Azadi ka Amrit Mahotsav

GOVERNMENT OF ASSAM
ENVIRONMENT AND FOREST DEPARTMENT
DISPUR, GUWAHATI-6

No.FRS.67/2022/157 Dated Dispur, the 16th July, 2022

To : The Inspector General of Forest (Central),
Government of India,
Ministry of Environment, Forest & Climate Change,
Integrated Regional Office, 4th Floor, Housefed Building,
G.S Road, Rukminigaon, Guwahati-781022

Sub: Forest diversion proposal for 2.583 Ha. of forest land for 6 Nos. drill development wells from KHDI, KHEC, , KHED, KHEE, KHEF and KHEG in Rengma Reserved Forest under Golaghat Division in favour of ONGC, Jorhat.

Ref: Govt. of India letter No3-AS B 104/2022-GHY/2547-2548 dated 2.6.2022.

Sir,

In inviting a reference to your letter on the subject cited above, I am directed to furnish herewith the additional information/documents as below for favour of your kind information and necessary action: -

Govt. of India letter No 3-AS B 104/2022-GHY/2547-2548 dated 2.6.2022	**Information Provided**
Condition No. (1)	As per DFO, Golaghat Division report the proposed area is under paddy cultivation done by some local habitants vide their letter No. A/62/ONGC/KHDI/Glt. Divn/2022/1407-08 dated 1.7.2022 (Copy enclosed as **Annexure-I**).
Condition No. (2)	The User Agency (ONGC) stated that the proposed area is a fresh land and no drilling activity has taken place vide letter No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster dated 2.7.2022 (Copy enclosed as **Annexure-II**).
Condition No. (3)	The User Agency (ONGC) stated that the proposed area is in "Rengma Reserved Forest" not in Nambar South Reserved Forest vide letter No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster dated 2.7.2022 (Copy enclosed as **Annexure-II**).
Condition No. (4)	The User Agency (ONGC) has submitted the cumulative Environment Impact Studies was conducted for this area. (Copy enclosed as **Annexure-III)**
Condition No. (5)	The User Agency (ONGC) has submitted the surface mining plan of this proposed 6 Nos. of drilling and development wells authenticated by the competent authority. (Copy enclosed as **Annexure-IV)**
Condition No. (6)	The DFO, Doomdooma Division has submitted Site Suitability Certificate for Compensatory Afforestation Area. (Copy enclosed as **Annexure-V**).

Condition No. (7)	The User Agency (ONGC) stated that the Environmental Clearance is under process vide letter No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster dated 2.7.2022 (Copy enclosed as **Annexure-II**).
Condition No. (8)	The User Agency (ONGC) has deposited the 2 % NPV for proposed drilling wells to the Ad-hoc CAMPA account on 30.9.2016 (Copy enclosed as **Annexure-VI**)
Condition No. (9)	The User Agency (ONGC) stated that the 6 Nos. of wells with 17.5 inches of Diameter are proposed from this land vide letter No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster dated 2.7.2022 (Copy enclosed as **Annexure-II**).
Condition No. (10)	The User Agency (ONGC) has submitted the layout map of the proposed area (Copy enclosed as **Annexure-VII**)
Condition No. (11)	The DFO, Golaghat Division has submitted the calculated revised rate of Net Present Value amount. (Copy enclosed as **Annexure-VIII**).
Condition No. (12)	The User Agency (ONGC) has submitted the undertaking for NPV (Copy enclosed as **Annexure-IX)**
Condition No. (13)	The User Agency (ONGC) stated that the FRA-2006 certificate is under process vide letter No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster dated 2.7.2022 (Copy enclosed as **Annexure-II**).

Yours faithfully,

Enclo: As stated above.

(I. Kalita, ACS)
Addl. Secretary to the Govt. of Assam
Environment and Forest Department

Memo No.FRS.67/2022/157-A

Dated Dispur, the 16th July, 2022

Copy to:

1. The Principal Chief Conservator of Forests & HoFF, Assam, Panjabari, Guwahati-37.

(I. Kalita, ACS)
Addl. Secretary to the Govt. of Assam
Environment and Forest Department

Nodal 05-7-22 Annex-I (37)

GOVERNMENMT OF ASSAM
OFFICE OF THE DIVISIONAL FOREST OFFICER
GOLAGHAT DIVISION:::::::::::::: GOLAGHAT

e-mail: dfo.t.golaghat@gmail.com

Letter No. A /62/ONGC/KHDI/Glt. Divn/2022/1407-08 Dtd. 01/07/2022.

