2	58	2.1	55	2.2	NE	911	0	0

29	12	Dec'19	2019	23:00	16.1	58.9	1.9	76	2.2	ENE	913	0	0
30	12	Dec'19	2019	00:00	15.8	63.2	2.4	56	5.5	NE	912	0	0
30	12	Dec'19	2019	01:00	15.6	64.2	2.8	58	3.5	ENE	912	0	0
30	12	Dec'19	2019	02:00	15.4	64.5	0.9	66	5.5	ENE	914	0	0
30	12	Dec'19	2019	03:00	15.2	63.2	0.8	4	1.5	N	916	0	0
30	12	Dec'19	2019	04:00	15.1	59.6	2.7	55	0.5	NE	919	0	0
30	12	Dec'19	2019	05:00	14.9	58.3	3.5	58	0.5	ENE	924	0	0
30	12	Dec'19	2019	06:00	15.2	52.4	3.5	66	0.5	ENE	920	0	0
30	12	Dec'19	2019	07:00	15.3	53.6	0.5	85	0.5	E	921	0	0
30	12	Dec'19	2019	08:00	15.8	52.3	0.8	36	0.5	NE	922	0	0
30	12	Dec'19	2019	09:00	15.9	51.9	3.5	4	0.1	N	923	0	0
30	12	Dec'19	2019	10:00	16.2	50.3	2.5	86	0.3	E	922	0	0
30	12	Dec'19	2019	11:00	16.3	48.1	3.5	50	1.2	NE	923	0	0
30	12	Dec'19	2019	12:00	16.4	47.1	0.9	70	3.2	ENE	926	0	3
30	12	Dec'19	2019	13:00	16.6	48.9	1.6	30	4.2	NNE	926	0	1
30	12	Dec'19	2019	14:00	16.9	46.8	1.2	9	1.5	N	927	1.6	3
30	12	Dec'19	2019	15:00	17.2	45.2	0.8	66	2.5	ENE	928	1.2	8
30	12	Dec'19	2019	16:00	17.3	47.6	1.6	86	1.3	E	923	1.2	7
30	12	Dec'19	2019	17:00	17.1	46.9	1.9	4	2.2	N	923	1	9
30	12	Dec'19	2019	18:00	16.8	49.8	2.1	59	2.2	ENE	918	1.3	5
30	12	Dec'19	2019	19:00	16.4	54.3	1.9	65	2.2	ENE	924	1.2	4
30	12	Dec'19	2019	20:00	16.2	53.6	2.4	76	2.5	ENE	916	0	7
30	12	Dec'19	2019	21:00	15.9	56.9	2.8	66	2.5	ENE	914	0	4
30	12	Dec'19	2019	22:00	15.8	58	0.9	28	2.5	NNE	913	0	0
30	12	Dec'19	2019	23:00	15.6	47.6	0.8	46	3.5	NE	914	0	0
30	12	Dec'19	2019	22:00	15.2	46.9	2.7	36	0.5	NE	914	0	0
30	12	Dec'19	2019	23:00	15.1	49.8	3.5	69	0.5	ENE	913	0	0
31	12	Dec'19	2019	00:00	14.9	58.3	3.5	4	1.5	N	912	0.12	0
31	12	Dec'19	2019	01:00	14.8	52.4	0.9	55	1.5	NE	912	0	0
31	12	Dec'19	2019	02:00	14.7	53.6	1.6	76	1.5	ENE	914	0	0
31	12	Dec'19	2019	03:00	14.6	52.3	1.2	56	2.1	NE	916	0	0
31	12	Dec'19	2019	04:00	14.3	51.9	0.8	70	2.3	ENE	919	0	0
31	12	Dec'19	2019	05:00	14.2	50.3	1.6	30	2.2	NNE	924	0.12	0
31	12	Dec'19	2019	06:00	14.4	48.1	1.9	9	2.2	N	920	0	0
31	12	Dec'19	2019	07:00	14.7	47.1	2.1	66	2.2	ENE	921	0	0
31	12	Dec'19	2019	08:00	14.9	48.9	1.9	86	1.5	E	922	0	0
31	12	Dec'19	2019	09:00	15.2	46.8	2.4	4	1.5	N	923	0	0
31	12	Dec'19	2019	10:00	15.6	45.2	2.8	59	0.3	ENE	922	0	0
31	12	Dec'19	2019	11:00	15.9	47.6	0.9	65	2.5	ENE	923	0	0
31	12	Dec'19	2019	12:00	16.2	46.9	0.8	76	3.2	ENE	926	0.13	0
31	12	Dec'19	2019	13:00	16.4	49.8	2.7	66	2.2	ENE	926	0	0
31	12	Dec'19	2019	14:00	16.6	54.3	3.5	28	2.5	NNE	927	0	0
31	12	Dec'19	2019	15:00	16.9	53.6	0.5	46	2.5	NE	928	0	0
31	12	Dec'19	2019	16:00	17.1	56.9	0.8	36	2.5	NE	923	0	0
31	12	Dec'19	2019	17:00	16.8	58	3.5	69	2.5	ENE	923	0	0
31	12	Dec'19	2019	18:00	16.5	58.9	2.5	4	1.5	N	918	0	0
31	12	Dec'19	2019	19:00	16.2	63.2	3.5	55	1.5	NE	924	0.13	0
31	12	Dec'19	2019	20:00	15.8	64.2	0.9	76	1.5	ENE	916	0	0
31	12	Dec'19	2019	21:00	15.6	50.3	1.6	66	1.5	ENE	914	0	0
31	12	Dec'19	2019	22:00	15.4	48.1	1.2	85	3.5	E	913	0	0
31	12	Dec'19	2019	23:00	15.3	47.1	0.8	36	1.1	NE	914	0	0
1	1	Jan'20	2020	00:00	15.1	53.6	0.8	69	0.3	ENE	912	0	0
1	1	Jan'20	2020	01:00	14.9	56.9	2.7	4	1.2	N	915	0.1	0
1	1	Jan'20	2020	02:00	14.8	58	3.5	55	1.2	NE	912	0	0
1	1	Jan'20	2020	03:00	14.6	58.9	4.5	76	2.2	ENE	914	0	0
1	1	Jan'20	2020	04:00	14.5	63.2	1.8	56	2.5	NE	916	0	0
1	1	Jan'20	2020	05:00	14.3	58.3	0.8	86	2.5	E	919	0	0
1	1	Jan'20	2020	06:00	14.2	52.4	3.5	50	1.3	NE	924	0.11	0
1	1	Jan'20	2020	07:00	14.8	53.6	2.5	70	2.2	ENE	920	0	0
1	1	Jan'20	2020	08:00	15.2	52.3	3.5	30	2.2	NNE	921	0	0
1	1	Jan'20	2020	09:00	15.3	51.9	0.9	9	2.2	N	922	0	0
1	1	Jan'20	2020	10:00	15.6	50.3	1.6	66	2.5	ENE	923	0	0
1	1	Jan'20	2020	11:00	15.7	48.1	1.2	86	2.5	E	922	0	0
1	1	Jan'20	2020	12:00	15.9	47.1	0.8	4	2.5	N	923	0	0
1	1	Jan'20	2020	13:00	16.1	48.9	1.6	59	1.5	ENE	926	0.12	0
1	1	Jan'20	2020	14:00	16.4	46.8	1.9	65	0.5	ENE	926	0	0
1	1	Jan'20	2020	15:00	16.6	45.2	2.1	76	0.5	ENE	927	0	0
1	1	Jan'20	2020	16:00	16.8	47.6	1.9	66	0.5	ENE	928	0	0
1	1	Jan'20	2020	17:00	16.9	46.9	2.4	28	0.5	NNE	923	0	0
1	1	Jan'20	2020	18:00	16.7	49.8	2.8	46	1.5	NE	923	0.11	0
1	1	Jan'20	2020	19:00	16.3	54.3	0.9	36	1.1	NE	918	0	0
1	1	Jan'20	2020	20:00	16.1	53.6	0.8	69	1.3	ENE	912	0	0
1	1	Jan'20	2020	21:00	15.9	56.9	2.7	4	3.2	N	912	0	0
1	1	Jan'20	2020	22:00	15.7	58	3.5	55	3.2	NE	911	0	0
1	1	Jan'20	2020	23:00	15.6	58.9	4.5	76	3.2	ENE	913	0	0
2	1	Jan'20	2020	00:00	15.2	63.2	1.8	56	4.5	NE	912	0	0
2	1	Jan'20	2020	01:00	15.1	64.2	1.8	58	4.5	ENE	912	0	0

2	1	Jan'20	2020	02:00	14.9	64.5	0.6	66	3.3	ENE	914	0	0
2	1	Jan'20	2020	03:00	14.8	63.2	0.8	85	5.2	E	916	0	0
2	1	Jan'20	2020	04:00	14.5	59.6	0.9	36	5.2	NE	919	0	0
2	1	Jan'20	2020	05:00	14.3	58.3	0.4	4	5.2	N	924	0	0
2	1	Jan'20	2020	06:00	14.2	52.4	0.5	86	4.5	E	920	0	0
2	1	Jan'20	2020	07:00	14.7	53.6	0.8	50	4.5	NE	921	0	0
2	1	Jan'20	2020	08:00	17.9	52.3	3.5	70	4.5	ENE	922	0	0
2	1	Jan'20	2020	09:00	15.2	51.9	2.5	30	3.5	NNE	923	0	0
2	1	Jan'20	2020	10:00	15.3	50.3	3.5	9	1.5	N	922	0	0
2	1	Jan'20	2020	11:00	15.6	48.1	0.9	66	1.5	ENE	923	0	0
2	1	Jan'20	2020	12:00	15.8	47.1	1.6	86	0.5	E	926	0	0
2	1	Jan'20	2020	13:00	16.4	48.9	1.2	4	0.5	N	926	0	0
2	1	Jan'20	2020	14:00	16.7	46.8	0.8	59	0.5	ENE	927	0	0
2	1	Jan'20	2020	15:00	16.9	45.2	1.6	65	2	ENE	928	0	0
2	1	Jan'20	2020	16:00	17.2	47.6	1.9	76	1.3	ENE	923	0	0
2	1	Jan'20	2020	17:00	17.1	46.9	2.1	66	1.2	ENE	923	0	0
2	1	Jan'20	2020	18:00	16.8	49.8	1.9	28	1.2	NNE	918	0	0
2	1	Jan'20	2020	19:00	16.7	54.3	2.4	46	1.2	NE	924	0	0
2	1	Jan'20	2020	20:00	16.5	53.6	2.8	36	1.5	NE	916	0	0
2	1	Jan'20	2020	21:00	16.4	56.9	0.9	69	1.5	ENE	914	0	0
2	1	Jan'20	2020	22:00	16.2	58	0.8	4	1.3	N	913	0	0
2	1	Jan'20	2020	23:00	16.1	58.9	2.7	55	1.3	NE	914	0	0
3	1	Jan'20	2020	00:00	15.8	63.2	3.5	58	3.2	ENE	912	0	0
3	1	Jan'20	2020	01:00	15.6	64.2	4.5	66	3.2	ENE	915	0	0
3	1	Jan'20	2020	02:00	15.4	64.5	1.8	85	3.2	E	912	0	0
3	1	Jan'20	2020	03:00	15.2	63.2	0.5	36	3.5	NE	914	0	0
3	1	Jan'20	2020	04:00	15.1	59.6	0.8	4	0	N	916	0	0
3	1	Jan'20	2020	05:00	14.9	58.3	3.5	86	0	E	919	0	0
3	1	Jan'20	2020	06:00	15.2	52.4	2.5	50	3.5	NE	924	0	0
3	1	Jan'20	2020	07:00	15.3	53.6	3.5	70	2.5	ENE	920	0	0
3	1	Jan'20	2020	08:00	15.8	52.3	0.9	30	2.5	NNE	921	0	0
3	1	Jan'20	2020	09:00	15.9	51.9	1.6	9	2.5	N	922	0	0
3	1	Jan'20	2020	10:00	16.2	50.3	1.2	66	1.5	ENE	923	0	0
3	1	Jan'20	2020	11:00	16.3	48.1	0.8	86	1.5	E	922	0	0
3	1	Jan'20	2020	12:00	16.4	47.1	1.6	4	1.1	N	923	0	0
3	1	Jan'20	2020	13:00	16.6	48.9	1.9	59	1.3	ENE	926	0	0
3	1	Jan'20	2020	14:00	16.9	46.8	2.1	65	1.2	ENE	926	0	0
3	1	Jan'20	2020	15:00	17.2	45.2	1.9	76	1.2	ENE	927	0	0
3	1	Jan'20	2020	16:00	17.3	47.6	2.4	66	1.2	ENE	928	0.14	0
3	1	Jan'20	2020	17:00	17.1	46.9	2.8	28	1.5	NNE	923	0	0
3	1	Jan'20	2020	18:00	16.8	49.8	0.9	46	1.5	NE	923	0	0
3	1	Jan'20	2020	19:00	16.4	54.3	0.8	36	0.3	NE	918	0	0
3	1	Jan'20	2020	20:00	16.2	53.6	2.7	69	2.2	ENE	912	0	0
3	1	Jan'20	2020	21:00	15.9	56.9	3.5	4	2.2	N	912	0	0
3	1	Jan'20	2020	22:00	15.8	58	0.5	55	2.2	NE	911	0	0
3	1	Jan'20	2020	23:00	15.6	58.9	0.8	76	3.5	ENE	913	0	0
4	1	Jan'20	2020	00:00	15.2	63.2	3.5	58	3.5	ENE	912	0	0
4	1	Jan'20	2020	01:00	15.1	64.2	4.5	66	3.5	ENE	912	0	0
4	1	Jan'20	2020	02:00	14.9	64.5	1.8	85	3.5	E	914	0	0
4	1	Jan'20	2020	03:00	14.8	63.2	0.5	36	3.5	NE	916	0	0
4	1	Jan'20	2020	04:00	14.7	59.6	0.8	4	3.5	N	919	0	0
4	1	Jan'20	2020	05:00	14.6	58.3	3.5	86	3.5	E	924	0	0
4	1	Jan'20	2020	06:00	14.3	52.4	2.5	50	2.5	NE	920	0	0
4	1	Jan'20	2020	07:00	14.2	53.6	3.5	70	2.5	ENE	921	0	0
4	1	Jan'20	2020	08:00	14.4	52.3	0.9	30	1.1	NNE	922	0	0
4	1	Jan'20	2020	09:00	14.7	51.9	1.6	9	1.3	N	923	0	0
4	1	Jan'20	2020	10:00	14.9	50.3	1.2	66	1.2	ENE	922	0	0
4	1	Jan'20	2020	11:00	15.2	48.1	0.8	86	3.2	E	923	0	0
4	1	Jan'20	2020	12:00	15.6	47.1	1.6	4	3.2	N	926	0	0
4	1	Jan'20	2020	13:00	15.9	48.9	1.9	59	2.5	ENE	926	0	0
4	1	Jan'20	2020	14:00	16.2	46.8	2.1	65	2.5	ENE	927	0	0
4	1	Jan'20	2020	15:00	16.4	45.2	1.9	76	1.3	ENE	928	0	0
4	1	Jan'20	2020	16:00	16.6	47.6	2.4	66	2.2	ENE	923	0	0
4	1	Jan'20	2020	17:00	16.9	46.9	2.8	28	2.2	NNE	923	0	0
4	1	Jan'20	2020	18:00	17.1	49.8	0.9	46	2.2	NE	918	0	0
4	1	Jan'20	2020	19:00	16.8	54.3	0.8	36	2.5	NE	924	0	0
4	1	Jan'20	2020	20:00	16.5	53.6	2.7	69	2.5	ENE	916	0	0
4	1	Jan'20	2020	21:00	16.2	56.9	3.5	4	2.5	N	914	0	0
4	1	Jan'20	2020	22:00	15.8	58	0.5	55	2.5	NE	913	0	0
4	1	Jan'20	2020	23:00	15.6	58.9	0.8	76	4.5	ENE	914	0	0
5	1	Jan'20	2020	00:00	15.4	53.6	0.8	69	0.5	ENE	912	0	0
5	1	Jan'20	2020	01:00	15.3	56.9	2.7	4	0.5	N	915	0	0
5	1	Jan'20	2020	02:00	15.2	58	3.5	55	0.5	NE	912	0	0
5	1	Jan'20	2020	03:00	15.1	58.9	4.5	76	0.5	ENE	914	0	0
5	1	Jan'20	2020	04:00	14.9	63.2	1.8	56	1.1	NE	916	0	0
5	1	Jan'20	2020	05:00	14.8	58.3	0.8	86	1.3	E	919	0	0
5	1	Jan'20	2020	06:00	14.7	52.4	3.5	50	1.2	NE	924	0	0