To,

The Chief Conservator of Forests & Nodal Officer (FC Act.),
O/o the PCCF & HoFF, Assam,
Panjabari, Ghy-37.

Sub: Forest diversion proposal for 2.583 ha. of forest land for 6 nos. drill development wells in KHDI, KHEC, KHED, KHEE, KHEF and KHEG in Rengma Reserved Forest under Golaghat Division in favour of ONGC.

Ref: CCF & Nodal Officer (FC Act.), O/o the PCCF & HoFF, Assam vide letter no. FG.27/Nodal/Driiling Location/ONGC, dtd. 04/06/2022.

Sir,

With reference to the subject cited above, I have the honour to submit herewith the information/documents as per the query raised by the Intergrated Regional Office (IRO), Guwahati against the forest diversion proposal for 2.583 ha. of forest land for 6 nos. drill development wells in KHDI, KHEC, KHED, KHEE, KHEF and KHEG in Rengma Reserved Forest under Golaghat Division in favour of ONGC are as follows:

SL. No.	Observations	Reply
1	The current status of the encroachment in the proposed area 2.583 ha as DFO in Part II form mentioned that "the entire RF is encroached by human being and not a habitat of wildlife animal."	The proposed area is under paddy cultivation done by some local habitants.
2	Whether any earlier drilling activities has been carried out in proposed drilling site or not, if yes, the detail on the forest clearance under F(C) Act,1980 is to be provided.	**Replied by the User Agency:** This is a fresh land and no drilling activity has taken place.
3	To clarify the legal status of the proposed area as it is mentioned as 'Nambar South RF" in the submitted "Justification for locating the project in forest land" whereas as mentioned as "Rengma RF" in the other submitted documents.	**Replied by the User Agency:** The Proposed area is in "Rengma RF" not in Nambar South RF
4	The cumulative impact study of the proposed 6 Nos. of drill development wells from KHDI, KHEC, KHED, KHEE, KHEF, and KHEG in Rengma Reserve Forest under Golaghat Division.	**Replied by the User Agency:** Cumulative Environment Impact Studies was conducted for this area copy enclosed as annexure -I
5	The surface mining plan of this proposed 6 nos. of drilling and development wells authenticated by the competent authority.	**Replied by the User Agency:** The surface mining plan of this proposed 6 nos. of drilling and development wells authenticated by the competent authority is enclosed as annexure -II
6	The corrected site suitability certificate of the identified compensatory afforestation in lieu of the proposed diversion mentioning the actual name of the proposal including 6 nos. of drilling and development wells development wells as proposed.	Corrected site suitability certificate submitted by the DFO, Doomdooma is enclosed herewith.
7	The current status of Environment Clearance of this instant proposal.	**Replied by the User Agency:** Environmental Clearance is under Process
8	The State Govt to clarift whether 2% NPV of the forest area involved in the "Khoraghat EXTN-I PML" in Golaghat District, Assam" has been realized or not; and	**Replied by the User Agency:** ONGC has paid the 2% NPV for "Khoraghat EXTN-I PML"

	whether grant of forest clearance of the forest area involved in the PML as per Ministry's guideline dated 24.06.2015 has been completed or not.	**(Copy enclosed as annexure -III)**
9	The number of bore hole and size involved in the proposed area.	**Replied by the User Agency:** 06 No of wells with 17.5 inches of Diameter are proposed from this land.
10	The layout map of the proposed area is to be resubmitted indicating 6 nos of drilling locations, the proposed plinth and approach road.	**Replied by the User Agency:** The layout map of the proposed area is to be resubmitted indicating 6 nos of drilling locations, the proposed plinth and approach road is enclosed as **Annexure - IV**
11	The calculated revised rate of Net Present Value amount of the forest land being diverted in respect of this instant proposal as per the Ministry letter File No.5-3/2011-FC(Vol-I) dated 21.03.2022.	NPV calculation sheet has already been submitted as per the revised rate by this division. However, photo copy of the same is enclosed for your ready reference. Revised Ca estimate is enclosed herewith.
12	The undertaking certificate by the user agency for NPV for the proposed site.	Replied by the user agency: The undertaking certificate for NPV for the proposed site is enclosed as **Annexure - V**
13	The current status of Forest Right Act, 2006 certificate in respect to this proposed area.	**Replied by the User Agency:** Forest Right Act, 2006 certificate in respect to this proposed area is under Process.

Enclo: As stated above.

This is for favour of your kind information and necessary action.

Yours Faithfully

Divisional Forest Officer
Golaghat Division
Division

Copy to the Conservator of Forests, Eastern Assam Circle, Jorhat for favour of his kind information.

Divisional Forest Officer
Golaghat Division
Division

Memo. No. B/62/ONGC/DPDU/Glt. Divn/2022/4087 Dtd. 01/07/2022.

Copy to the General Manger, Head HSE, Jorhat Asset, ONGC, Chinnamara, Jorhat-785704 for favour of her kind information.

Divisional Forest Officer
Golaghat Division
Division

Annex-II (35)

OIL & NATURAL GAS CORPORATION LTD.

Office of Head HSE, Nambar-I, Jorhat Asset

Jorhat-785704. Ph: 0376-2707317

No. ONGC/JRT/HSE/Forest Clearance/KHDI Cluster Date: 02.07.2022

OFFICE OF THE DIVISIONAL FOREST OFFICER GOLAGHAT DIVISION No. 1770 Date 4/7/22

To,

Divisional Forest Officer
Golaghat Division, Golaghat

Sub: Proposal is for diversion of 2.583 ha of forest land for drilling 6 Nos. of drill development wells KHDI, KHEC, KHED, KHEE, KHEF, and KHEG in Rengma Reserve Forest under Golaghat Division in favour of ONGC, Jorhat.

Ref: i. No.3-AS B 104/2022-GHY/2547-2548 dated 02.06.2022 of Govt. of India
ii. FG.27/Nodal/Drilling location/ONGC dated 04.06.2022 of CCF & Nodal Officer Assam.

Sir,

With respect to the observations/queries regarding the forest diversion proposal of 2.75 ha of forest land for 06 nos drill development wells KHDI, KHEC, KHED, KHEE, KHEF, and KHEG in Rengma Reserve Forest of ONGC, Jorhat under Golaghat Division.

Point wise compliance/reply is given below for your kind consideration.

SL. No.	Observations	Reply
1	The current status of the encroachment in the proposed area 2.583 ha as DFO in Part II form mentioned that "the entire RF is encroached by human being and not a habitat of wildlife animal."	To be provided by DFO Office
2	Whether any earlier drilling activities has been carried out in proposed drilling site or not, if yes, the detail on the forest clearance under F(C) Act,1980 is to be provided.	This is a fresh land and no drilling activity has taken place
3	To clarify the legal status of the proposed area as it is mentioned as 'Nambar South RF" in the submitted "Justification for locating the project in forest land" whereas as mentioned as "Rengma RF" in the other submitted documents.	The Proposed area is in "Rengma RF" not in Nambar South RF
4	The cumulative impact study of the proposed 6 Nos. of drill development wells from KHDI, KHEC, KHED, KHEE, KHEF, and KHEG in Rengma Reserve Forest under Golaghat Division.	Cumulative Environment Impact Studies was conducted for this area Annexure -I
5	The surface mining plan of this proposed 6 nos. of drilling and development wells authenticated by the competent authority.	Attached at annexure -II

6	The corrected site suitability certificate of the identified compensatory afforestation in lieu of the proposed diversion mentioning the actual name of the proposal including 6 nos. of drilling and development wells development wells as proposed.	To be replied by DFO office
7	The current status of Environment Clearance of this instant proposal.	Environmental Clearance is under Process
8	The State Govt to clarift whether 2% NPV of the forest area involved in the "Khoraghat EXTN-I PML" in Golaghat District, Assam" has been realized or not; and whether grant of forest clearance of the forest area involved in the PML as per Ministry's guideline dated 24.06.2015 has been completed or not.	ONGC has paid the 2% NPV for "Khoraghat EXTN-I PML" Annexure -III
9	The number of bore hole and size involved in the proposed area.	06 No of wells with 17.5 inches of Diameter are proposed from this land.
10	The layout map of the proposed area is to be resubmitted indicating 6 nos of drilling locations, the proposed plinth and approach road.	Annexure - IV
11	The calculated revised rate of Net Present Value amount of the forest land being diverted in respect of this instant proposal as per the Ministry letter File No.5-3/2011-FC(Vol-I) dated 21.03.2022.	To be Provided by DFO office
12	The undertaking certificate by the user agency for NPV for the proposed site.	Annexure - V
13	The current status of Forest Right Act, 2006 certificate in respect to this proposed area.	Under Process

02/07/2022

(Niva Tamuli)
Head HSE, Jorhat Asset
ONGC, Jorhat.