5	1	Jan'20	2020	07:00	14.6	53.6	2.5	70	1.2	ENE	920	0	0
5	1	Jan'20	2020	08:00	15.1	52.3	3.5	30	1.2	NNE	921	0	0
5	1	Jan'20	2020	09:00	15.2	51.9	0.9	9	1.5	N	922	0	0
5	1	Jan'20	2020	10:00	15.4	50.3	1.6	66	1.5	ENE	923	0.12	0
5	1	Jan'20	2020	11:00	15.6	48.1	1.2	86	2.3	E	922	0	0
5	1	Jan'20	2020	12:00	15.7	47.1	0.8	4	5.2	N	923	0.11	0
5	1	Jan'20	2020	13:00	15.8	48.9	1.6	59	3.1	ENE	926	0	0
5	1	Jan'20	2020	14:00	16.1	46.8	1.9	65	2.2	ENE	926	0	0
5	1	Jan'20	2020	15:00	16.3	45.2	2.1	76	2.5	ENE	927	0	0
5	1	Jan'20	2020	16:00	16.5	47.6	1.9	66	2.5	ENE	928	0	0
5	1	Jan'20	2020	17:00	16.8	46.9	2.4	28	2.5	NNE	923	0	0
5	1	Jan'20	2020	18:00	16.9	49.8	2.8	46	2.5	NE	923	0.11	0
5	1	Jan'20	2020	19:00	16.4	54.3	0.9	36	0.5	NE	918	0	0
5	1	Jan'20	2020	20:00	16.1	53.6	0.8	69	2.5	ENE	912	0	0
5	1	Jan'20	2020	21:00	15.9	56.9	2.7	4	2.5	N	912	0	0
5	1	Jan'20	2020	22:00	15.7	58	3.5	55	1.5	NE	911	0	0
5	1	Jan'20	2020	23:00	15.6	58.9	4.5	76	0.5	ENE	913	0	0
6	1	Jan'20	2020	00:00	15.1	63.2	1.8	56	0.1	NE	912	0	0
6	1	Jan'20	2020	01:00	14.9	64.2	1.8	58	0.3	ENE	912	0	0
6	1	Jan'20	2020	02:00	14.8	64.5	0.6	66	1.2	ENE	914	0	0
6	1	Jan'20	2020	03:00	14.6	63.2	0.8	85	2.2	E	916	0	0
6	1	Jan'20	2020	04:00	14.2	59.6	0.9	36	2.2	NE	919	0	0
6	1	Jan'20	2020	05:00	13.9	58.3	0.4	4	1.5	N	924	0	0
6	1	Jan'20	2020	06:00	13.9	52.4	0.5		1.5	NNW	920	0	0
6	1	Jan'20	2020	07:00	14.2	53.6	0.8	50	0.3	NE	921	0	0
6	1	Jan'20	2020	08:00	14.5	52.3	3.5	70	2.2	ENE	922	0	0
6	1	Jan'20	2020	09:00	14.7	51.9	2.5	30	4.2	NNE	923	0	0
6	1	Jan'20	2020	10:00	14.8	50.3	3.5	9	2.2	N	922	0	0
6	1	Jan'20	2020	11:00	15.2	48.1	0.9	66	2.5	ENE	923	0	0
6	1	Jan'20	2020	12:00	15.7	47.1	1.6	86	3.5	E	926	0	0
6	1	Jan'20	2020	13:00	15.8	48.9	1.2	4	3.5	N	926	0	0
6	1	Jan'20	2020	14:00	16.1	46.8	0.8	59	2.8	ENE	927	0	0
6	1	Jan'20	2020	15:00	16.5	45.2	1.6	65	1.8	ENE	928	0	0
6	1	Jan'20	2020	16:00	16.7	47.6	1.9	76	1.8	ENE	923	0	0
6	1	Jan'20	2020	17:00	16.4	46.9	2.1	66	1.8	ENE	923	0	0
6	1	Jan'20	2020	18:00	16.2	49.8	1.9	28	1.8	NNE	918	0	0
6	1	Jan'20	2020	19:00	15.9	54.3	2.4	46	1.8	NE	924	0	0
6	1	Jan'20	2020	20:00	15.7	53.6	2.8	36	1.4	NE	916	0	0
6	1	Jan'20	2020	21:00	15.7	56.9	0.9	69	1.6	ENE	914	0	0
6	1	Jan'20	2020	22:00	15.6	58	0.8	4	3.2	N	913	0	0
6	1	Jan'20	2020	23:00	15.2	58.9	2.7	55	3.2	NE	914	0	0
7	1	Jan'20	2020	00:00	15.1	63.2	3.5	58	3.2	ENE	912	0	0
7	1	Jan'20	2020	01:00	14.9	64.2	4.5	66	2.5	ENE	915	0	0
7	1	Jan'20	2020	02:00	14.8	64.5	1.8	85	2.5	E	912	0	0
7	1	Jan'20	2020	03:00	14.5	63.2	0.5	36	1.3	NE	914	0	0
7	1	Jan'20	2020	04:00	14.3	59.6	0.8	4	2.2	N	916	0	0
7	1	Jan'20	2020	05:00	14.2	58.3	3.5	86	2.2	E	919	0	0
7	1	Jan'20	2020	06:00	14.7	52.4	2.5	50	2.2	NE	924	0	0
7	1	Jan'20	2020	07:00	17.9	53.6	3.5	70	2.5	ENE	920	0	0
7	1	Jan'20	2020	08:00	15.2	52.3	0.9	30	2.5	NNE	921	0	0
7	1	Jan'20	2020	09:00	15.3	51.9	1.6	9	2.5	N	922	0	0
7	1	Jan'20	2020	10:00	15.6	50.3	1.2	66	2.5	ENE	923	0	0
7	1	Jan'20	2020	11:00	15.8	48.1	0.8	86	1.5	E	922	0	0
7	1	Jan'20	2020	12:00	16.4	47.1	1.6	4	2.5	N	923	0	0
7	1	Jan'20	2020	13:00	16.7	48.9	1.9	59	2.5	ENE	926	0	0
7	1	Jan'20	2020	14:00	16.9	46.8	2.1	65	2.5	ENE	926	0	0
7	1	Jan'20	2020	15:00	17.2	45.2	1.9	76	2.5	ENE	927	0	0
7	1	Jan'20	2020	16:00	17.1	47.6	2.4	66	1.4	ENE	928	0	0
7	1	Jan'20	2020	17:00	16.8	46.9	2.8	28	1.6	NNE	923	0	0
7	1	Jan'20	2020	18:00	16.7	49.8	0.9	46	3.2	NE	923	0	0
7	1	Jan'20	2020	19:00	16.5	54.3	0.8	36	3.2	NE	918	0	0
7	1	Jan'20	2020	20:00	16.4	53.6	2.7	69	3.2	ENE	912	0	0
7	1	Jan'20	2020	21:00	16.2	56.9	3.5	4	2.5	N	912	0	0
7	1	Jan'20	2020	22:00	16.1	58	0.5	55	2.5	NE	911	0	0
7	1	Jan'20	2020	23:00	15.8	58.9	0.8	76	1.3	ENE	913	0	0
8	1	Jan'20	2020	00:00	15.6	53.6	0.8	69	5.2	ENE	912	0	0
8	1	Jan'20	2020	01:00	15.4	56.9	3.5	4	1.2	N	912	0	0
8	1	Jan'20	2020	02:00	15.2	58	2.5	55	2.2	NE	914	0	0
8	1	Jan'20	2020	03:00	15.1	58.9	3.5	76	3.4	ENE	916	0	0
8	1	Jan'20	2020	04:00	14.9	63.2	0.9	56	3.4	NE	919	0	0
8	1	Jan'20	2020	05:00	15.2	58.3	1.6	86	4.5	E	924	0	0
8	1	Jan'20	2020	06:00	15.3	52.4	1.2	50	1.5	NE	920	0	0
8	1	Jan'20	2020	07:00	15.8	53.6	0.8	70	1.5	ENE	921	0	0
8	1	Jan'20	2020	08:00	15.9	52.3	1.6	30	1.5	NNE	922	0	0
8	1	Jan'20	2020	09:00	16.2	51.9	1.9	9	1.5	N	923	0	0
8	1	Jan'20	2020	10:00	16.3	50.3	2.1	66	2.5	ENE	922	0	0
8	1	Jan'20	2020	11:00	16.4	48.1	1.9	86	1.8	E	923	0	0

8	1	Jan'20	2020	12:00	16.6	47.1	2.4	4	1.4	N	926	0	0
8	1	Jan'20	2020	13:00	16.9	48.9	2.8	59	1.6	ENE	926	0	0
8	1	Jan'20	2020	14:00	17.2	46.8	0.9	65	3.1	ENE	927	0	0
8	1	Jan'20	2020	15:00	17.3	45.2	2.8	76	3.1	ENE	928	0	0
8	1	Jan'20	2020	16:00	17.1	47.6	0.9	66	3.1	ENE	923	0	0
8	1	Jan'20	2020	17:00	16.8	46.9	0.8	28	3.4	NNE	923	0	0
8	1	Jan'20	2020	18:00	16.4	49.8	2.7	46	3.4	NE	918	0	0
8	1	Jan'20	2020	19:00	16.2	54.3	3.5	36	1.6	NE	924	0	0
8	1	Jan'20	2020	20:00	15.9	53.6	0.5	69	2.5	ENE	916	0	0
8	1	Jan'20	2020	21:00	15.8	56.9	0.8	4	2.5	N	914	0	0
8	1	Jan'20	2020	22:00	15.6	58	0.8	55	3.2	NE	913	0	0
8	1	Jan'20	2020	23:00	15.2	58.9	3.5	76	3.5	ENE	914	0	0
9	1	Jan'20	2020	00:00	15.1	53.6	2.5	69	2.5	ENE	912	0	0
9	1	Jan'20	2020	01:00	14.9	56.9	3.5	4	2.5	N	915	0	0
9	1	Jan'20	2020	02:00	14.8	58	0.9	55	2.5	NE	912	0	0
9	1	Jan'20	2020	03:00	14.7	58.9	1.6	76	1.5	ENE	914	0	0
9	1	Jan'20	2020	04:00	14.6	63.2	1.2	56	1.5	NE	916	0	0
9	1	Jan'20	2020	05:00	14.3	58.3	0.8	86	1.5	E	919	0	0
9	1	Jan'20	2020	06:00	14.2	52.4	1.6	50	1.5	NE	924	0	0
9	1	Jan'20	2020	07:00	14.4	53.6	1.9	70	1.5	ENE	920	0	0
9	1	Jan'20	2020	08:00	14.7	52.3	2.1	30	1.1	NNE	921	0	0
9	1	Jan'20	2020	09:00	14.9	51.9	0.8	9	1.3	N	922	0	0
9	1	Jan'20	2020	10:00	15.2	50.3	0.9	66	2.2	ENE	923	0	0
9	1	Jan'20	2020	11:00	15.6	48.1	0.4	86	2.2	E	922	0	0
9	1	Jan'20	2020	12:00	15.9	47.1	0.5	4	2.2	N	923	0	0
9	1	Jan'20	2020	13:00	16.2	48.9	0.8	59	2.5	ENE	926	0	0
9	1	Jan'20	2020	14:00	16.4	46.8	3.5	65	2.5	ENE	926	0	0
9	1	Jan'20	2020	15:00	16.6	45.2	2.5	76	1.3	ENE	927	0	0
9	1	Jan'20	2020	16:00	16.9	47.6	3.5	66	2.2	ENE	928	0	0
9	1	Jan'20	2020	17:00	17.1	46.9	0.9	28	2.2	NNE	923	0	0
9	1	Jan'20	2020	18:00	16.8	49.8	1.6	36	2.2	NE	923	0	0
9	1	Jan'20	2020	19:00	16.5	54.3	1.2	69	2.5	ENE	918	0	0
9	1	Jan'20	2020	20:00	16.2	53.6	0.8	4	5.5	N	912	0	0
9	1	Jan'20	2020	21:00	15.8	56.9	1.6	55	1.5	NE	912	0	0
9	1	Jan'20	2020	22:00	15.6	58	1.9	76	1.5	ENE	911	0	0
9	1	Jan'20	2020	23:00	15.4	58.9	2.1	76	0.5	ENE	913	0	0
10	1	Jan'20	2020	00:00	15.3	53.6	0.8	75	1.5	ENE	912	0	0
10	1	Jan'20	2020	01:00	15.2	56.9	0.9	56	1.5	NE	912	0	0
10	1	Jan'20	2020	02:00	15.1	58	0.4	86	1.5	E	914	0	0
10	1	Jan'20	2020	03:00	14.9	58.9	0.5	50	1.5	NE	916	0	0
10	1	Jan'20	2020	04:00	14.8	63.2	0.8	70	2.1	ENE	919	0	0
10	1	Jan'20	2020	05:00	14.7	58.3	3.5	30	2.3	NNE	924	0	0
10	1	Jan'20	2020	06:00	14.6	52.4	2.5	9	2.2	N	920	0	0
10	1	Jan'20	2020	07:00	15.1	53.6	3.5	66	2.2	ENE	921	0	0
10	1	Jan'20	2020	08:00	15.3	52.3	0.9	86	2.2	E	922	0	0
10	1	Jan'20	2020	09:00	15.6	51.9	1.6	4	1.5	N	923	0	0
10	1	Jan'20	2020	10:00	15.9	50.3	1.2	59	1.5	ENE	922	0	0
10	1	Jan'20	2020	11:00	16.2	48.1	0.8	65	1.6	ENE	923	0	0
10	1	Jan'20	2020	12:00	16.5	47.1	1.6	76	2.2	ENE	926	0	0
10	1	Jan'20	2020	13:00	16.7	48.9	1.9	66	2.2	ENE	926	0	0
10	1	Jan'20	2020	14:00	17.1	46.8	2.1	28	2.2	NNE	927	0	0
10	1	Jan'20	2020	15:00	17.3	45.2	0.8	46	2.5	NE	928	0	0
10	1	Jan'20	2020	16:00	17.6	47.6	0.9	4	2.5	N	923	0	0
10	1	Jan'20	2020	17:00	17.2	46.9	0.4	55	2.5	NE	923	0	0
10	1	Jan'20	2020	18:00	17.1	49.8	0.5	76	2.5	ENE	918	0	0
10	1	Jan'20	2020	19:00	16.8	54.3	0.8	76	1.5	ENE	924	0	0
10	1	Jan'20	2020	20:00	16.5	53.6	3.5	56	1.5	NE	916	0	0
10	1	Jan'20	2020	21:00	16.2	56.9	2.5	86	0.5	E	914	0	0
10	1	Jan'20	2020	22:00	16.1	58	3.5	50	3.5	NE	913	0	0
10	1	Jan'20	2020	23:00	15.9	58.9	0.9	36	0.5	NE	914	0	0
11	1	Jan'20	2020	00:00	15.7	53.6	1.6	69	0.1	ENE	912	0	0
11	1	Jan'20	2020	01:00	15.6	56.9	1.2	4	0.3	N	915	0	0
11	1	Jan'20	2020	02:00	15.4	58	0.8	55	2.2	NE	912	0	0
11	1	Jan'20	2020	03:00	15.2	58.9	1.6	76	2.2	ENE	914	0	0
11	1	Jan'20	2020	04:00	14.9	63.2	1.9	56	2.2	NE	916	0	0
11	1	Jan'20	2020	05:00	14.8	58.3	2.1	58	2.5	ENE	919	0	0
11	1	Jan'20	2020	06:00	14.7	52.4	0.8	66	2.5	ENE	924	0	0
11	1	Jan'20	2020	07:00	15.1	53.6	0.9	85	1.3	E	920	0	0
11	1	Jan'20	2020	08:00	15.2	52.3	0.4	36	2.2	NE	921	0	0
11	1	Jan'20	2020	09:00	15.6	51.9	0.5	4	2.2	N	922	0	0
11	1	Jan'20	2020	10:00	15.8	50.3	0.8	86	2.2	E	923	0	0
11	1	Jan'20	2020	11:00	15.9	48.1	3.5	66	2.5	ENE	922	0	0
11	1	Jan'20	2020	12:00	16.3	47.1	2.5	28	2.5	NNE	923	0	0
11	1	Jan'20	2020	13:00	16.5	48.9	3.5	46	1.5	NE	926	0	0
11	1	Jan'20	2020	14:00	16.6	46.8	0.9	58	1.5	ENE	926	0	0
11	1	Jan'20	2020	15:00	16.8	45.2	1.6	55	0.5	NE	927	0	0
11	1	Jan'20	2020	16:00	17.1	47.6	1.2	76	0.5	ENE	928	0	0

11	1	Jan'20	2020	17:00	16.7	46.9	0.8	76	1.5	ENE	923	0	0
11	1	Jan'20	2020	18:00	16.4	49.8	1.6	56	1.5	NE	923	0	0
11	1	Jan'20	2020	19:00	16.1	54.3	1.9	86	1.5	E	918	0	0
11	1	Jan'20	2020	20:00	15.9	53.6	2.1	66	1.1	ENE	912	0	0
11	1	Jan'20	2020	21:00	15.7	56.9	3.5	85	2.3	E	912	0	0
11	1	Jan'20	2020	22:00	15.6	58	2.5	36	3.2	NE	911	0	0
11	1	Jan'20	2020	23:00	15.4	58.9	3.5	58	3.2	ENE	913	0	0
12	1	Jan'20	2020	00:00	15.3	49.8	0.9	86	4.2	E	912	0	0
12	1	Jan'20	2020	01:00	15.1	54.3	1.6	66	4.5	ENE	912	0	0
12	1	Jan'20	2020	02:00	14.9	53.6	1.2	28	4.5	NNE	914	0	0
12	1	Jan'20	2020	03:00	14.7	56.9	0.8	46	3.3	NE	916	0	0

Appendix 3.3: Ambient Air quality Monitoring Results

AAQ 1

26° 22′ 17.9″ N 94° 0′ 20.4″ E

Lakhbari

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	76	40	8.8	20.5	0.9	12.3	<2.0	<0.5	13.6	<0.01	0.97	<0.5	<2.5	<2.5	<2.0
22/10/2019	74	29	8.2	18.9	0.5	13.2	<2.0	<0.5	16.5	<0.01	0.67	<0.5	<2.5	<2.5	<2.0
24/10/2019	74	28	8	18.1	0.8	16.5	<2.0	<0.5	11.6	<0.01	0.63	<0.5	<2.5	<2.5	<2.0
30/10/2019	72	26	8.5	14.8	0.9	9.5	<2.0	<0.5	15.6	<0.01	0.94	<0.5	<2.5	<2.5	<2.0
01/11/2019	73	19	8.1	13.1	0.8	17.2	<2.0	<0.5	14.6	<0.01	0.80	<0.5	<2.5	<2.5	<2.0
05/11/2019	75	39	8.4	14	0.8	14.5	<2.0	<0.5	12.1	<0.01	0.95	<0.5	<2.5	<2.5	<2.0
07/11/2019	71	19	6.3	13.1	0.6	12.3	<2.0	<0.5	16.7	<0.01	0.64	<0.5	<2.5	<2.5	<2.0
12/11/2019	76	38	9.4	17.2	0.7	16.1	<2.0	<0.5	16.2	<0.01	0.89	<0.5	<2.5	<2.5	<2.0
14/11/2017	71	40	10.5	14.7	0.6	17.1	<2.0	<0.5	22.7	<0.01	0.98	<0.5	<2.5	<2.5	<2.0
21/11/2019	72	32	9	16	0.2	12	<2.0	<0.5	12.6	<0.01	1.1	<0.5	<2.5	<2.0	<2.0
23/11/2019	68	19	8.2	12.4	0.8	9.3	<2.0	<0.5	12.7	<0.01	0.98	<0.5	<2.5	<2.0	<2.0
25/11/2019	68	21	7.0	14.7	0.5	13.7	<2.0	<0.5	15.9	<0.01	0.52	<0.5	<2.5	<2.0	<2.0
01/12/2019	68	38	9.8	13.6	0.8	14.6	<2.0	<0.5	14.2	<0.01	0.6	<0.5	<2.5	<2.5	<2.0
03/12/2019	72	33	8.7	12.4	0.4	7.1	<2.0	<0.5	13.4	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
05/12/2019	74	29	8.1	16.2	0.4	13.5	<2.0	<0.5	12.6	<0.01	0.5	<0.5	<2.5	<2.5	<2.0
21/12/2019	73	21	8.3	13.5	0.7	19.6	<2.0	<0.5	14.8	<0.01	0.6	<0.5	<2.5	<2.5	<2.0
23/12/2019	72	37	7.8	13.7	0.8	15.2	<2.0	<0.5	15.2	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
29/12/2019	70	39	6.5	11.8	0.5	13.5	<2.0	<0.5	15.7	<0.01	1.1	<0.5	<2.5	<2.5	<2.0
31/12/2019	69	38	8.1	13.5	0.8	10.6	<2.0	<0.5	15.2	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
02/01/2020	73	37	7.2	10.5	0.6	14.2	<2.0	<0.5	14.7	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
08/01/2020	74	39	10.0	14.7	0.4	14.1	<2.0	<0.5	15.8	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
10/01/2020	67	35	10.1	11.5	0.5	13.8	<2.0	<0.5	13.5	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
15/01/2020	71	32	9.6	16.4	0.6	12.9	<2.0	<0.5	13.6	<0.01	1.0	<0.5	<2.5	<2.5	<2.0
18/01/2020	68	39	7.2	15.0	0.5	13.6	<2.0	<0.5	13.3	<0.01	0.6	<0.5	<2.5	<2.5	<2.0

AAQ 2
26° 20′ 4.9″ N 94° 2′ 57.5″ E
Chowdang Bali Para

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	78	38	9.8	20	0.5	16.3	<2.0	<0.5	10.8	<0.01	0.70	<0.5	<2.5	<2.5	<2.0
22/10/2019	75	40	8.6	19.5	0.7	14.7	<2.0	<0.5	13.7	<0.01	0.85	<0.5	<2.5	<2.5	<2.0
24/10/2019	74	27	8.2	18.6	0.9	18.5	<2.0	<0.5	22.3	<0.01	0.81	<0.5	<2.5	<2.5	<2.0
30/10/2019	68	29	7.9	14.7	0.6	12.5	<2.0	<0.5	14.8	<0.01	0.74	<0.5	<2.5	<2.5	<2.0
01/11/2019	72	38	6	14.9	0.8	12.3	<2.0	<0.5	15.8	<0.01	1.05	<0.5	<2.5	<2.5	<2.0
05/11/2019	76	35	6.8	14.8	0.8	10.6	<2.0	<0.5	14.7	<0.01	0.62	<0.5	<2.5	<2.5	<2.0
07/11/2019	75	34	7.6	14.2	0.9	16.5	<2.0	<0.5	13.9	<0.01	0.77	<0.5	<2.5	<2.5	<2.0
12/11/2019	77	42	6.5	15.6	0.8	12.6	<2.0	<0.5	20.4	<0.01	1.08	<0.5	<2.5	<2.5	<2.0
14/11/2017	69	35	8.2	16.9	0.9	16.7	<2.0	<0.5	18.6	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
21/11/2019	68	29	9	14.7	0.8	11	<2.0	<0.5	15.6	<0.01	2.2	<0.5	<2.5	<2.5	<2.0
23/11/2019	73	29	8.3	16.6	0.5	16.3	<2.0	<0.5	16.7	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
25/11/2019	72	33	9.7	15.1	0.4	10.3	<2.0	<0.5	14.3	<0.01	0.48	<0.5	<2.5	<2.5	<2.0
01/12/2019	67	36	11.2	16.8	0.6	16.8	<2.0	<0.5	13.8	<0.01	0.8	<0.5	<2.5	<2.5	<2.0
03/12/2019	62	28	11.6	16.7	0.7	17.2	<2.0	<0.5	15.7	<0.01	0.5	<0.5	<2.5	<2.5	<2.0
05/12/2019	87	36	11.9	16.1	0.7	13.2	<2.0	<0.5	16.8	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
21/12/2019	73	25	9.8	14.6	0.8	15.9	<2.0	<0.5	17.2	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
23/12/2019	69	35	8.9	14.5	0.4	15.0	<2.0	<0.5	12.7	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
29/12/2019	67	34	7.9	16.9	0.4	16.9	<2.0	<0.5	12.3	<0.01	0.8	<0.5	<2.5	<2.5	<2.0
31/12/2019	64	30	10.3	14.6	0.9	16.3	<2.0	<0.5	16.5	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
02/01/2020	72	38	8.9	12.7	0.8	16.2	<2.0	<0.5	12.5	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
08/01/2020	77	26	8.2	14.8	0.9	16.9	<2.0	<0.5	12.6	<0.01	0.9	<0.5	<2.5	<2.5	<2.0
10/01/2020	68	32	8.8	15.8	0.7	12.4	<2.0	<0.5	14.6	<0.01	0.6	<0.5	<2.5	<2.5	<2.0
15/01/2020	58	31	8.4	13.4	0.4	16.7	<2.0	<0.5	16.5	<0.01	1.0	<0.5	<2.5	<2.5	<2.0
18/01/2020	72	34	8.6	11.6	0.9	14.2	<2.0	<0.5	17.9	<0.01	0.8	<0.5	<2.5	<2.5	<2.0

AAQ 3
26° 19′ 15.4″ N 94° 5′ 44.9″ E
Merapani

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	72	21	8.9	15.4	0.8	14.5	<2.0	<0.5	16.8	<0.01	0.96	<0.5	<2.5	<2.5	<2.0
22/10/2019	72	27	7.9	16.2	0.8	10.6	<2.0	<0.5	14.6	<0.01	0.71	<0.5	<2.5	<2.5	<2.0
24/10/2019	73	23	9.6	15.1	0.7	15.6	<2.0	<0.5	15.6	<0.01	0.78	<0.5	<2.5	<2.5	<2.0
30/10/2019	71	33	8.5	14.9	0.4	9.7	<2.0	<0.5	16.4	<0.01	0.80	<0.5	<2.5	<2.5	<2.0
01/11/2019	69	23	7.5	17.2	0.5	15.6	<2.0	<0.5	13.6	<0.01	0.62	<0.5	<2.5	<2.5	<2.0
05/11/2019	73	27	8.2	14.8	0.9	9.2	<2.0	<0.5	10.8	<0.01	0.74	<0.5	<2.5	<2.5	<2.0
07/11/2019	73	38	8.9	13.9	0.9	11.2	<2.0	<0.5	19.7	<0.01	0.67	<0.5	<2.5	<2.5	<2.0
12/11/2019	73	37	7.2	15	0.8	14.2	<2.0	<0.5	16.9	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
14/11/2017	74	39	10	17.8	0.8	14.2	<2.0	<0.5	15.8	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
21/11/2019	70	30	10	17	0.6	11	<2.0	<0.5	17.2	<0.01	1.1	2.56	<2.5	<2.5	<2.0
23/11/2019	71	30	10.0	17.8	0.4	13.7	<2.0	<0.5	15.7	<0.01	0.98	<0.5	<2.5	<2.5	<2.0
25/11/2019	68	33	7.9	16.9	0.9	14.5	<2.0	<0.5	16.2	<0.01	0.57	<0.5	<2.5	<2.5	<2.0
01/12/2019	60	34	9.4	16.0	0.4	15.9	<2.0	<0.5	12.6	<0.01	0.57	<0.5	<2.5	<2.5	<2.0
03/12/2019	68	26	7.6	13.9	0.6	17.4	<2.0	<0.5	13.4	<0.01	0.84	<0.5	<2.5	<2.5	<2.0
05/12/2019	72	31	10.8	17.9	0.9	13.4	<2.0	<0.5	16.5	<0.01	0.62	<0.5	<2.5	<2.5	<2.0
21/12/2019	70	28	11.6	13.9	0.8	15.6	<2.0	<0.5	10.4	<0.01	0.59	<0.5	<2.5	<2.5	<2.0
23/12/2019	72	29	9.1	14.9	0.5	15.6	<2.0	<0.5	15.5	<0.01	0.64	<0.5	<2.5	<2.5	<2.0
29/12/2019	69	37	7.6	15.1	0.8	17.2	<2.0	<0.5	15.7	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
31/12/2019	76	25	7.8	14.3	0.7	11.5	<2.0	<0.5	14.6	<0.01	1.02	<0.5	<2.5	<2.5	<2.0
02/01/2020	67	35	10.6	10.6	0.7	14.6	<2.0	<0.5	14.2	<0.01	0.62	<0.5	<2.5	<2.5	<2.0
08/01/2020	68	27	9.5	11.7	0.5	13.4	<2.0	<0.5	14.6	<0.01	1.10	<0.5	<2.5	<2.5	<2.0
10/01/2020	74	35	10.0	15.4	0.8	14.6	<2.0	<0.5	16.2	<0.01	0.71	<0.5	<2.5	<2.5	<2.0
15/01/2020	65	33	12.5	16.2	0.8	16.5	<2.0	<0.5	14.6	<0.01	0.68	<0.5	<2.5	<2.5	<2.0
18/01/2020	73	37	8.2	15.8	0.6	14.8	<2.0	<0.5	15.2	<0.01	0.93	<0.5	<2.5	<2.5	<2.0

AAQ 4
26° 15′ 11.2″ N, 94° 2′ 26.6″ E
Panbari

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	69	26	8.1	17.6	0.9	15.6	<2.0	<0.5	19.5	<0.01	0.56	<0.5	<2.5	<2.5	<2.0
22/10/2019	73	29	7.9	17.1	0.9	12.9	<2.0	<0.5	13.5	<0.01	0.76	<0.5	<2.5	<2.5	<2.0
24/10/2019	72	40	6.8	16.8	0.8	13.7	<2.0	<0.5	18.3	<0.01	0.79	<0.5	<2.5	<2.5	<2.0
30/10/2019	73	37	8.1	16.4	0.8	12.3	<2.0	<0.5	18.5	<0.01	0.97	<0.5	<2.5	<2.5	<2.0
01/11/2019	74	21	8.3	14.9	0.7	17.5	<2.0	<0.5	17.7	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
05/11/2019	72	39	7.6	13.8	0.5	10.3	<2.0	<0.5	13.4	<0.01	0.71	<0.5	<2.5	<2.5	<2.0
07/11/2019	73	28	7.7	14.2	0.6	10.3	<2.0	<0.5	22.4	<0.01	0.71	<0.5	<2.5	<2.5	<2.0
12/11/2019	70	17	6.8	13.9	0.5	10.7	<2.0	<0.5	17.3	<0.01	0.93	<0.5	<2.5	<2.5	<2.0
14/11/2017	71	37	8.9	14.7	0.7	10.5	<2.0	<0.5	12.6	<0.01	0.98	<0.5	<2.5	<2.5	<2.0
21/11/2019	68	38	9.8	16.3	0.4	10	<2.0	<0.5	14.2	<0.01	1.1	<0.5	<2.5	<2.5	<2.0
23/11/2019	73	40	7.5	13.5	0.7	8.1	<2.0	<0.5	18.5	<0.01	1.04	<0.5	<2.5	<2.5	<2.0
25/11/2019	74	29	8.1	16.2	0.7	10.2	<2.0	<0.5	12.6	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
01/12/2019	71	26	10.1	12.3	0.9	12.4	<2.0	<0.5	17.2	<0.01	0.69	<0.5	<2.5	<2.5	<2.0
03/12/2019	72	34	9.6	15.2	0.8	9.6	<2.0	<0.5	10.6	<0.01	0.55	<0.5	<2.5	<2.5	<2.0
05/12/2019	69	29	8.6	14.3	0.8	9.7	<2.0	<0.5	17.6	<0.01	0.49	<0.5	<2.5	<2.5	<2.0
21/12/2019	72	40	9.5	17.1	0.6	10.2	<2.0	<0.5	15.8	<0.01	0.95	<0.5	<2.5	<2.5	<2.0
23/12/2019	68	23	8.5	14.9	0.7	12.4	<2.0	<0.5	18.5	<0.01	0.57	<0.5	<2.5	<2.5	<2.0
29/12/2019	72	32	8.9	12.4	0.6	8.7	<2.0	<0.5	14.9	<0.01	0.86	<0.5	<2.5	<2.5	<2.0
31/12/2019	74	24	9.6	16.8	0.8	11.0	<2.0	<0.5	15.3	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
02/01/2020	70	32	9.4	14.6	0.6	12.7	<2.0	<0.5	17.6	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
08/01/2020	67	37	12.8	14.8	0.8	8.6	<2.0	<0.5	13.5	<0.01	1.07	<0.5	<2.5	<2.5	<2.0
10/01/2020	69	41	10.3	13.4	0.4	10.3	<2.0	<0.5	12.7	<0.01	0.72	<0.5	<2.5	<2.5	<2.0
15/01/2020	71	34	9.2	14.6	0.9	12.4	<2.0	<0.5	14.7	<0.01	0.66	<0.5	<2.5	<2.5	<2.0
18/01/2020	68	43	9.5	15.4	0.7	10.4	<2.0	<0.5	16.5	<0.01	0.72	<0.5	<2.5	<2.5	<2.0

AAQ 5
26°15.121'N, 94°2.269'E
Sarupani Village

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
18/10/2019	68	38	9.8	16.3	0.5	16.4	<2.0	<0.5	14.2	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
21/10/2019	72	33	8.7	14.2	0.9	7.1	<2.0	<0.5	13.4	<0.01	0.70	<0.5	<2.5	<2.5	<2.0
23/10/2019	68	28	9.3	15.2	0.9	12.6	<2.0	<0.5	16.5	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
29/10/2019	73	39	8.1	14.6	0.5	7.8	<2.0	<0.5	19.2	<0.01	0.87	<0.5	<2.5	<2.5	<2.0
31/10/2019	74	23	7	15.3	0.9	12.5	<2.0	<0.5	16.5	<0.01	1.09	<0.5	<2.5	<2.5	<2.0
04/11/2019	75	28	8.2	16.1	0.8	13.2	<2.0	<0.5	17.5	<0.01	0.77	<0.5	<2.5	<2.5	<2.0
06/11/2019	69	37	7.9	14.2	0.9	16.3	<2.0	<0.5	21.6	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
12/11/2019	73	35	9.8	13.8	0.8	17.2	<2.0	<0.5	21.4	<0.01	0.92	<0.5	<2.5	<2.5	<2.0
14/11/2019	75	34	10	14.5	0.9	15.7	<2.0	<0.5	21.4	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
22/11/2019	68	30	9.8	16.3	0.6	8	<2.0	<0.5	15.9	<0.01	1.0	<0.5	<2.5	<2.5	<2.0
24/11/2019	72	31	8.9	15.8	0.5	12.8	<2.0	<0.5	15.7	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
28/11/2019	74	32	8.1	14.7	0.8	14.7	<2.0	<0.5	12.5	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
30/11/2019	73	30	7.6	13.7	0.4	10.3	<2.0	<0.5	15.6	<0.01	0.48	<0.5	<2.5	<2.5	<2.0
02/12/2019	66	28	8.4	12.7	0.9	13.4	<2.0	<0.5	10.6	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
04/12/2019	72	34	9.1	14.7	0.8	15.7	<2.0	<0.5	11.5	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
22/12/2019	67	31	9.7	15.6	0.4	11.8	<2.0	<0.5	16.8	<0.01	0.67	<0.5	<2.5	<2.5	<2.0
26/12/2019	68	23	8.2	15.5	0.8	15.4	<2.0	<0.5	15.4	<0.01	0.66	<0.5	<2.5	<2.5	<2.0
28/12/2019	63	30	7.9	16.8	0.4	13.7	<2.0	<0.5	14.4	<0.01	1.06	<0.5	<2.5	<2.5	<2.0
30/12/2019	65	31	9.6	12.4	0.7	13.2	<2.0	<0.5	15.8	<0.01	0.97	<0.5	<2.5	<2.5	<2.0
01/01/2020	69	24	8.8	13.2	0.4	11.3	<2.0	<0.5	12.3	<0.01	0.85	<0.5	<2.5	<2.5	<2.0
07/01/2020	68	29	10.8	13.4	0.9	14.7	<2.0	<0.5	12.5	<0.01	0.77	<0.5	<2.5	<2.5	<2.0
09/01/2020	71	29	7.8	10.8	0.7	16.1	<2.0	<0.5	11.6	<0.01	0.85	<0.5	<2.5	<2.5	<2.0
14/01/2020	67	34	8.2	14.2	0.9	16.8	<2.0	<0.5	14.6	<0.01	0.93	<0.5	<2.5	<2.5	<2.0
17/01/2020	71	31	11.6	12.2	0.9	14.9	<2.0	<0.5	15.8	<0.01	0.93	<0.5	<2.5	<2.5	<2.0