Impact Assessment of Oil and Natural Gas Production and Development in Golaghat District

Oil and Natural Gas Corporation Limited

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   - 5.16 Illumination Management Plan
   - 5.17 Site Closure Plan
   - 5.18 Environment Management Plan

1. 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 development drilling, GGS, EPS and Laying of pipelines.

1.1 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 4-1, with consultation in every phase.

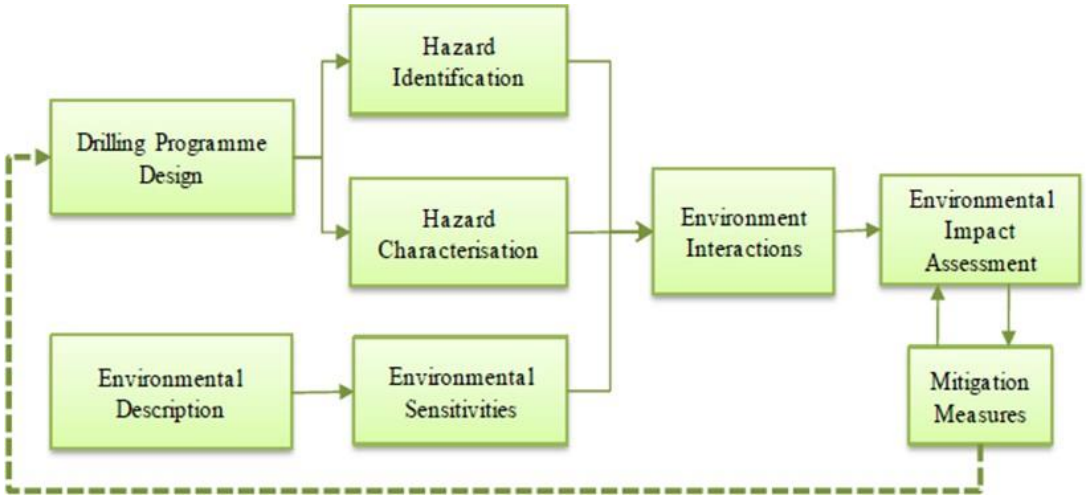


Figure 4-1. Methodology for Environmental Impact Assessment

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 4-1:

Table 4-1. 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.	2

Impacts elements	Criteria	Ranking
	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.	
	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 study area.	3
	14. Largely local level impact limited to immediate vicinity of the development 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 4-2 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 4-2. 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	
1	1	2	2	
1	2	1	2	
1	1	2	2	**Low**
1	2	2	4	
2	1	2	4	
3	1	2	6	
1	3	2	6	
2	2	2	8	
3	2	2	12	**Medium**
2	3	2	12	
2	2	3	12	
3	3	2	18	
3	2	3	18	
2	3	3	18	**High**
3	3	3	27	
Beneficial Impact			++	

To assist in determining and presenting significance of an impact, an impact evaluation matrix (*Table 4-2*) 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 4-3. Impact Identification Matrix

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment												
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Pre- Drilling activities																													
Site selection and land acquisition	■																	■			■	■							
Site Preparation		■	■	■	■					■	■	■					■						■	■			■	■	
Well site & access road construction	■	■		■	■												■		■		■		■				■	■	■
Sourcing & transportation of borrow material etc		■	■	■	■					■	■						■		■	■	■		■				■	■	■
Storage and handling of				■													■											■	

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
construction debris																													
Transportation of drilling rig and ancillaries																													
Operation of DG set																													
Workforce engagement & accommodation at construction site																													
Consumption of water for construction & domestic use for labourer																													

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Generation of domestic solid waste & disposal			■						■						■		■												■
Generation of waste water & discharge from construction activity & labour camp							■		■							■						■							■
Surface run-off from construction site		■	■				■		■						■														
Drilling and Testing																													
Physical Presence of drill site											■						■												