AAQ 6
26° 7'44.2"N, 93°57'39"E
Sonaur Village

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	72	35	10.1	17.1	0.4	9.5	<2.0	<0.5	10.4	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
22/10/2019	74	22	9.3	16.5	0.7	12.5	<2.0	<0.5	13.4	<0.01	0.81	<0.5	<2.5	<2.5	<2.0
24/10/2019	73	21	8.3	15.3	0.7	19.6	<2.0	<0.5	18.4	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
30/10/2019	71	26	7.6	15.8	0.4	16.3	<2.0	<0.5	19.5	<0.01	0.88	<0.5	<2.5	<2.5	<2.0
01/11/2019	72	39	9	16.1	0.6	9.7	<2.0	<0.5	14.7	<0.01	0.74	<0.5	<2.5	<2.5	<2.0
05/11/2019	72	38	8,3	14.7	0.9	8.1	<2.0	<0.5	21.5	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
07/11/219	70	36	7.7	15.6	0.9	12.9	<2.0	<0.5	15.6	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
13/11/2019	72	37	8.9	16	0.8	9.7	<2.0	<0.5	17.2	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
15/11/2019	71	26	7.6	11.2	0.4	16	<2.0	<0.5	19.5	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
21/11/2019	72	31	10.0	13.7	0.8	10.6	<2.0	<0.5	12.4	<0.01	2.07	<0.5	<2.5	<2.5	<2.0
23/11/2019	72	30	8.8	11.7	0.4	13.5	<2.0	<0.5	10.6	<0.01	1.02	<0.5	<2.5	<2.5	<2.0
25/11/2019	70	23	8.8	12.8	0.8	12.7	<2.0	<0.5	15.6	<0.01	0.56	<0.5	<2.5	<2.5	<2.0
01/12/2019	69	34	11.3	13.2	0.6	14.7	<2.0	<0.5	13.4	<0.01	0.89	<0.5	<2.5	<2.5	<2.0
03/12/2019	64	37	8.4	10.9	0.7	15.2	<2.0	<0.5	12.7	<0.01	0.63	<0.5	<2.5	<2.5	<2.0
05/12/2019	71	32	10.6	11.6	0.8	15.7	<2.0	<0.5	14.0	<0.01	0.69	<0.5	<2.5	<2.5	<2.0
21/12/2019	73	27	12.4	15.2	0.4	16.1	<2.0	<0.5	13.5	<0.01	0.99	<0.5	<2.5	<2.5	<2.0
23/12/2019	72	29	8.6	12.7	0.7	14.3	<2.0	<0.5	11.9	<0.01	0.76	<0.5	<2.5	<2.5	<2.0
29/12/2019	67	28	8.8	11.4	0.8	13.3	<2.0	<0.5	14.3	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
31/12/2019	69	32	13.2	14.2	0.4	10.9	<2.0	<0.5	13.4	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
02/01/2020	65	23	8.9	13.4	0.5	12.4	<2.0	<0.5	15.6	<0.01	0.56	<0.5	<2.5	<2.5	<2.0
08/01/2020	63	22	9.1	13.4	0.8	13.7	<2.0	<0.5	15.3	<0.01	0.85	<0.5	<2.5	<2.5	<2.0
10/01/2020	72	32	9.2	14.2	0.6	12.9	<2.0	<0.5	14.9	<0.01	0.92	<0.5	<2.5	<2.5	<2.0
15/01/2020	71	30	8.9	12.2	0.6	13.4	<2.0	<0.5	13.6	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
18/01/2020	68	31	6.8	13.0	0.7	12.8	<2.0	<0.5	13.4	<0.01	0.66	<0.5	<2.5	<2.5	<2.0

AAQ 7
26° 5'26.7"N, 93°51'49.2"E
Jonali Pothar Village

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	HC as Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	68	30	9.8	16.3	0.8	8.1	<2.0	<0.5	15.9	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
22/10/2019	72	31	8.9	15.8	0.9	15.6	<2.0	<0.5	15.7	<0.01	0.89	<0.5	<2.5	<2.5	<2.0
24/10/2019	76	32	9.7	15.2	0.6	13.5	<2.0	<0.5	13.8	<0.01	0.91	<0.5	<2.5	<2.5	<2.0
30/10/2019	79	37	7.8	15.6	0.6	15.2	<2.0	<0.5	22.5	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
01/11/2019	69	34	8.8	14.7	0.7	12.6	<2.0	<0.5	14.6	<0.01	0.86	<0.5	<2.5	<2.5	<2.0
05/11/2019	69	38	8.1	15.3	0.9	10.6	<2.0	<0.5	22.5	<0.01	0.87	<0.5	<2.5	<2.5	<2.0
07/11/219	72	35	7.5	14.4	0.9	17.3	<2.0	<0.5	16.3	<0.01	0.97	<0.5	<2.5	<2.5	<2.0
13/11/2019	73	29	8.4	15.7	0.8	15.8	<2.0	<0.5	21.6	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
15/11/2019	71	37	7.8	15.6	0.8	15	<2.0	<0.5	22.5	<0.01	0.6	<0.5	<2.5	<2.5	<2.0
21/11/2019	68	27	10.3	15.3	0.6	13.2	<2.0	<0.5	16.8	<0.01	1.08	<0.5	<2.5	<2.5	<2.0
23/11/2019	72	33	8.7	14.2	0.8	7.1	<2.0	<0.5	13.4	<0.01	1	<0.5	<2.5	<2.5	<2.0
25/11/2019	74	22	8.6	11.7	0.4	9.7	<2.0	<0.5	15.9	<0.01	0.87	<0.5	<2.5	<2.5	<2.0
01/12/2019	69	29	9.2	12.4	0.5	13.5	<2.0	<0.5	17.2	<0.01	0.64	<0.5	<2.5	<2.5	<2.0
03/12/2019	71	21	10.2	11.9	0.8	10.8	<2.0	<0.5	15.8	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
05/12/2019	65	25	8.7	13.6	0.4	13.2	<2.0	<0.5	15.6	<0.01	1.04	<0.5	<2.5	<2.5	<2.0
21/12/2019	68	30	8.4	10.6	0.6	11.4	<2.0	<0.5	16.6	<0.01	0.53	<0.5	<2.5	<2.5	<2.0
23/12/2019	70	32	7.8	13.4	0.6	13.4	<2.0	<0.5	12.3	<0.01	1.03	<0.5	<2.5	<2.5	<2.0
29/12/2019	68	22	11.6	12.2	0.7	12.4	<2.0	<0.5	16.5	<0.01	0.72	<0.5	<2.5	<2.5	<2.0
31/12/2019	67	24	10.0	13.9	0.4	13.7	<2.0	<0.5	15.0	<0.01	1.02	<0.5	<2.5	<2.5	<2.0
02/01/2020	71	30	7.6	14.1	0.4	10.5	<2.0	<0.5	16.7	<0.01	0.78	<0.5	<2.5	<2.5	<2.0
08/01/2020	68	21	8.6	11.9	0.4	13.3	<2.0	<0.5	12.8	<0.01	1.08	<0.5	<2.5	<2.5	<2.0
10/01/2020	65	29	9.2	14.2	0.9	12.8	<2.0	<0.5	15.3	<0.01	0.62	<0.5	<2.5	<2.5	<2.0
15/01/2020	68	27	7.2	13.9	0.8	13.7	<2.0	<0.5	15.3	<0.01	0.69	<0.5	<2.5	<2.5	<2.0
18/01/2020	71	26	7.2	12.0	0.6	13.8	<2.0	<0.5	13.5	<0.01	0.92	<0.5	<2.5	<2.5	<2.0

AAQ 8
26° 4'1.3"N, 93°54'9.8"E
3No Saluk Pathar

Parameters	PM10	PM2.5	SO_2	NOx	CO	NH3	C_6H_6	BAP	O_3	Pb	Ni	As	HC as Methane	Non-Methane	VOC
Units	µg/m3	µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m2	ng/m3	µg/m3	µg/m3	µg/m3
19/10/2019	77	39	9.2	16.4	0.6	7.5	<2.0	<0.5	18.7	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
22/10/2019	73	36	9.3	16	0.8	19.5	<2.0	<0.5	18.5	<0.01	0.90	<0.5	<2.5	<2.5	<2.0
24/10/2019	74	39	8.1	17.4	0.4	14.7	<2.0	<0.5	17.5	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
30/10/2019	71	39	7.6	14.2	0.9	13.4	<2.0	<0.5	20.4	<0.01	0.67	<0.5	<2.5	<2.5	<2.0
01/11/2019	76	37	7	14.7	0.9	13.7	<2.0	<0.5	12.1	<0.01	0.96	<0.5	<2.5	<2.5	<2.0
05/11/2019	74	37	8.9	14.7	0.5	9.5	<2.0	<0.5	20.4	<0.01	0.75	<0.5	<2.5	<2.5	<2.0
07/11/219	72	36	8.4	15.1	0.6	16.4	<2.0	<0.5	19.2	<0.01	0.84	<0.5	<2.5	<2.5	<2.0
13/11/2019	69	43	8.7	14.1	0.5	14.7	<2.0	<0.5	18.3	<0.01	1.01	<0.5	<2.5	<2.5	<2.0
15/11/2019	71	39	7.6	14.2	0.7	13	<2.0	<0.5	20.4	<0.01	0.7	<0.5	<2.5	<2.5	<2.0
21/11/2019	70	28	9.8	12.5	0.9	10.3	<2.0	<0.5	22.7	<0.01	1.69	<0.5	<2.5	<2.5	<2.0
23/11/2019	71	31	10.2	13.4	0.6	7.5	<2.0	<0.5	10.3	<0.01	2.23	<0.5	<2.5	<2.5	<2.0
25/11/2019	73	32	7.2	12.6	0.7	11.7	<2.0	<0.5	16.5	<0.01	0.55	<0.5	<2.5	<2.5	<2.0
01/12/2019	68	31	8.6	12.9	0.5	18.5	<2.0	<0.5	11.9	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
03/12/2019	63	35	8.6	15.9	0.6	23.8	<2.0	<0.5	11.9	<0.01	0.85	<0.5	<2.5	<2.5	<2.0
05/12/2019	71	27	8.5	12.6	0.7	10.3	<2.0	<0.5	20.6	<0.01	0.71	<0.5	<2.5	<2.5	<2.0
21/12/2019	66	22	7.6	11.7	0.5	20.6	<2.0	<0.5	18.7	<0.01	0.61	<0.5	<2.5	<2.5	<2.0
23/12/2019	69	26	10.6	13.4	0.8	18.6	<2.0	<0.5	13.4	<0.01	1.03	<0.5	<2.5	<2.5	<2.0
29/12/2019	70	29	11.2	12.8	0.4	20.6	<2.0	<0.5	16.5	<0.01	0.81	<0.5	<2.5	<2.5	<2.0
31/12/2019	67	26	10.0	14.2	0.8	21.5	<2.0	<0.5	15.8	<0.01	0.84	<0.5	<2.5	<2.5	<2.0
02/01/2020	69	23	9.6	13.4	0.7	18.6	<2.0	<0.5	11.6	<0.01	0.64	<0.5	<2.5	<2.5	<2.0
08/01/2020	73	25	8.9	11.8	0.5	19.8	<2.0	<0.5	14.8	<0.01	0.80	<0.5	<2.5	<2.5	<2.0
10/01/2020	62	31	9.8	13.1	0.4	15.8	<2.0	<0.5	14.6	<0.01	0.83	<0.5	<2.5	<2.5	<2.0
15/01/2020	64	35	6.8	12.4	0.5	14.6	<2.0	<0.5	14.6	<0.01	0.76	<0.5	<2.5	<2.5	<2.0
18/01/2020	68	29	9.1	13.7	0.4	14.6	<2.0	<0.5	16.6	<0.01	1.03	<0.5	<2.5	<2.5	<2.0

Appendix 3.4: Ambient Noise Monitoring Results

Location code	Leq Day Time (dBA)	Leq Night Time (dBA)	Applicable Daytime Standards	Applicable Night-time Standards
NQ1	53.7	46.1	55	45
NQ2	52.8	42.1	55	45
NQ3	52.4	41.5	55	45
NQ4	52.3	43.6	55	45
NQ5	53.5	42.9	55	45
NQ6	52.7	45.4	55	45
NQ7	52	43.6	55	45
NQ 8	51.3	42.6	55	45

Noise Monitoring Results

Appendix 3.5: Ground Water Quality Monitoring Results

Sl. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW- 8
1	Colour	Hazen	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	Odour	-	Agreeable	unobjectionable	Unobjectionable	unobjectionable	unobjectionable	unobjectionable	unobjectionable	Unobjectionable
3	Temperature	°C	24.7	24.8	24.6	24.8	24.6	24.8	24.7	24.6
4	pH	-	7.5 at 24.7 °C	7.4 at 24.8 °C	7.3 at 24.6 °C	7.5 at 24.8 °C	7.5 at 24.6 °C	7.3 at 24.8 °C	7.4 at 24.7 °C	7.4 at 24.6 °C
5	Turbidity	NTU	0.86	0.8	0.32	0.38	0.74	0.62	0.25	0.76
6	Total Dissolved Solids	mg/l	66	172	234	150	205	176	285	245
7	Electrical Conductivity	µS/Cm	117	303	416	264	351	306	490	415
8	Salinity	psu	0.07	0.15	0.22	0.14	0.18	0.16	0.26	0.21
9	Dissolved oxygen	mg/l	6.96	7.06	7.25	6.86	6.96	7.35	6.86	7.06
10	Anionic Detergent (as MBAS)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
11	Barium (Ba)	mg/l	<0.013	<0.015	0.016	<0.001	0.279	0.026	0.029	0.02
12	Chloride	mg/l	5.34	8.74	19.91	9.71	12.14	9.71	21.85	15.06
13	Copper(Cu)	mg/l	<0.001	<0.001	<0.001	<0.001	0.246	0.006	<0.001	<0.001
14	Fluoride as F	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
15	Iron (Fe)	mg/l	0.21	<0.001	<0.001	0.137	29.6	12.7	0.062	<0.001
16	Nitrate	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17	Sodium	mg/l	3.29	5.09	11.85	5.79	7.15	5.8	13.22	8.95

Ground water Monitoring results

Sl. No.	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW- 8
18	Total Alkalinity	mg/l	36	100	126	88	114	100	152	140
19	Total Hardness	mg/l	32	88	116	76	112	94	152	124
20	Zinc(Zn)	mg/l	0.048	0.016	0.005	0.001	0.912	0.055	<0.02	<0.001
21	Cadmium (Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
22	Lead (Pb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Mercury (Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24	Nickel (as Ni)	mg/l	<0.001	<0.001	<0.001	<0.001	0.685	0.014	<0.001	<0.001
25	Hexavalent Chromium(Cr+6)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
26	Arsenic(As)	mg/l	0.001	0.001	0.001	0.006	0.058	0.015	0.016	<0.001
27	Total Coliform	MPN/100ml	<2	<2	<2	<2	<2	<2	<2	<2
28	Faecal Coliform	MPN/100ml	<2	<2	<2	<2	<2	<2	<2	<2

Appendix 3.6: Surface Water QualityMonitoring Results

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
1	Colour	Hazen	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	Odour	None	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Temperature	°C	24.8	24.7	24.6	24.7	24.7	24.6	24.6	24.8	24.7
4	pH value	None	7.6 at 24.8 °C	7.6 at 24.7 °C	7.5 at 24.6 °C	7.4 at 24.7 °C	7.6 at 24.7°C	7.6 at 24.6 °C	7.6 at 24.6 °C	7.5 at 24.8 °C	7.8 at 24.7 °C
5	Conductivity	µS/cm	171	323	178	172	227	230	151	140	445
6	DO	mg/l	7.55	7.55	7.45	7.55	7.64	7.35	7.35	7.55	7.64
7	Turbidity	N.T.U.	0.45	0.75	0.68	0.57	0.34	0.48	0.26	0.43	0.82
8	Total Dissolved Solids (as TDS)	mg/l	96	190	105	90	128	135	86	80	260
9	Biochemical Oxygen Demand (as BOD)	mg/l	1.5	1.7	1.5	1.7	1.8	1.6	1.2	1.3	2.2
10	Chemical Oxygen Demand (COD)	mg/l	10.24	11.26	9.22	10.24	12.29	11.26	9.22	9.22	11.26
11	Total Hardness (as CaCO3)	mg/l	56	106	54	46	64	72	42	42	140
12	Alkalinity (as CaCO3)	mg/l	56	108	60	50	74	76	46	42	154
13	Sodium (as Na)	mg/l	3.56	5.25	3.49	4.18	4.06	4.53	4.78	3.14	5.98
14	Sodium Adsorption Ration (as SAR)	None	1.12	1.2	1.12	1.45	1.21	1.27	1.75	1.15	1.22
15	Phosphate	mg/l	0.11	<0.05	0.1	0.12	<0.05	0.11	0.15	0.1	0.12

Surface water monitoring results

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
16	Anionic Detergents (as MBAS)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
17	Barium (as Ba)	mg/l	0.01	0.01	0.006	0.021	0.011	0.009	0.02	0.009	0.005
18	Chloride (as Cl)	mg/l	5.83	8.74	5.83	6.8	7.28	7.77	7.77	5.34	10.2
19	Copper (as Cu)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20	Fluoride (as F)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Iron (as Fe)	mg/l	0.919	0.009	0.049	0.25	0.046	0.124	0.253	0.157	0.045
22	Magnesium (as Mg)	mg/l	3.4	6.32	3.4	2.92	4.86	5.35	2.92	2.92	12.15
23	Nitrate (as NO3)	mg/l	1.27	2.34	1.66	1.35	2.18	3.22	2.16	<0.5	2.14
24	Sulphate (as SO4)	mg/l	1.26	1.68	1.28	2.35	1.62	2.11	2.52	1.56	2.45
25	Cadmium (as Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
26	Lead (as Pb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
27	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Arsenic (as As)	mg/l	0.001	0.011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
29	Nickel (as Ni)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
30	Zinc (as Zn)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001
31	Hexavalent Chromium (as Cr+6)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Sl. No.	Parameter	Unit	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
32	Salinity	None	0.1	0.16	0.1	0.1	0.12	0.12	0.08	0.07	0.21
33	Polychlorinated biphenyls (as PCB)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
34	Total coliform	MPN/100ml	48	109	25	79	22	17	63	17	21
35	Faecal coliform	MPN/100ml	8	14	<2	21	7	<2	26	<2	<2