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Operation of DG sets and machinery				■	■						■																	■	■
Operation of drilling rig					■							■											■					■	
Storage and disposal of drill cuttings and mud			■				■		■								■												
Generation of process waste water & discharge							■								■														
Surface run-off from drill site			■						■						■														
Generation of domestic			■						■						■														

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment												
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
waste water & discharge			■						■						■														
Generation of Municipal waste & disposal			■						■								■												
Workforce engagement & accommodation at drill site																			■			■			■		■		■
Accidental events – blow out			■	■			■		■	■		■			■													■	■
Accidental events-spillage of chemical & oil			■				■		■																				
Laying of Pipeline																													

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Site selection and land acquisition																													
Site Preparation																													
Trenching																													
Sourcing & transportation of burrow material etc																													
Storage and handling of construction debris																													
Transfer of pipes to construction site																													

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Operation of DG set																													
Workforce engagement & accommodation at construction site																													
Consumption of water for construction & domestic use for labourer																													
Generation of domestic solid waste & disposal																													
Generation of waste water &																													

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment													
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
discharge from construction activity & labour camp																													
Surface run-off from construction site																													
Early production System and GGS																													
GEG/DG Set of Emission																													
Produced Water																													
Decommissioning																													
Dismantling of rig and associated facilities																													

Activity \ Environmental Aspect	Physical Environment		Physico-Chemical Environment							Ecological Environment							Human Environment												
	Land Use	Topography & Drainage	Soil Quality	Air Quality	Noise & Vibration	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Flora and Floral Habitat	Wildlife Habitat	Fauna	Threatened and Endangered Species	Migratory corridor and Route	Aquatic habitat	Aquatic Flora & Fauna	Aesthetic & Visual Impact	Loss of Livelihood	Conflict on Job Opportunity	Disruption of Infrastructure	Transport & Traffic	Common property resources	Dust and Noise discomfort	Loss of agricultural productivity	Influx of population	Cultural and Heritage site	Job and economic opportunity	Occupational Health and Safety	Community Health and Safety
Transportation of drilling rig and ancillaries																													
Removal of well site construction materials & disposal																													

Impact Assessment

This section describes the impacts of the project activities, (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 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

Development wells

The forest PML is an operating oil field, which has a number of development 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 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 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. Since this area is devoid of Industries except for tea processing units, hence the construction of GGS and EPS will add a physical infrastructural feature that will be a stand out 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 is envisaged to be low as the visual impact will be highest during the construction phase and would gradually be acclimatized during 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

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 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, 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 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 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 Working+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 (SO_2) 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 4-4.

Table 4-4. 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 4-5.

Table 4-5: 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, SO_2 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 4-6.

Table 4-6: Resultant Consideration for SO_2, NO_2 and PM 10

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 ($\mu g/m^3$)	NAAQS, 2009
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
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

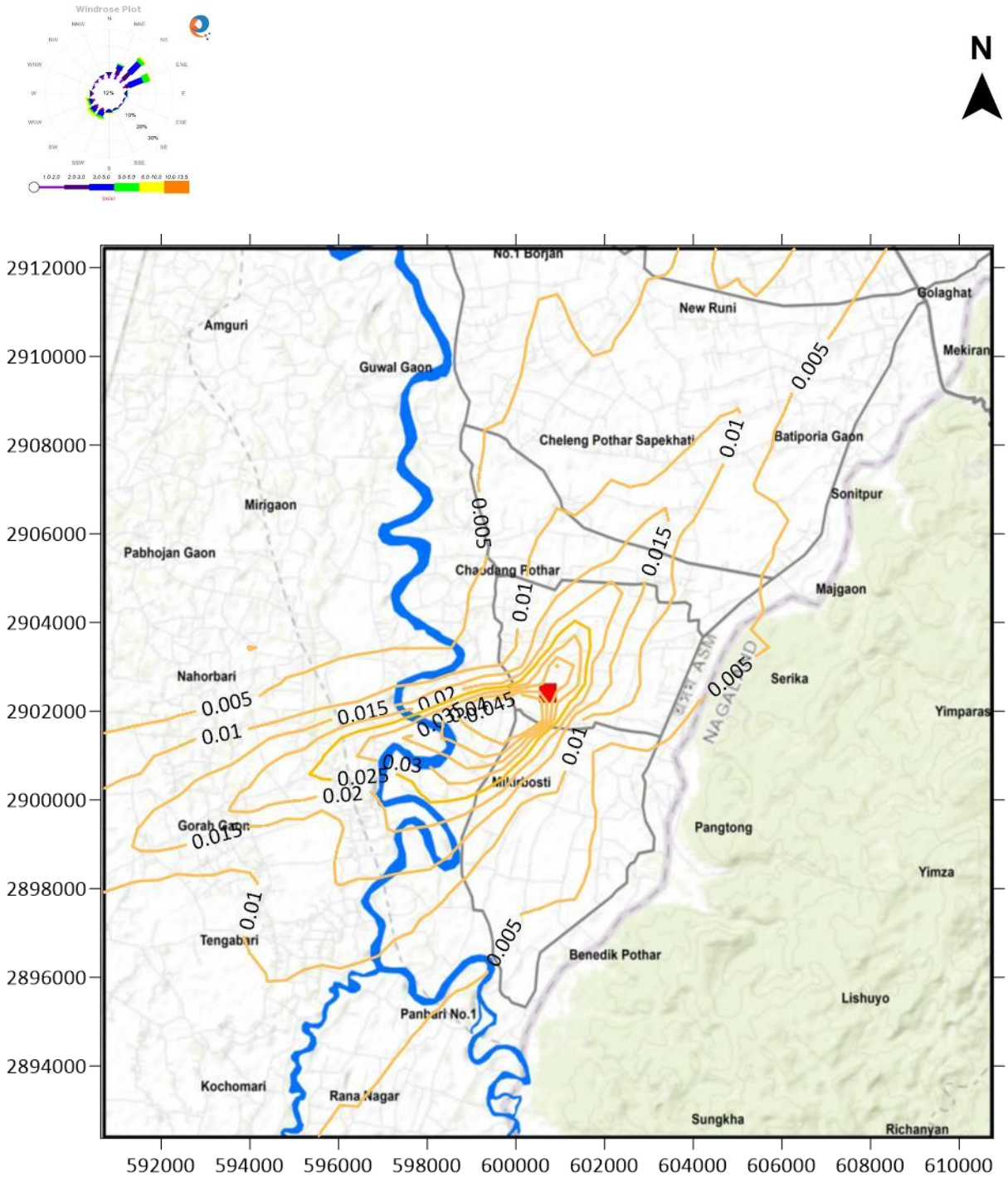


Figure 4-2. 24 HOURLY GLCs OF SO2

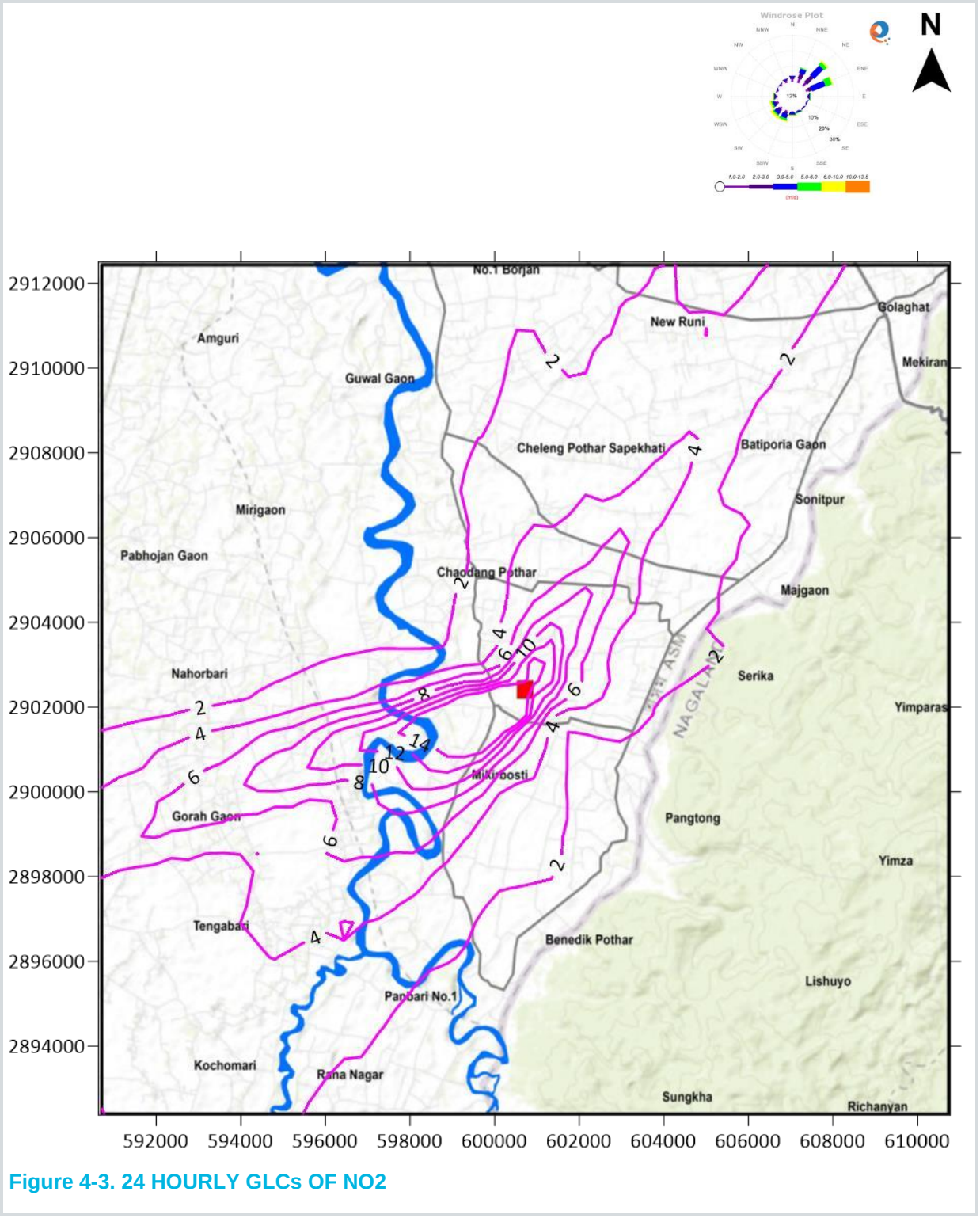


Figure 4-3. 24 HOURLY GLCs OF NO2

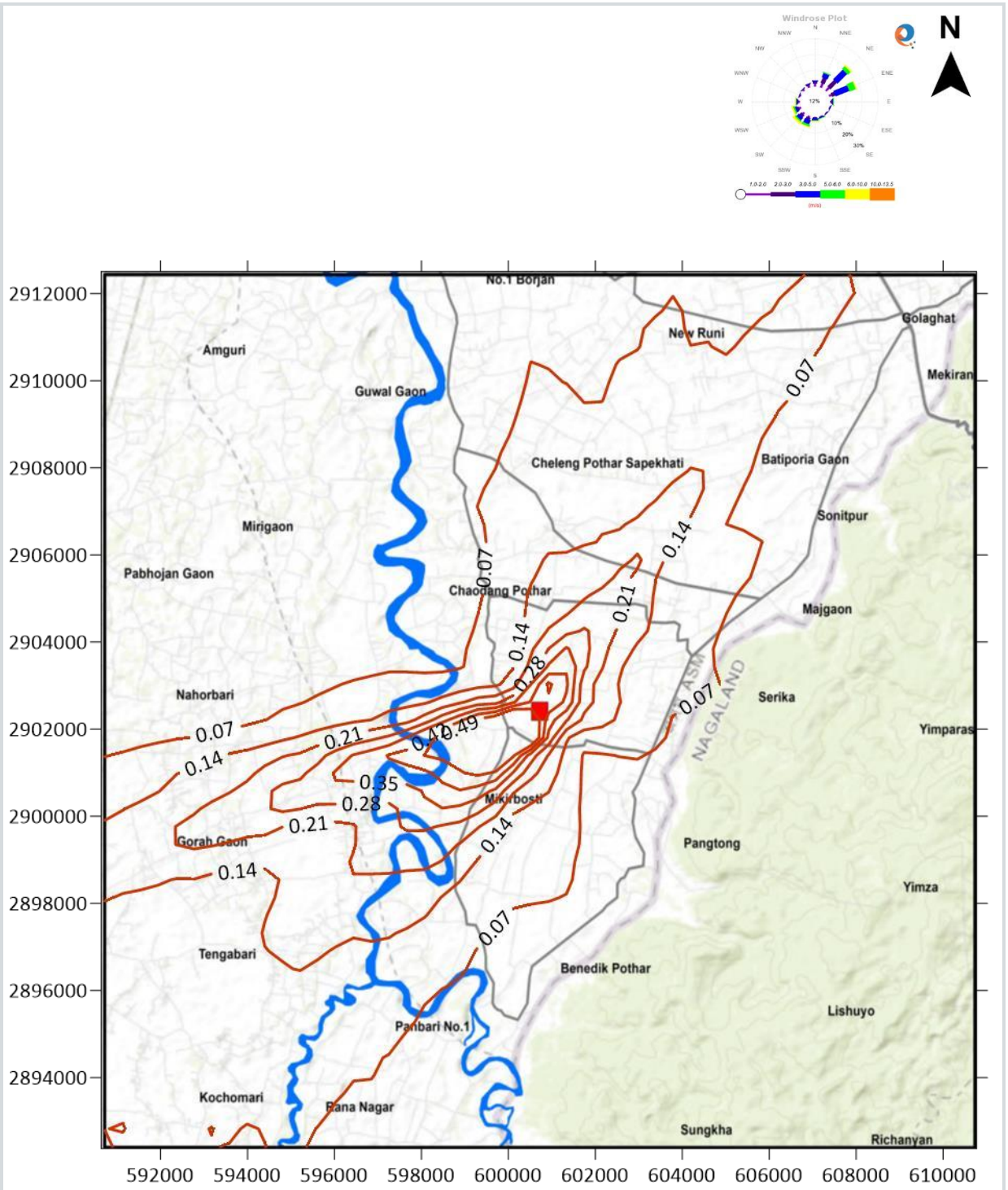


Figure 4-4. HOURLY GLCs OF PM10

Mitigation Measures:

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

- The exhaust of the DG sets will be vented at sufficient height as per CPCB norms to allow dispersions of the pollutants and periodical maintenance of DG sets so that emissions will be within stipulated limits.
- Low Sulphur diesel to will be used to reduce emissions of pollutant SO_2.
- Most of the equipment, machinery and vehicles have inbuilt pollution control devices.
- Providing personnel protective equipment like mask to workers.
- The storage and handling of top soils and materials will be carefully managed using covers, storing at the upwind side etc. 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 to mitigate emission from vehicles and equipment:

- 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.
- 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.

GGS, EPS and Pipeline

During construction phase of GGS, EPS and laying of pipeline, it is eminent that there will be generation of fugitive dust . All the issues pertaining to air pollution that have been dealt in above section for development well will