Appendix 3.7:
Soil Quality Monitoring Results

Sl. No.	Parameters	SQ 1	SQ2	SQ 3	SQ 4	SQ 5	SQ 6
1	pH	5.8	8.0	5.7	6.5	6.8	5.9
2	EC	105	462	163	177	146	488
3	Nitrogen (%)	0.63	0.81	0.76	0.83	1.37	0.97
4	Nitrate(mg/kg)	17.5	22.24	24.7	25.44	24.8	20.84
5	Phosphate(mg/kg)	162.68	184.47	92.16	143.70	104.65	78.43
6	Porosity (%)	17.15	16.63	13.75	13.08	25.02	19.57
7	Permeability(cm/min)	4.20	4.40	3.80	3.90	6.95	5.20
8	Nitrites(mg/kg)	5.2	6.7	5.5	4.3	5.6	5.9
9	Total Hydrocarbon	ND	ND	ND	ND	ND	ND
10	Texture	Loamy Fine Sand	Loamy Fine Sand	Sandy Clay Loam	Loamy Fine Sand	Loamy Fine Sand	Sandy Clay Loam
11	Phosphorus(mg/kg)	53.68	60.87	30.41	47.42	34.53	25.88
12	Cr (ppm)	25.44	6.24	6.02	26.59	21.54	20.78
13	Fe (ppm)	4098.00	4021.61	4776.23	4764.35	4467.64	4599.58
14	Ni (ppm)	18.619	3.578	3.484	19.112	29.012	28.368
15	Cu (ppm)	8.494	1.566	1.542	8.964	10.506	10.252
16	Zn (ppm)	23.856	8.396	8.237	24.716	38.422	37.801
17	As (ppm)	5.347	0.944	0.925	5.633	2.475	2.451
18	Cd (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
19	Hg (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
20	Pb (ppm)	7.941	2.629	2.600	8.267	7.889	7.880
21	Ba (ppm)	25.085	11.360	11.283	26.372	13.269	13.296
22	Potassium(K) (ppm)	168.78	203.59	197.45	197.20	184.82	191.09
23	Manganese (Mn) (ppm)	75.77	80.08	88.73	88.25	82.77	85.46

Soil Quality Monitoring Result

24	SAR (meq/Kg)	3.12	2.34	2.56	2.48	2.68	2.51
25	CEC (meq/100g)	30.24	28.14	28.18	28.08	36.72	35.62

Appendix 3.8: Traffic Survey Results

Time (Hours)	Weekdays (2No Nabajyoti to Godapani Rd_UP)	Weekdays (2No Nabajyoti to Godapani Rd_DOWN)	Weekdays total PCU	Holiday (2No Nabajyoti to Godapani Rd_UP)	Holiday (2No Nabajyoti to Godapani Rd_DOWN)	Holiday total PCU
9.00-10.00	218.5	258.5	477.0	282	261.5	543.5
10.00-11.00	166.5	273.5	440.0	286.5	224.5	511
11.00-12.00	200.5	251	451.5	210.5	220	430.5
12.00-13.00	161.5	230	391.5	173	244.5	417.5
13.00-14.00	147.5	199	346.5	152.5	228	380.5
14.00-15.00	129.5	236.5	366.0	184	198	382
15.00-16.00	132	227.5	359.5	196	211	407
16.00-17.00	182.5	227	409.5	118.5	223.5	342
17.00-18.00	146	234	380.0	166.5	190	356.5
18.00-19.00	149	139	288.0	142.5	177.5	320
19.00-20.00	115	160	275.0	160.5	129	289.5
20.00-21.00	180	134.5	314.5	141	102	243
21.00-22.00	277.5	122	399.5	187	87	274
22.00-23.00	118.5	66.5	185.0	200.5	78.5	279
23.00-00.00	178.5	56	234.5	227.5	34	261.5
00.00-01.00	158	14	172.0	165	16	181
01.00-02.00	109	13.5	122.5	230.5	18.5	249
02.00-03.00	151.5	4.5	156.0	213	10	223
03.00-04.00	145	13.5	158.5	180	25.5	205.5
04.00-05.00	111.5	31	142.5	269	31	300
05.00-06.00	172.5	42	214.5	130	58	188
06.00-07.00	159	80	239.0	118.5	154.5	273
07.00-08.00	140	275	415.0	198.5	260.5	459
08.00-09.00	127	316	443.0	205.5	316	521.5

Time (Hours)	Weekdays (Torani Gaon to Golaghat (SH3) Rd_UP)	Weekdays (Torani Gaon to Golaghat (SH3) Rd_DOWN)	Weekdays total PCU	Holiday (Torani Gaon to Golaghat (SH3) Rd_UP)	Holiday (Torani Gaon to Golaghat (SH3) Rd_DOWN)
9.00-10.00	258.0	236.5	494.5	89.5	198.5
10.00-11.00	218	211.5	429.5	118	215
11.00-12.00	234.5	252	486.5	101	250
12.00-13.00	225	299	524.0	122.5	247
13.00-14.00	210	258.5	468.5	111	210.5
14.00-15.00	219.5	265	484.5	94	234
15.00-16.00	232	236	468.0	118.5	249.5
16.00-17.00	204.5	251.5	456.0	91	206.5
17.00-18.00	161	207	368.0	54.5	148.5
18.00-19.00	164.5	182	346.5	89	146
19.00-20.00	128	148	276.0	105	117.5
20.00-21.00	106.5	119	225.5	104.5	131.5
21.00-22.00	104	100.5	204.5	95.5	62
22.00-23.00	66	68	134.0	108	36
23.00-00.00	26	69	95.0	69	60
00.00-01.00	12	60.5	72.5	83	28.5
01.00-02.00	15	17.5	32.5	89.5	20
02.00-03.00	27	25	52.0	109.5	17.5
03.00-04.00	38	60	98.0	88.5	61
04.00-05.00	55.5	92	147.5	71.5	70.5
05.00-06.00	73.5	94	167.5	82	99

Time (Hours)	Weekdays (Torani Gaon to Golaghat (SH3) Rd_UP)	Weekdays (Torani Gaon to Golaghat (SH3) Rd_DOWN)	Weekdays total PCU	Holiday (Torani Gaon to Golaghat (SH3) Rd_UP)	Holiday (Torani Gaon to Golaghat (SH3) Rd_DOWN)
06.00-07.00	162	158	320.0	66.5	133.5
07.00-08.00	280.5	296.5	577.0	66	310.5
08.00-09.00	317.5	332	649.5	43.5	296.5

Time (Hours)	Weekdays (Merapani to Nagaland (WOKHA) Rd_UP)	Weekdays (Merapani to Nagaland (WOKHA) Rd_DOWN)	Weekdays total PCU	Holiday (Merapani to Nagaland (WOKHA) Rd_UP)	Holiday (Merapani to Nagaland (WOKHA) Rd_DOWN)	Holiday total PCU
9.00-10.00	252.5	206.5	459.0	249.5	178.5	428
10.00-11.00	148	210	358.0	283	196.5	479.5
11.00-12.00	230	234	464.0	248	231.5	479.5
12.00-13.00	216	169.5	385.5	197	227.5	424.5
13.00-14.00	162.5	188	350.5	1444	273	1717
14.00-15.00	206.5	171	377.5	240	202	442
15.00-16.00	210	168	378.0	240.5	174.5	415
16.00-17.00	156.5	195.5	352.0	195	130	325
17.00-18.00	163.5	236	399.5	199	235	434
18.00-19.00	121	191	312.0	205.5	144.5	350
19.00-20.00	131	178.5	309.5	119	100	219
20.00-21.00	219	171	390.0	118	81.5	199.5
21.00-22.00	126.5	69	195.5	106.5	72.5	179
22.00-23.00	197.5	19	216.5	70.5	62.5	133
23.00-00.00	88.5	21.5	110.0	74.5	50.5	125
00.00-01.00	30.5	20.5	51.0	21	15	36
01.00-02.00	47.5	29.5	77.0	15	7	22
02.00-03.00	12	4.5	16.5	20	62	82
03.00-04.00	37.5	5.5	43.0	3	29.5	32.5
04.00-05.00	51.5	6.5	58.0	5	33	38

Time (Hours)	Weekdays (Merapani to Nagaland (WOKHA) Rd_UP)	Weekdays (Merapani to Nagaland (WOKHA) Rd_DOWN)	Weekdays total PCU	Holiday (Merapani to Nagaland (WOKHA) Rd_UP)	Holiday (Merapani to Nagaland (WOKHA) Rd_DOWN)	Holiday total PCU
05.00-06.00	171	85.5	256.5	79	33	112
06.00-07.00	155	143	298.0	132	63	195
07.00-08.00	176.5	134	310.5	138.5	122.5	261
08.00-09.00	174.5	164	338.5	181.5	186.5	368

Time (Hours)	Weekdays (MU Rd. to Sonaali Pathar_UP)	Weekdays (MU Rd. to Sonaali Pathar_DOWN)	Weekdays total PCU	Holiday (MU Rd. to Sonaali Pathar_UP)	Holiday (MU Rd. to Sonaali Pathar_DOWN)	Holiday total PCU
9.00-10.00	188.0	138.5	326.5	247.5	206.5	454
10.00-11.00	199.5	268	467.5	259.5	229	488.5
11.00-12.00	281	160.5	441.5	203.5	229	432.5
12.00-13.00	182	218	400.0	239.5	189	428.5
13.00-14.00	176	214	390.0	209.5	189.5	399
14.00-15.00	212	207	419.0	203	236	439
15.00-16.00	207.5	120	327.5	203	222.5	425.5
16.00-17.00	170	241.5	411.5	211	162	373
17.00-18.00	126.5	171	297.5	169.5	173.5	343
18.00-19.00	86.5	200	286.5	145	143	288
19.00-20.00	73.5	228.5	302.0	115.5	82.5	198
20.00-21.00	55	89	144.0	88	65	153
21.00-22.00	67	40	107.0	36	69	105
22.00-23.00	20	36	56.0	40.5	48	88.5
23.00-00.00	4.5	39.5	44.0	24.5	44	68.5
00.00-01.00	5	3	8.0	14	24	38
01.00-02.00	8.5	2	10.5	0	16	16
02.00-03.00	9	4	13.0	0	0	0
03.00-04.00	22.5	3	25.5	9	1.5	10.5
04.00-05.00	15	2.5	17.5	22.5	1	23.5

Time (Hours)	Weekdays (MU Rd. to Sonaali Pathar_UP)	Weekdays (MU Rd. to Sonaali Pathar_DOWN)	Weekdays total PCU	Holiday (MU Rd. to Sonaali Pathar_UP)	Holiday (MU Rd. to Sonaali Pathar_DOWN)	Holiday total PCU
05.00-06.00	25	5	30.0	57	62	119
06.00-07.00	59.5	58.5	118.0	94	97.5	191.5
07.00-08.00	127	121	248.0	194.5	109.5	304
08.00-09.00	201	101	302.0	231	174	405

Time (Hours)	Weekdays (Merapani Rd. to Sarupani Rd._UP)	Weekdays (Merapani Rd. to Sarupani Rd._DOWN)	Weekdays total PCU	Holiday (Merapani Rd. to Sarupani Rd._UP)	Holiday (Merapani Rd. to Sarupani Rd._DOWN)	Holiday total PCU
9.00-10.00	280.5	265.5	546.0	201	245.45	446.45
10.00-11.00	250.5	270.5	521.0	257.5	221.2	478.7
11.00-12.00	227.5	251.5	479.0	244	217.6	461.6
12.00-13.00	228.5	259	487.5	220.5	209.1	429.6
13.00-14.00	250.5	220.5	471.0	208.5	213.9	422.4
14.00-15.00	210	212.5	422.5	176	216.6	392.6
15.00-16.00	215.5	202.5	418.0	252	173.6	425.6
16.00-17.00	181	208.5	389.5	198	201.35	399.35
17.00-18.00	214.5	225.5	440.0	163	173.4	336.4
18.00-19.00	185.5	163	348.5	109	149.1	258.1
19.00-20.00	127	195.5	322.5	83.5	67.5	151
20.00-21.00	110	115	225.0	59.5	65.5	125
21.00-22.00	81.5	52.5	134.0	53	58.5	111.5
22.00-23.00	85.5	56.5	142.0	34	7.5	41.5
23.00-00.00	58.5	27	85.5	17	8	25
00.00-01.00	44.5	1.5	46.0	9	7.5	16.5
01.00-02.00	13.5	4.5	18.0	0	0	0
02.00-03.00	12.5	1	13.5	5	0	5
03.00-04.00	10	4.5	14.5	0	20	20

Time (Hours)	Weekdays (Merapani Rd. to Sarupani Rd._UP)	Weekdays (Merapani Rd. to Sarupani Rd._DOWN)	Weekdays total PCU	Holiday (Merapani Rd. to Sarupani Rd._UP)	Holiday (Merapani Rd. to Sarupani Rd._DOWN)	Holiday total PCU
04.00-05.00	7	22	29.0	52	31.5	83.5
05.00-06.00	63	43.5	106.5	109	111.25	220.25
06.00-07.00	131	127.5	258.5	157.5	155.3	312.8
07.00-08.00	234	190	424.0	255.5	221.75	477.25
08.00-09.00	270.5	248	518.5	236.5	219.75	456.25

Time (Hours)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)_DOWN)	Weekdays total PCU	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._DOWN)	Holiday total PCU
9.00-10.00	157.5	215.5	373.0	227	198	425
10.00-11.00	221.5	206.5	428.0	224.5	190	414.5
11.00-12.00	238.5	185	423.5	183.5	227.5	411
12.00-13.00	238	298	536.0	164	263	427
13.00-14.00	261.5	176.5	438.0	208.5	207	415.5
14.00-15.00	226.5	178	404.5	183.5	263.5	447
15.00-16.00	634.5	196.5	831.0	188.5	211	399.5
16.00-17.00	199.5	190	389.5	221.5	180.5	402
17.00-18.00	176	96	272.0	246.5	169	415.5

Time (Hours)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)_DOWN)	Weekdays total PCU	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._DOWN)	Holiday total PCU
18.00-19.00	125	189.5	314.5	216	153.5	369.5
19.00-20.00	92	89.5	181.5	47.5	94	141.5
20.00-21.00	90	83.5	173.5	55.5	63.5	119
21.00-22.00	58	32	90.0	37.5	23	60.5
22.00-23.00	20	58.95	79.0	36.5	5	41.5
23.00-00.00	14	0	14.0	3	27	30
00.00-01.00	0	0	0.0	3	0	3
01.00-02.00	4.5	1.5	6.0	5.5	0	5.5
02.00-03.00	23.5	3	26.5	9.5	6	15.5
03.00-04.00	21	10	31.0	0	20	20
04.00-05.00	76	23.5	99.5	6.5	11.5	18
05.00-06.00	150	33	183.0	24	87.5	111.5
06.00-07.00	175.5	95.5	271.0	96	169.5	265.5
07.00-08.00	222.5	167.5	390.0	154	181.5	335.5

Time (Hours)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Weekdays (Chungayan to Salukpathar (Naojan MV Rd.)_DOWN)	Weekdays total PCU	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._UP)	Holiday (Chungayan to Salukpathar (Naojan MV Rd.)._DOWN)	Holiday total PCU
08.00-09.00	204	216.5	420.5	158.5	184.5	343

Time (Hours)	Weekdays (Woroku to Uriamghat Rd._UP)	Weekdays (Woroku to Uriamghat Rd._DOWN)	Weekdays total PCU	Holiday (Woroku to Uriamghat Rd._UP)	Holiday (Woroku to Uriamghat Rd._DOWN)	Holiday total PCU
9.00-10.00	74.5	217.5	292.0	238.5	222.5	461
10.00-11.00	59	194	253.0	276.5	193	469.5
11.00-12.00	94	234	328.0	268.5	215	483.5
12.00-13.00	83.5	184.5	268.0	299.5	182.5	482
13.00-14.00	82	206.5	288.5	292	110	402
14.00-15.00	84	240.5	324.5	256	112	368
15.00-16.00	85.5	180.5	266.0	246.5	166	412.5
16.00-17.00	64	161.5	225.5	253.5	210.5	464
17.00-18.00	86.5	171	257.5	187	197.5	384.5
18.00-19.00	74.5	134.5	209.0	185	157	342
19.00-20.00	29	30	59.0	125.5	126.5	252
20.00-21.00	31	175	206.0	105	83.5	188.5
21.00-22.00	18	23	41.0	108	9	117
22.00-23.00	1.5	5.5	7.0	0	4.5	4.5
23.00-00.00	4	1	5.0	72	13.5	85.5
00.00-01.00	9	3	12.0	54	0	54
01.00-02.00	11.5	2	13.5	0	0	0
02.00-03.00	26.5	7.5	34.0	0	0	0
03.00-04.00	22	9	31.0	0	0	0
04.00-05.00	56.5	20.5	77.0	0	0	0

Time (Hours)	Weekdays (Woroku to Uriamghat Rd._UP)	Weekdays (Woroku to Uriamghat Rd._DOWN)	Weekdays total PCU	Holiday (Woroku to Uriamghat Rd._UP)	Holiday (Woroku to Uriamghat Rd._DOWN)	Holiday total PCU
05.00-06.00	65	49	114.0	35	42.5	77.5
06.00-07.00	115	82	197.0	85.5	113	198.5
07.00-08.00	108.5	87.5	196.0	183	126.5	309.5
08.00-09.00	138.5	138	276.5	210	198	408

Appendix 3.9: Demographic Profile of the Study Area

Table 1: Demographic Profile

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Nambor PML										
Nikhikhe	29	157	5.41	77	80	1039	0	0.00	0	0.00
Amguri No.1	81	446	5.51	238	208	874	1	0.22	0	0.00
Aao Bosti	55	267	4.85	127	140	1102	0	0.00	12	4.49
Amguri No.2	35	203	5.80	98	105	1071	0	0.00	0	0.00
Kuki Bosti	94	499	5.31	246	253	1028	0	0.00	20	4.01
Ming Mang No.2	73	358	4.90	172	186	1081	1	0.28	273	76.26
Khehoi	0	0	4.88	0	0	1089	0	0.00	0	74.36
Damodar No.2	24	117	4.94	56	61	925	0	0.00	87	31.47
Panjan No.2	0	0	4.41	0	0	1012	0	0.00	0	15.12
Ratanpur	94	464	5.14	241	223	917	0	0.15	146	80.86
Janata Pathar	147	648	5.64	322	326	840	0	0.00	98	5.81
Sonali Pathar No 1&2	126	648	4.75	338	310	981	1	0.00	524	0.24
Sankarpur	61	344	4.53	187	157	994	0	0.00	20	74.03
Sonalinagar No.2	174	826	4.49	417	409	877	0	4.97	2	0.40
Thaigirguri	74	335	5.41	168	167	1039	0	0.00	248	0.00
Doyalpur	0	0	5.51	0	0	874	0	0.22	0	0.00
Morajan No.1	224	1006	4.85	536	470	1102	50	0.00	4	4.49
East Lakhibari PML										

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Ghiladhari Bagan	981	4661	4.75	2337	2324	994	7	0.15	28	0.60
Merapani F.S.	717	3518	4.91	1914	1604	838	158	4.49	136	3.87
Matikhula Gaon	143	696	4.87	359	337	939	0	0.00	112	16.09
Golaghat PML										
Naojan Gaon	553	2406	4.35	1234	1172	950	131	5.44	21	0.87
Sungajan Block No.5	90	416	4.62	199	217	1090	0	0.00	19	4.57
Bosapathar No.1	128	554	4.33	269	285	1059	0	0.00	10	1.81
Sungajan Block No.2	104	524	5.04	256	268	1047	0	0.00	0	0.00
Sungajan Block No.3	164	775	4.73	401	374	933	0	0.00	31	4.00
Betoni Jan	90	465	5.17	241	224	929	0	0.00	0	0.00
No.1 Parghat	31	141	4.90	72	69	946	0	5.29	0	7.91
Sarupathar Gaon	475	2327	4.77	1196	1131	1024	123	0.00	184	100.00
Chukia Pathar	145	650	4.59	321	329	892	0	0.00	2	98.57
Pachim Panbari	53	253	6.72	125	128	1000	0	0.00	253	95.87
Santipur No.2	61	280	4.96	148	132	950	0	0.00	276	100.00
Pathori Miching Gaon	36	242	5.38	121	121	926	0	1.24	232	0.00
Sialmari	55	273	5.05	140	133	1149	0	0.00	273	69.31
Padum Pothar	150	807	4.61	419	388	931	10	2.00	0	32.74
Kalyanpur No.2	40	202	6.06	94	108	577	0	0.00	140	77.32
Bijoypur Sissupani	55	236	5.21	114	122	1009	0	0.00	229	44.29

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Tanajan Miching	195	898	4.35	465	433	950	18	5.44	294	0.87
Odali Pothar	32	194	4.62	123	71	1090	0	0.00	150	4.57
Doimuguri	42	219	4.33	109	110	1059	0	0.00	97	1.81
Kasomarigaon Additional PML										
Samukjan No.2	73	376	5.15	191	185	969	201	53.46	12	3.19
Doyalpur Bagan	0	0	5.36	0	0	987	0	0.00	0	63.00
Milonpur	56	300	4.69	151	149	984	0	84.26	189	2.19
Samukjan	107	502	5.86	253	249	952	423	0.00	11	0.00
Mikirbosti	7	41	5.08	21	20	1103	0	0.00	0	98.36
Pathortoli No.1	24	122	5.19	58	64	1037	0	0.13	120	98.44
Golekpur	96	497	5.75	253	244	1000	0	0.00	490	0.00
Dineshpur	148	768	4.99	377	391	924	1	0.00	756	22.56
Pawali Pothar	103	517	4.88	256	261	870	0	0.00	385	10.99
Terenga Pothar	24	138	5.00	69	69	945	0	0.00	0	74.95
Cheleng Pothar Sapekhati	111	554	4.71	288	266	924	0	6.65	125	6.83
Janata Pothar	112	546	5.11	292	254	964	0	0.00	60	1.45
Chaodang Pothar	290	1449	4.72	745	704	931	0	0.00	1086	0.00
Jeypur Veleuguri	118	556	4.69	289	267	1039	37	0.14	38	42.25
Chalang Pothar	298	1522	5.15	775	747	969	0	53.46	22	3.19
Adarsha No.1	212	994	5.36	524	470	987	0	0.00	1	63.00

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Tarani T.G.	65	307	4.69	159	148	984	0	84.26	0	2.19
Singphura	308	1446	5.86	709	737	952	2	0.00	611	0.00
Kasomarigaon PML										
Madhupur	86	429	4.99	223	206	924	424	98.83	4	0.93
Teteliguri	33	175	5.30	88	87	989	0	0.00	168	96.00
Dighalpani Kadamguri	87	415	4.77	205	210	1024	0	0.00	395	95.18
Anantapur	36	160	4.44	85	75	882	0	0.00	0	0.00
Milonpur Dighalpani	13	55	4.23	29	26	897	0	0.00	40	72.73
Sibangpara	86	372	4.33	182	190	1044	0	0.00	94	25.27
Batiporia Gaon	41	207	5.05	107	100	935	0	0.00	3	1.45
Nalani Pothar	251	1343	5.35	689	654	949	205	15.26	631	46.98
Jaroni No.2	126	603	4.79	298	305	1023	0	0.00	41	6.80
Athgaon	143	656	4.59	341	315	924	0	0.00	0	0.00
Kulajan No.2	158	793	5.02	408	385	944	0	0.00	56	7.06
Puli Bagan	53	244	4.60	120	124	1033	0	0.00	47	19.26
Bhakat Gaon	118	549	4.65	273	276	1011	535	97.45	11	2.00
Titabor Tangia	129	582	4.51	289	293	1014	0	0.00	237	40.72
Banua Tangia	212	940	4.43	485	455	938	0	0.00	239	25.43
Torani No.1	281	1300	4.63	652	648	994	0	0.00	90	6.92
Khoraghat PML										

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Ranipukhuri	98	472	4.82	263	209	795	0	0.00	244	51.69
Haripur	59	299	5.07	151	148	980	0	0.00	259	86.62
Jitapara	17	75	4.41	38	37	974	0	0.00	55	73.33
Lakhi Pathar	217	968	4.46	496	472	952	8	0.83	4	0.41
Owabari	50	195	3.90	101	94	931	0	0.00	8	4.10
Gelajan	64	308	4.81	160	148	925	0	0.00	0	0.00
Sankarpur	61	344	5.95	187	157	961	0	0.00	20	13.44
Krishnapur	265	1577	5.65	804	773	738	0	6.56	212	2.42
Kempur	53	322	4.80	168	154	880	0	1.49	8	0.00
Chetiagaon No.1	205	1159	4.31	667	492	958	76	0.00	28	7.12
Chetiagaon No.2	98	470	4.93	250	220	1082	7	0.00	0	97.52
Da-Kawalipathar No.1	75	323	6.34	165	158	1115	0	0.00	23	5.91
Jordolong No.1	41	202	5.80	97	105	977	0	13.03	197	4.98
Jordolong No.2	32	203	4.94	96	107	1203	0	0.00	12	83.44
Jahajibosti	45	261	4.33	132	129	947	34	0.00	13	48.10
Gholapani	114	451	5.14	235	216	977	0	0.00	1	0.00
Jurpukhuri	33	163	4.94	74	89	1148	0	3.45	136	7.76
Dimorujan	85	368	4.79	189	179	790	0	0.00	177	7.07
Bordondi No.2	85	437	5.18	221	216	882	0	0.00	0	0.00
Goroibil	47	232	4.63	108	124	1020	8	0.00	18	0.29

Name	No of Household	Total Population Person	Household Size	Total Population Male	Total Population Female	Sex Ratio	Scheduled Castes Population Person	Scheduled Castes Population %	Scheduled Tribes Population Person	Scheduled Tribes Population %
Dhonpur No.2	0	0	5.19	0	0	1087	0	0.00	0	78.13
Haldhibari	183	877	4.72	490	387	915	0	0.00	62	98.52
Lachit Gaon No.1	80	414	4.41	220	194	980	0	0.00	0	70.10
Bilgaon	151	699	6.05	346	353	919	0	0.00	2	0.00
Tamulpur	37	192	4.92	92	100	1000	0	0.00	150	100.00
Lotapur	43	203	4.96	106	97	989	0	0.00	200	0.34
Panbari	44	194	5.73	98	96	958	0	0.00	136	0.00
Bidyapur	363	2197	4.55	1145	1052	1000	0	0.00	0	13.33
Janakpur	39	192	4.76	96	96	1167	0	0.00	192	2.47
Hatidubi	176	873	4.71	439	434	825	0	0.00	3	95.89
Madhupur No.2	364	2087	5.48	1066	1021	951	0	0.00	0	31.50
Kamalpur	33	150	4.84	75	75	1016	0	0.00	20	82.04
Lakhinagar No.1	136	648	4.86	299	349	813	0	0.00	16	94.85
Indrapur	31	146	4.27	80	66	982	0	1.80	140	51.35
Barijan	73	400	4.42	205	195	993	0	5.57	126	0.17
Chetonapur	77	373	5.39	185	188	782	0	0.00	306	0.00
Ajharguri No.1	28	136	4.82	75	61	795	0	0.00	129	51.69
Kathonipur	26	111	5.07	56	55	980	2	0.00	57	86.62
Kochomari	130	574	4.41	288	286	974	32	0.00	1	73.33
Rana Nagar	79	426	4.46	239	187	952	0	0.83	0	0.41

Table 2: Core Zone Village: Literacy

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Nambor PML				
Nikhikhe	94	71.21	76.19	66.67
Amguri No.1	323	79.75	86.45	72.25
Aao Bosti	173	73.00	76.11	70.16
Amguri No.2	118	67.82	75.00	61.11
Kuki Bosti	373	86.74	90.05	83.56
Ming Mang No.2	188	62.67	73.29	52.60
Khehoi	0	64.65	73.47	56.00
Damodar No.2	64	63.86	74.41	52.33
Panjan No.2	0	85.94	91.41	80.22
Ratanpur	258	69.28	78.41	59.65
Janata Pathar	489	71.10	83.53	54.96
Sonali Pathar No 1&2	406	77.07	85.05	68.82
Sankarpur	214	74.33	80.41	68.42
Sonalinagar No.2	558	69.35	73.82	64.20
Thaigirguri	223	71.21	76.19	66.67
Doyalpur	0	79.75	86.45	72.25
Morajan No.1	604	73.00	76.11	70.16
East Lakhibari PML				

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Ghiladhari Bagan	2457	62.27	71.52	53.02
Merapani F.S.	2746	88.07	90.99	84.57
Matikhula Gaon	534	85.58	92.09	78.90
Golaghat PML				
Naojan Gaon	1729	82.81	86.45	78.98
Sungajan Block No.5	308	83.24	92.61	74.74
Bosapathar No.1	374	77.11	84.03	70.45
Sungajan Block No.2	329	73.77	85.52	62.22
Sungajan Block No.3	619	88.30	94.12	82.27
Betoni Jan	335	80.92	89.81	71.21
No.1 Parghat	117	74.83	81.91	67.46
Sarupathar Gaon	1534	58.41	60.38	56.48
Chukia Pathar	444	58.85	70.54	45.61
Pachim Panbari	125	78.71	88.24	69.00
Santipur No.2	143	76.47	84.43	68.10
Pathori Miching Gaon	159	77.29	83.92	69.97
Sialmari	182	91.89	98.86	85.57
Padum Pothar	541	75.35	81.03	69.29
Kalyanpur No.2	170	72.63	80.17	58.73
Bijoypur Sissupani	148	82.32	87.00	77.55
Tanajan Miching	593	82.81	86.45	78.98
Odali Pothar	130	83.24	92.61	74.74

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Doimuguri	163	77.11	84.03	70.45
Kasomarigaon Additional PML				
Samukjan No.2	253	78.09	87.80	68.13
Doyalpur Bagan	0	76.77	87.60	65.60
Milonpur	195	82.74	90.74	74.40
Samukjan	350	48.39	62.50	33.33
Mikirbosti	15	66.67	69.39	64.29
Pathortoli No.1	70	72.30	80.12	65.18
Golekpur	286	65.22	74.14	56.14
Dineshpur	496	81.62	88.93	73.97
Pawali Pothar	258	82.35	88.68	75.00
Terenga Pothar	75	85.18	90.16	79.94
Cheleng Pothar Sapekhati	404	80.00	84.52	75.32
Janata Pothar	406	74.21	80.42	67.75
Chaodang Pothar	1115	84.04	89.73	77.94
Jeypur Veleuguri	376	74.53	79.59	69.60
Chalang Pothar	981	78.09	87.80	68.13
Adarsha No.1	746	76.77	87.60	65.60
Tarani T.G.	237	82.74	90.74	74.40
Singphura	954	48.39	62.50	33.33
Kasomarigaon PML				
Madhupur	313	84.37	87.83	80.77

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Teteliguri	106	72.11	85.33	58.33
Dighalpani Kadamguri	247	66.58	76.24	57.37
Anantapur	107	69.93	81.71	56.34
Milonpur Dighalpani	31	65.96	73.91	58.33
Sibangpara	269	79.82	83.44	76.44
Batiporia Gaon	169	89.42	96.91	81.52
Nalani Pothar	960	82.83	90.42	74.82
Jaroni No.2	357	69.46	78.66	60.54
Athgaon	539	90.13	96.46	83.28
Kulajan No.2	619	88.94	95.13	82.71
Puli Bagan	188	89.10	92.38	85.85
Bhakat Gaon	439	96.06	98.28	93.78
Titabor Tangia	463	89.73	95.65	84.03
Banua Tangia	544	67.75	73.12	62.05
Torani No.1	1003	85.73	88.78	82.65
Khoraghat PML				
Ranipukhuri	196	53.99	63.50	42.33
Haripur	157	58.80	68.66	48.87
Jitapara	57	83.82	97.06	70.59
Lakhi Pathar	620	73.81	82.44	64.89
Owabari	148	87.57	93.10	81.71
Gelajan	249	87.37	91.95	82.35

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Sankarpur	214	60.02	66.35	52.88
Krishnapur	710	70.57	79.46	58.31
Kempur	146	63.64	75.00	50.83
Chetiagaon No.1	717	73.17	86.52	60.27
Chetiagaon No.2	245	69.83	75.82	63.64
Da-Kawalipathar No.1	210	75.28	86.90	64.89
Jordolong No.1	125	60.20	67.01	53.54
Jordolong No.2	134	68.46	77.14	60.76
Jahajibosti	118	73.17	84.62	61.01
Gholapani	265	70.80	80.61	60.73
Jurpukhuri	102	67.35	79.12	57.14
Dimorujan	240	65.06	72.69	55.22
Bordondi No.2	274	73.48	82.65	62.65
Goroibil	132	78.66	85.19	72.56
Dhonpur No.2	0	85.80	94.94	77.78
Haldhibari	499	69.54	78.65	60.00
Lachit Gaon No.1	266	81.61	92.13	70.59
Bilgaon	483	67.14	74.03	59.68
Tamulpur	145	80.11	88.51	71.91
Lotapur	121	64.38	68.72	60.00
Panbari	142	48.94	52.71	45.00
Bidyapur	1134	80.14	87.14	73.24

Name	Literate Population Person	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Janakpur	141	77.78	93.73	63.95
Hatidubi	479	72.95	85.07	58.18
Madhupur No.2	741	73.84	84.66	62.50
Kamalpur	113	55.42	62.58	48.52
Lakhinagar No.1	427	65.25	76.12	50.98
Indrapur	89	75.76	86.27	64.58
Barijan	254	82.46	89.84	75.10
Chetonapur	184	68.55	74.47	61.07
Ajharguri No.1	77	53.99	63.50	42.33
Kathonipur	75	58.80	68.66	48.87
Kochomari	423	83.82	97.06	70.59
Rana Nagar	231	73.81	82.44	64.89

Table 3: Core Zone Village: Livelihood

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Nambor PML										
Nikhikhe	29	157	40.76	45.31	54.69	59.24	95.31	3.13	0.00	1.56
Amguri No.1	81	446	46.41	40.10	59.90	53.59	46.38	39.61	0.48	13.53
Aao Bosti	55	267	25.84	84.06	15.94	74.16	84.06	15.94	0.00	0.00

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Amguri No.2	35	203	51.23	37.50	62.50	48.77	63.46	34.62	0.00	1.92
Kuki Bosti	94	499	43.69	56.42	43.58	56.31	89.91	3.21	0.46	6.42
Ming Mang No.2	73	358	25.70	23.91	76.09	74.30	30.43	58.70	0.00	10.87
Khehoi	0	0	61.54	58.33	41.67	38.46	52.78	1.39	22.22	23.61
Damodar No.2	24	117	50.65	99.15	0.85	49.35	66.38	0.00	5.96	27.66
Panjan No.2	0	0	33.64	79.36	20.64	66.36	55.05	27.52	0.00	17.43
Ratanpur	94	464	37.35	47.11	52.89	62.65	84.71	14.46	0.00	0.83
Janata Pathar	147	648	38.37	49.24	50.76	61.63	10.61	75.00	0.00	14.39
Sonali Pathar No 1&2	126	648	56.17	84.05	15.95	43.83	81.03	15.73	0.43	2.80
Sankarpur	61	344	26.87	100.00	0.00	73.13	92.22	6.67	0.00	1.11
Sonalinagar No.2	174	826	34.69	87.68	12.32	65.31	64.18	29.51	0.57	5.73
Thaigirguri	74	335	40.76	45.31	54.69	59.24	95.31	3.13	0.00	1.56
Doyalpur	0	0	46.41	40.10	59.90	53.59	46.38	39.61	0.48	13.53
Morajan No.1	224	1006	25.84	84.06	15.94	74.16	84.06	15.94	0.00	0.00
East Lakhibari PML										
Ghiladhari Bagan	981	4661	49.17	74.61	25.39	50.83	20.55	2.62	0.48	76.35
Merapani F.S.	717	3518	47.13	64.35	35.65	52.87	27.38	14.84	6.57	51.21
Matikhula Gaon	143	696	59.48	71.01	28.99	40.52	80.68	17.15	0.24	1.93
Golaghat PML										

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Naojan Gaon	553	2406	34.04	92.31	7.69	65.96	25.03	14.90	1.47	58.61
Sungajan Block No.5	90	416	34.38	90.91	9.09	65.63	36.36	4.20	0.70	58.74
Bosapathar No.1	128	554	70.58	32.99	67.01	29.42	78.26	16.62	1.02	4.09
Sungajan Block No.2	104	524	27.86	97.26	2.74	72.14	57.53	30.14	1.37	10.96
Sungajan Block No.3	164	775	26.45	80.98	19.02	73.55	33.17	1.95	0.49	64.39
Betoni Jan	90	465	33.76	60.51	39.49	66.24	61.15	38.22	0.00	0.64
No.1 Parghat	31	141	38.89	57.57	42.43	61.11	47.51	35.14	1.99	15.36
Sarupathar Gaon	475	2327	54.94	41.73	58.27	45.06	97.84	0.00	0.00	2.16
Chukia Pathar	145	650	50.36	90.78	9.22	49.64	98.58	0.00	0.00	1.42
Pachim Panbari	53	253	45.87	60.36	39.64	54.13	45.05	36.94	0.00	18.02
Santipur No.2	61	280	60.07	35.98	64.02	39.93	92.68	5.49	0.00	1.83
Pathori Miching Gaon	36	242	66.54	64.80	35.20	33.46	74.12	18.81	1.30	5.77
Sialmari	55	273	52.97	99.07	0.93	47.03	88.79	0.93	1.87	8.41
Padum Pothar	150	807	60.13	27.78	72.22	39.87	32.96	45.56	2.41	19.07
Kalyanpur No.2	40	202	58.25	84.07	15.93	41.75	41.59	0.00	7.96	50.44
Bijoypur Sissupani	55	236	60.27	26.52	73.48	39.73	65.91	32.58	0.00	1.52
Tanajan Miching	195	898	34.04	92.31	7.69	65.96	25.03	14.90	1.47	58.61
Odali Pothar	32	194	34.38	90.91	9.09	65.63	36.36	4.20	0.70	58.74
Doimuguri	42	219	70.58	32.99	67.01	29.42	78.26	16.62	1.02	4.09

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Kasomarigaon Additional PML										
Samukjan No.2	73	376	32.98	83.87	16.13	67.02	67.74	29.03	0.00	3.23
Doyalpur Bagan	0	0	58.00	39.08	60.92	42.00	53.45	43.68	0.00	2.87
Milonpur	56	300	79.88	98.00	2.00	20.12	51.62	35.66	9.23	3.49
Samukjan	107	502	46.34	42.11	57.89	53.66	63.16	21.05	5.26	10.53
Mikirbosti	7	41	40.98	92.00	8.00	59.02	70.00	0.00	2.00	28.00
Pathortoli No.1	24	122	66.54	61.25	38.75	33.46	72.99	14.48	7.83	4.70
Golekpur	96	497	34.78	97.92	2.08	65.22	89.58	4.17	0.00	6.25
Dineshpur	148	768	46.75	64.09	35.91	53.25	84.56	5.41	0.00	10.04
Pawali Pothar	103	517	64.29	42.45	57.55	35.71	58.40	16.24	15.10	10.26
Terenga Pothar	24	138	60.11	48.45	51.55	39.89	41.10	56.37	0.57	1.95
Cheleng Pothar Sapekhati	111	554	61.51	41.52	58.48	38.49	68.13	24.56	0.29	7.02
Janata Pothar	112	546	38.44	74.53	25.47	61.56	36.24	51.97	1.54	10.26
Chaodang Pothar	290	1449	50.81	83.33	16.67	49.19	53.85	0.00	39.10	7.05
Jeypur Veleuguri	118	556	43.78	50.08	49.92	56.22	61.77	9.32	2.37	26.54
Chalang Pothar	298	1522	32.98	83.87	16.13	67.02	67.74	29.03	0.00	3.23
Adarsha No.1	212	994	58.00	39.08	60.92	42.00	53.45	43.68	0.00	2.87
Tarani T.G.	65	307	79.88	98.00	2.00	20.12	51.62	35.66	9.23	3.49
Singphura	308	1446	46.34	42.11	57.89	53.66	63.16	21.05	5.26	10.53

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Kasomarigaon PML										
Madhupur	86	429	58.51	89.24	10.76	41.49	72.11	10.36	0.40	17.13
Teteliguri	33	175	56.00	72.45	27.55	44.00	51.02	34.69	6.12	8.16
Dighalpani Kadamguri	87	415	46.51	18.65	81.35	53.49	47.67	37.82	1.04	13.47
Anantapur	36	160	57.50	46.74	53.26	42.50	73.91	8.70	6.52	10.87
Milonpur Dighalpani	13	55	56.36	48.39	51.61	43.64	51.61	48.39	0.00	0.00
Sibangpara	86	372	50.54	51.06	48.94	49.46	46.28	27.66	13.83	12.23
Batiporia Gaon	41	207	56.04	76.72	23.28	43.96	64.66	18.97	4.31	12.07
Nalani Pothar	251	1343	62.77	60.85	39.15	37.23	68.56	19.34	3.44	8.66
Jaroni No.2	126	603	73.13	34.92	65.08	26.87	59.18	31.97	8.16	0.68
Athgaon	143	656	62.50	37.80	62.20	37.50	71.22	14.88	0.00	13.90
Kulajan No.2	158	793	69.86	29.06	70.94	30.14	79.60	16.06	1.08	3.25
Puli Bagan	53	244	60.66	46.62	53.38	39.34	37.16	48.65	3.38	10.81
Bhakat Gaon	118	549	56.10	6.82	93.18	43.90	88.96	9.42	0.65	0.97
Titabor Tangia	129	582	65.29	62.11	37.89	34.71	62.89	25.26	2.11	9.74
Banua Tangia	212	940	43.09	57.78	42.22	56.91	56.54	19.26	0.00	24.20
Torani No.1	281	1300	59.15	65.15	34.85	40.85	80.10	11.05	0.13	8.71
Khoraghat PML										
Ranipukhuri	98	472	40.89	54.40	45.60	59.11	90.16	8.81	0.00	1.04

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Haripur	59	299	54.52	73.01	26.99	45.48	93.25	2.45	0.00	4.29
Jitapara	17	75	92.00	24.64	75.36	8.00	100.00	0.00	0.00	0.00
Lakhi Pathar	217	968	65.19	10.78	89.22	34.81	68.15	19.18	2.54	10.14
Owabari	50	195	35.38	98.55	1.45	64.62	84.06	2.90	4.35	8.70
Gelajan	64	308	52.60	75.31	24.69	47.40	96.91	1.85	0.00	1.23
Sankarpur	61	344	40.08	90.03	9.97	59.92	77.69	0.00	4.11	18.20
Krishnapur	265	1577	61.86	35.01	64.99	38.14	55.37	18.69	0.56	25.38
Kempur	53	322	58.51	45.45	54.55	41.49	94.18	2.91	0.36	2.55
Chetiagaon No.1	205	1159	44.58	65.97	34.03	55.42	98.61	0.00	0.00	1.39
Chetiagaon No.2	98	470	20.79	100.00	0.00	79.21	73.81	7.14	0.00	19.05
Da-Kawalipathar No.1	75	323	31.53	73.44	26.56	68.47	78.13	17.19	0.00	4.69
Jordolong No.1	41	202	51.34	60.45	39.55	48.66	98.51	0.75	0.00	0.75
Jordolong No.2	32	203	34.36	92.86	7.14	65.64	100.00	0.00	0.00	0.00
Jahajibosti	45	261	22.55	97.59	2.41	77.45	91.57	1.20	0.00	7.23
Gholapani	114	451	67.73	25.00	75.00	32.27	33.45	30.07	5.07	31.42
Jurpukhuri	33	163	57.33	42.86	57.14	42.67	73.68	24.81	0.00	1.50
Dimorujan	85	368	61.69	37.89	62.11	38.31	31.79	32.16	0.00	36.04
Bordondi No.2	85	437	31.88	100.00	0.00	68.12	80.30	10.61	0.00	9.09
Goroibil	47	232	40.34	60.64	39.36	59.66	93.97	2.13	1.77	2.13

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Dhonpur No.2	0	0	54.17	36.54	63.46	45.83	34.62	63.46	0.00	1.92
Haldhibari	183	877	31.53	68.75	31.25	68.47	65.63	31.25	0.00	3.13
Lachit Gaon No.1	80	414	55.67	56.48	43.52	44.33	33.33	18.52	2.78	45.37
Bilgaon	151	699	36.60	58.33	41.67	63.40	56.84	6.09	3.86	33.21
Tamulpur	37	192	68.23	33.59	66.41	31.77	99.24	0.00	0.00	0.76
Lotapur	43	203	72.16	31.27	68.73	27.84	76.67	17.30	0.00	6.03
Panbari	44	194	30.95	68.11	31.89	69.05	74.46	10.37	0.31	14.86
Bidyapur	363	2197	43.33	55.38	44.62	56.67	83.08	16.92	0.00	0.00
Janakpur	39	192	58.64	33.42	66.58	41.36	56.58	23.42	0.26	19.74
Hatidubi	176	873	51.37	70.67	29.33	48.63	44.00	45.33	5.33	5.33
Madhupur No.2	364	2087	65.00	39.62	60.38	35.00	100.00	0.00	0.00	0.00
Kamalpur	33	150	27.08	80.20	19.80	72.92	71.29	20.79	0.99	6.93
Lakhinagar No.1	136	648	61.76	35.71	64.29	38.24	32.14	65.48	0.00	2.38
Indrapur	31	146	63.06	37.14	62.86	36.94	35.71	62.86	0.00	1.43
Barijan	73	400	42.68	63.67	36.33	57.32	79.59	13.88	2.86	3.67
Chetonapur	77	373	35.45	70.86	29.14	64.55	47.02	30.46	1.32	21.19
Ajharguri No.1	28	136	40.89	54.40	45.60	59.11	90.16	8.81	0.00	1.04
Kathonipur	26	111	54.52	73.01	26.99	45.48	93.25	2.45	0.00	4.29
Kochomari	130	574	92.00	24.64	75.36	8.00	100.00	0.00	0.00	0.00

Name	No of Households	Total Population Person	Total Workers (%)	Main Workers (%)	Marginal Workers (%)	Non workers (%)	Total Cultivators (%)	Total Agricultural Workers (%)	Household	Other
Rana Nagar	79	426	65.19	10.78	89.22	34.81	68.15	19.18	2.54	10.14

Appendix 3.10 Consultation of the Socio-Economic

Consultation with Villagers

<table>
<tr><td>A</td><td colspan="2">Project Title:</td><td colspan="2">Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.</td></tr>
<tr><td>B</td><td colspan="2">Stakeholder Title:</td><td colspan="2">Villagers</td></tr>
<tr><td rowspan="3">C</td><td colspan="4">Basic details: The villagers group consisted of women from the community and tea garden workers</td></tr>
<tr><td colspan="2">Location:</td><td colspan="2">Chowdang Pothar</td></tr>
<tr><td colspan="2">Date</td><td colspan="2">3rd January 2020</td></tr>
<tr><td rowspan="4">D</td><td colspan="4">Attended By</td></tr>
<tr><td>Sr.</td><td colspan="2">Name</td><td>Designation</td></tr>
<tr><td>1.</td><td colspan="3">Villagers of Giladhari</td></tr>
<tr><td>2.</td><td colspan="2">Debsagar Das</td><td>Aecom Representative</td></tr>
<tr><td></td><td>3;</td><td colspan="2">Sudin Paul</td><td>Aecom representative</td></tr>
<tr><td rowspan="2">E</td><td colspan="4">Purpose of Consultation:</td></tr>
<tr><td colspan="4">To understanding the socio-economic condition of the village
To know Basic facilities availed by the people
To understand attitude towards any development project
To understand problems of the villagers and their expectations</td></tr>
<tr><td>F</td><td colspan="4">Key Points Inferred:
Most of the villagers are farmer by occupation.
Cast is mainly Hindu.
All the farmers are having their own land.
Transportation facility is poor.
Government schemes are not distributed properly.
1 Primary and middle school is present in the village.
Land erosion is a problem during monsoon.
Drinking water avaibility is mainly from tubewell.
Lack of medical facility.</td></tr>
</table>

Consultation with School teacher

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.
B	***Stakeholders:***	Local villagers
C	***Basic details:*** Consultation with School Headmaster	
	Location:	Kachomari Majgaon
	Date	3rd January 2020

D	***Attended By***		
	Sr.	**Name**	**Designation**
	1.	Nilkanta Baruah	Headmaster
	2.	Debsagar Das	Social Expert
	3;	Sudin Paul	External Consultant

E	***Purpose of Consultation:***
	• To understanding the socio-economic condition of the town • To understand employment opportunities of the town • To know Basic facilities availed by the people • To understand attitude towards any development project • To understand problems and their expectations
F	***Key Points Inferred:*** • Most of the villagers are farmer by occupation. • Cast is mainly Hindu. • Most of the children are school going. • Transportation facility is poor. • Electricity is well available in the villages. • Government facility is not well distributed. • Medical facility needs to developed.

Consultation with the villagers

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.	
B	***Stakeholder Title:***	Farmer (Female)	
C	***Basic details:*** Consultation with the farmere		
	Location:	Dineshpur	
	Date	4th January 2020	
D	***Attended By***		
	Sr.	**Name**	**Designation**
	1.	Janaki Rabha	Farmer
	2.	Debsagar Das	Aecom representative
	3;	Sudin Paul	Aecom representative
E	***Purpose of Consultation:***		
	• To understanding the socio-economic condition • To know Basic facilities availed by the people • To understand attitude towards any development project • To understand problems of the villagers and their expectations		
F	***Key Points Inferred:*** • Most of the villagers are farmer by occupation. • Cast is mainly Hindu. • Two school is present in the village and mid day meal is available there. • Government facility for new house is available, along with BPL card facility. • Krishi Rin is not available. • Land erosion is a huge problem during monsoon. • ONGC has some CSR activity in the specific village. • Irrigation is done from mainly rain water. • Weekly hat is there. • Medical facility needs to be debeloped.		

Consultation with Business man

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.
B	***Stakeholder Title:***	Local shop owner
C	***Basic details:*** Consultation with the local shop owner who has recently started this store.	
	Location:	Rengma Grant
	Date	4^{th} January 2020
D	***Attended By***	

Sr.	Name	Designation
1.	Akhil Soikhia	Shop Owner
2.	Debsagar Das	Aecom representative
3;	Sudin Paul	Aecom representative

E ***Purpose of Consultation:***

- To understanding the socio-economic condition
- To know Basic facilities availed by the people
- To understand attitude towards any development project
- To understand problems of the villagers and their expectations

F ***Key Points Inferred:***

- Most of the villagers are farmer by occupation.
- Cast is mainly Hindu.
- Two school is present in the village and mid day meal is available there.
- Most of the villagers are literate.
- Government facility for new house is available, along with BPL card facility.
- Land erosion is a huge problem during monsoon.
- Irrigation is done from mainly rain water.
- Weekly hat is there.
- Medical facility needs to be developed.
- Villagers are well aware of the oil drilling.

Consultation with Villager

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.
B	***Stakeholder Title:***	Local villagers
C	***Basic details:*** Consultation with the villagers and elderly members of the community	
	Location:	Majnapara
	Date	4th January 2020

D ***Attended By***

Sr.	Name	Designation
1.	Biswa Das	Farmer/Driver
2.	Debsagar Das	Aecom representative
3;	Sudin Paul	Aecom representative

E ***Purpose of Consultation:***

- To understanding the socio-economic condition
- To know Basic facilities availed by the people
- To understand attitude towards any development project
- To understand problems of the villagers and their expectations

F ***Key Points Inferred:***

- Most of the villagers are farmer by occupation.
- Cast is mainly Hindu and Muslims.
- Two primary and one middle school is present.
- Most of the villagers are literate.
- Government facility for new house is available, along with BPL card facility.
- Land erosion is a huge problem during monsoon.
- Irrigation is done from mainly rain water.
- Weekly hat is there.
- Medical facility needs to be developed.
- Rainwater harvesting is a practice here.

Consultation with Panchayet

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.		
B	***Stakeholder Title:***	Local villagers and nurse		
C	***Basic details:*** Consultation with the Panchayet member			
	Location:	Na Gaon Bosai		
	Date	4th January 2020		
D	***Attended By***			
	Sr.	**Name**	**Designation**	
	1.	Dilip Hazorika	Panchayet Member	
	2.	Debsagar Das	Aecom representative	
	3;	Sudin Paul	Aecom representative	
E	***Purpose of Consultation:***			
	• To understanding the socio-economic condition • To know Basic facilities especially medical facility availed by the people • To understand attitude towards any development project • To understand problems of the villagers and their expectations			
F	***Key Points Inferred:*** • Most of the villagers are farmer by occupation. • Cast is mainly Hindu and Muslims. • One primary and one middle school is present. • Most of the villagers are literate. • Government facility for new house is available, along with BPL card facility. • Land erosion is a huge problem during monsoon. • Irrigation is done from mainly rain water. • Weekly hat is there. • Medical facility needs to be developed. • Road Condition is worse in the season of monsoon.			

Consultation with Villagers

<table>
<tr><td>A</td><td colspan="2">Project Title:</td><td colspan="2">Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.</td></tr>
<tr><td>B</td><td colspan="2">Stakeholder Title:</td><td colspan="2">Villagers of Giladhari</td></tr>
<tr><td rowspan="3">C</td><td colspan="4">Basic details: The villagers group consisted of women from the community and tea garden workers</td></tr>
<tr><td colspan="2">Location:</td><td colspan="2">Giladhari</td></tr>
<tr><td colspan="2">Date</td><td colspan="2">3rd January 2020</td></tr>
<tr><td rowspan="4">D</td><td colspan="4">Attended By</td></tr>
<tr><td>Sr.</td><td colspan="2">Name</td><td>Designation</td></tr>
<tr><td>1.</td><td colspan="3">Villagers of Giladhari</td></tr>
<tr><td>2.</td><td colspan="2">Dripta Nag</td><td>Social Expert</td></tr>
<tr><td></td><td>3;</td><td colspan="2">Arindam Ghosh</td><td>External Consultant</td></tr>
<tr><td rowspan="2">E</td><td colspan="4">Purpose of Consultation:</td></tr>
<tr><td colspan="4">To understanding the socio-economic condition of the village
To know Basic facilities availed by the people
To understand attitude towards any development project
To understand problems of the villagers and their expectations</td></tr>
<tr><td>F</td><td colspan="4">Key Points Inferred:
It was informed that this village has adequate number of schools with 1 lower primary school, 3 primary schools and 1 higher secondary school. It was also mentioned that the children do not have to extensively walk to reach the schools. Most of the population of village work in the tea garden which was provides employment to the women of the village. It was stated that the villagers depend on the private tea garden hospital nearby for any medical assistance. The local transport means like autos connects this village with the nearby towns like Golaghat. The condition of the main road is satisfactory while the internal roads are not in good condition especially during rainy season. village lacks adequate and regular supply of water which is an issue. The villagers expressed their concern about lack of employment opportunity where the villagers have only two options of agriculture or working in the tea garden.</td></tr>
</table>

Consultation with the local shop owners

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.
B	***Stakeholders:***	Local shop owners
C	***Basic details:***: Consultation with the local shop owners who live in the town	
	Location:	Gomari
	Date	3rd January 2020
D	***Attended By***	

Sr.	Name	Designation
1.	Shop owners of Gomari	
2.	Dripta Nag	Social Expert
3;	Arindam Ghosh	External Consultant

E ***Purpose of Consultation:***

- To understanding the socio-economic condition of the town
- To understand employment opportunities of the town
- To know Basic facilities availed by the people
- To understand attitude towards any development project
- To understand problems and their expectations

F ***Key Points Inferred:***

The shop owners told that this town has a population of 20000. Agriculture is the primary occupation and rice is the only crop grown here along with vegetables which are sold in local and nearby markets. This town is a major trading centre for the surrounding village and it was informed that almost 20% of the population in engaged in trade and commerce. Very few people are engaged in service sector. It was informed that there are adequate educational facilities in this town with primary, middle, higher secondary schools. The piped water supply is not irregular and most of the population depend on tube wells. It was reported that almost 90% of the population have toilets at home. However, many have a problem in maintaining the toilets. It was stated that the condition of the roads is a concern for the population. There are very limited opportunities for work and people from this town regularly migrate for work. There are many unemployed young people in the town and it was stated that their employment is a general concern among the people.

Consultation with the villagers

<table>
<tr><td>A</td><td colspan="2">Project Title:</td><td colspan="2">Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.</td></tr>
<tr><td>B</td><td colspan="2">Stakeholder Title:</td><td colspan="2">Shop owner and villagers</td></tr>
<tr><td rowspan="3">C</td><td colspan="4">Basic details: Consultation with the local shop owner and villagers</td></tr>
<tr><td colspan="2">Location:</td><td colspan="2">Adekoho near Singapura</td></tr>
<tr><td colspan="2">Date</td><td colspan="2">3rd January 2020</td></tr>
<tr><td rowspan="4">D</td><td colspan="4">Attended By</td></tr>
<tr><td>Sr.</td><td colspan="2">Name</td><td>Designation</td></tr>
<tr><td>1.</td><td colspan="3">the local shop owners and villagers</td></tr>
<tr><td>2.</td><td colspan="2">Dripta Nag</td><td>Social Expert</td></tr>
<tr><td></td><td>3;</td><td colspan="2">Arindam Ghosh</td><td>External Consultant</td></tr>
<tr><td rowspan="2">E</td><td colspan="4">Purpose of Consultation:</td></tr>
<tr><td colspan="4">To understanding the socio-economic condition
To know Basic facilities availed by the people
To understand attitude towards any development project
To understand problems of the villagers and their expectations</td></tr>
<tr><td>F</td><td colspan="4">Key Points Inferred:
It was informed during interaction that the village has a population size of 2000. There is one primary school and children have to travel to other villages or to Merapani for education. The electricity supply is not regular and on an average they have 12 hrs of electricity a day. The village does not have piped water supply and depend on tube wells. Agriculture is the primary occupation here and most of the households own small tea gardens. It was informed that almost 90% have tea gardens. For any medical emergencies the villagers have to go to Merapani PHC. This village has no medical facility and it remains a concern for the villagers. It was also informed that they have to depends on other nearby villages for health camps. The roads are broken and there is limited public transport available in this area.</td></tr>
</table>

Consultation with Shop-owner

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.	
B	***Stakeholder Title:***	Local shop owner	
C	***Basic details:*** Consultation with the local shop owner who has recently started this store.		
	Location:	Dayalpur	
	Date	3rd January 2020	
D	***Attended By***		
	Sr.	**Name**	**Designation**
	1.	Local shop owner	
	2.	Dripta Nag	Social Expert
	3;	Arindam Ghosh	External Consultant
E	***Purpose of Consultation:***		
	• To understanding the socio-economic condition • To know Basic facilities availed by the people • To understand attitude towards any development project • To understand problems of the villagers and their expectations		
F	***Key Points Inferred:*** It was informed during interaction that the village has a population size of 1000. It was informed that a considerable number of different tribes mainly from Nagaland live in this village. There is one lower primary and one middle school. To avail any medical facility, the villagers have to travel to Merapani PHC. The village gest on an average 20 hours of electricity a day. Though almost every household has toilet, there is no septic tank and the wastewater is discharged in the open drain. Agriculture is the primary occupation and paddy is mainly grown here. There is no waste collection system and the waste is dumped and burnt frequently.		

Consultation with Villagers

A	***Project Title:***	Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.	
B	***Stakeholder Title:***	Local villagers	
C	***Basic details:*** Consultation with the villagers and elderly members of the community		
	Location:	Singimari	
	Date	4rd January 2020	
D	***Attended By***		
	Sr.	**Name**	**Designation**
	1.	Local villagers	
	2.	Dripta Nag	Social Expert
	3;	Arindam Ghosh	External Consultant
E	***Purpose of Consultation:***		
	• To understanding the socio-economic condition • To know Basic facilities availed by the people • To understand attitude towards any development project • To understand problems of the villagers and their expectations		
F	***Key Points Inferred:*** It was informed during interaction that the village has 70 households. It was informed that connectivity is a major problem for this village. The roads are broken and during rainy season the village is completely cut of from the main road. There is a lowland in the village which causes frequent flooding. Agriculture is the primary occupation here where paddy, jute and mustard are grown. However, agriculture is majorly affected because of flood. Most of the households do not have toilet. For any medical emergencies, the villagers have to go to Barapathar.		

Consultation with Nurse and Patients

<table>
<tr><td>A</td><td colspan="2">Project Title:</td><td colspan="2">Socio-economic studies for studying the impact of the upcoming proposed development of exploratory and appraisal wells.</td></tr>
<tr><td>B</td><td colspan="2">Stakeholder Title:</td><td colspan="2">Local villagers and nurse</td></tr>
<tr><td rowspan="3">C</td><td colspan="4">Basic details: Consultation with the villagers who came to the State dispensary and the nurse</td></tr>
<tr><td colspan="2">Location:</td><td colspan="2">Silonijaan</td></tr>
<tr><td colspan="2">Date</td><td colspan="2">4rd January 2020</td></tr>
<tr><td rowspan="4">D</td><td colspan="4">Attended By</td></tr>
<tr><td>Sr.</td><td colspan="2">Name</td><td>Designation</td></tr>
<tr><td>1.</td><td colspan="3">Local villagers and nurse</td></tr>
<tr><td>2.</td><td colspan="2">Dripta Nag</td><td>Social Expert</td></tr>
<tr><td></td><td>3;</td><td colspan="2">Arindam Ghosh</td><td>External Consultant</td></tr>
<tr><td rowspan="2">E</td><td colspan="4">Purpose of Consultation:</td></tr>
<tr><td colspan="4">To understanding the socio-economic condition
To know Basic facilities especially medical facility availed by the people
To understand attitude towards any development project
To understand problems of the villagers and their expectations</td></tr>
<tr><td>F</td><td colspan="4">Key Points Inferred:
It was informed during interaction that the villagers avail the medical facility of the state dispensary for illnesses like fever, diarrhoea and hypertension. On an average this state dispensary treats 30-40 patients. There is no anti-venom vaccination available in this dispensary. The local villagers also informed that they rely on this state dispensary for child delivery. The is no piped water supply since many years and they depend on wells. There is no garbage collection system avail and the garbage is usually dumped and burnt. The internal roads are broken. The electricity supply is very irregular and it was informed that they get an average of only 5-6 hours of electricity.</td></tr>
</table>

Appendix 3.11

Well profile of the Block

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
1	ELDA	26°22'4.73"N 94° 2'58.19"E	East Lakhibari PML	Merapani		Golaghat	Existing well pad of ELAA	An approach road is there, just beside the well pad, which is connected to Wokha Merapani road, to the east.	Flat land	NA	The well is present within the Dayang reserve forest.	The ESZ of Nambor WLS is present 0.15 km west from the PML boundary.	Some scattered patch of settlement is present within the 1 km radis of the well location. Wokha T.E, Matikhula, Merapani, Ghiladhari, Mokrong T.E, Jerpai and Rupkolia are the nearest settlement present within 2.5 km km radius of the well location. Only 1 school is present within the 1 km radius of the well location, to north east. No health centre is present within the 2.5 km radius of the well location.	NA	NA
2	KSDC	26°17'38.79" N 94° 2'48.43"E	Kasomarigaon PML	Athgaon		Golaghat	Existing well pad	No such approach road is present, but	Flat land	NA	The well is present within the	NA	Some scattered patch of settlement is present within the 1 km radius of	NA	An existing well pad is

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
								a village road is present 0.16 km south from the well location, which is connected to wokha merapani road, to the west.			Dayang reserve forest.		the well location, to the west. Noloni Pothar, Panchvati, Athgaon, Milonpur Dighalpani are the nearest settlement present within the 1 km radius of the well location. No health care centre or school is present within the 1 km radius of the well location.		present 1.23 km north east from well location.
3	KSDD	26°17'58.45" N 94° 3'26.20"E	Kasomarigaon PML	Athgaon		Golaghat	Existing well pad	An approach road is present for the existing well pad, which is connected to Wokha Merapani road.	Flat land	NA	The well is present within the Dayang Reserve forest.	NA	No such settlement is present within the 1 km radius of the well ocation, except some scattered patch of settlement, the nearest settlement is present 0.28 km NW from the well location. Athgaon, Jaroni No. 2, Kulajan No. 2, Upper	NA	An existing well pad is present 1.23 km SW from the well location.

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
													Merapani are the nearest villeges present within the 1 km radius of the well location. No health care centre or school is present within the 1 km radius of the well location.		
4	DPDM, DPDN, DPDO, DPDP, DPDQ, DPDR	26°14'16.04" N 94° 0'30.01"E	Cluster 3, Kasomari gaon PML (Additional Area)	Sonapur		Golaghat	Agricultural land	Dineshpur Road is present 0.16 km North from the well location, later this road is connected to Golaghat Kachomari road.	Flat land	NA	The well is present within Dayang Reserve forest	NA	A small patch of settlement is present 0.20 km NE from the well location. Sonapur, Chitalmari, Ratanpur, Panbari are the villages present within the 1 km radius of the well location. A school is present 0.67 km SW from the well location.	NA	NA

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
													No health care facility is present within the 1 km radius of the well location.		
5	DPDD, DPDH, DPDI, DPDJ, DPDK, DPDL	26°13'36.33" N 94° 0'4.06"E	Cluster 2, Kasomarigaon PML (Additional Area)	Jitpur No. 2		Golaghat	Agricultural land	Kalyanpur road is 0.21 km west from the well location.	Flat land	Dhansiri river is 0.91 km west from the well location.	The wells are within the Dayang Reserve forest.	NA	Some small patch of settlement is present to the east within the 0.60 km from the well location. Jitpur No. 2, Sonalipothar, Doyalpur, Lakhi Pothar No.2, Pathortoli No. 1 are the villages present within the 1 km radius of the well location. One primary school is present 0.69 km NE from the well location. No health care facility is present within the 1 km radius of the well location.	NA	NA

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
6	DPDA, DPDB, DPDC, DPDE, DPDF, DPDG	26°12'29.19" N 93°59'24.93" E	Golaghat District PML	Sahidpur		Golaghat	Agricultural land	Kalyanpur Road is 0.12 km west from the well location.	Flat land	Dhansiri river is 0.77 km west from the well location.	The well locations are within the Dayang Reserve forest.	NA	A small patch of settlement is present to the east at a distance of 0.08 km from the well location. Sahidpur, new Roni Bosti, Sonali Pothar No.2, Joyti Pothar, are the villages present ithin the 1 km radius of the well locations. Nareshpur LP school is present 0.51 km south from the well location. No health care facility is present within the 1 km radius of the well locations.	NA	NA
7	NRDJ	26° 3'1.54"N	Nambar PML	No-Khuti		Golaghat	Existing well pad	An approach road is present with	Flat Land	NA	The well locations are within	NA	A small patch of settlement is present just beside the well pad.	NA	The well is itself present

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
		93°53'35.17" E						the existing well pad.			Nambar South Forest reserve.		Aao Basti, Nikhikhe are the villages present within the 1 km radius of the well location. A govt. Middle school is present 0.70 km SW from the well location. No health care facility is present within the 1 km radius of the well location.		in a well pad.
8	NRDK	26°3'18.11" N 93°54'37.13" E	Nambar PML	Sonalinagar No.2		Golaghat	Existing well pad	An approach road is present with the existing well pad.	Flat land	A river is 0.59 km east from the well location.	Nambar souh forest reserve	NA	A patch of settlement is present 0.29 km east from the well location. Sonalinagar No. 2 is the only village present within the 1 km radius of the well location. No school or health care facility is present within	NA	The well is present in a existing well pad.

Sl. No	Well Name	Geographical Coordinates	PML	Admiration Setting			Existing Land cover of wells	Accessibility (in approx.)	Environmental Setting of Wells		Ecological Sensitivity		Settlement/ School within 1km	Existing INDUSTRY	Existing facility
				Village	Block	District			Terrain Type	Stream/ River	Forest	WLS/ ESZ			
													the 1 km radius of the well location.		
9	KHDE	26° 5'9.74"N 93°56'58.79" E	Khoraghat Ext-1 PML	Chetiagaon No. 1		Golaghat	Agricultural land	Bidyapur road is 0.42 km east from the well location.	Flat land	NA	The well is within the Dayanf reserve forest	NA	Some scattered patch of settlement is present 0.26 km north from the well location. Chetiagaon No. 2, Chetiagaon No. 1, Lachit Gaon No. 1 are the villages present within 1 km radius of the well location. Two schools are present 0.79 km south from the well location, and one lower primary school is present 0.82 km east from the well location. No health care facility is present within the 1 km radius of the well location.	NA	GGS Khoraghat is present within the 1 km radius of the well location.

Appendix 9.1

Onsite Emergency Medical Policy

Manpower in the organization is the most important resource and maintaining their health is vital for productivity and effectiveness. As such, promotion of health of employees in the widest sense has become a high priority goal for the organization. ONGC has formulated a policy (effective from 5th July 2007) on Periodic Medical Examination (PME), some important features of which are detailed below:

Type of PME	**Employees to be covered**	**Periodicity**
General PME	Employees upto 45 years of age	5 Years
	Employees in age group of 46 to 55 years	3 Years
	Employees in age group of 56 years and above	2 Years
Specific PME	Employees having hazard-based profiles	2 Years
Intermediate PME	On need basis – upto 10% of employees examined in a particular year	Every Year

PME will be conducted in two stages

•Laboratory tests either in-house or at empanelled lab/diagnostic center.

•Clinical examination including interview, which will include physical parameters, spirometry, audiometry tests, flexibility test (P4), physical evaluation of male field personnel, interview to fill in the personal and family history sheets, psychological evaluation etc.

Procedure

•Medical Officer (Occupational Health) will record the pertinent findings in Periodic Medical Profile and simultaneously in Occupational Health System. He will record these findings in a register also which is required to be maintained in compliance with the provisions of Indian Factories Act.

•MO (OH) will issue form 'O' required under the provisions of Mines Act 1952, certifying the fitness of field employees to the concerned Sectional Head and the individual. A copy of the said document will also be kept in record at the Occupational Health Centre.