also be applicable for GGS and EPS. Stacks will be erected for venting off flaring emission in GGS & EPS. However, generation of air pollutants including fugitive dust is not envisaged for pipeline & GGS during the operation phase.

Mitigation Measure

The above mentioned mitigation measures for fugitive dust emission and DG set operation would be adopted.

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 will result in the 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. 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)

There will be noise generation of about 86.0 dB(A) from flaring operation, which is however an emergency operation, carried out during process upset.

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

Noise Modelling of ONGC's Drilling Pad

Simulation of noise levels is performed to predict noise levels that will result from the drill pad of the proposed ONGC's onshore well pad during the drilling phase as input to the Environmental Impact Assessment (EIA) study of the project. This assessment is utilised to evaluate the noise contributions from the various equipment from the proposed project on the sensitive receptors.

The present modelling study is carried out using SoundPLAN 8.1.

Basis of SoundPLAN Modelling Software

SoundPLAN is a modelling and presentation tool that helps in optimizing the noise control measures and visualizing the effects of noise propagation throughout complex systems. This model is very useful to calculate sound pressure levels and generate noise maps. The output of this software is a graphical representation of the calculated sound pressure levels, considering reflections and diffractions of sound, and taking into account the geometry of buildings at the site and topography. The pressure level calculated or interpolated for each point within the modelling domain are shown as a grid of sound pressure, from which a contour map is generated showing isophones (lines of equal sound pressure).

The Industrial Noise Propagation module of SoundPLAN 8.1 consists of two main components, the emission calculation and the propagation calculation. The emission

calculation is performed internally within the noise source database, where construction equipment's sound power (SP)/ pressure (SPL) level, sound generation height, their positions are defined. The propagation calculation is performed inside the calculation core of SoundPLAN. The performance of this module is further enhanced when used in conjunction with Wall Design to design and optimise the location and extent of noise barriers. Implemented calculation standards include BS5228-1:2009, CoRTN, CoRTN Lden, NORD 2000 and RLS-90, amongst many others.

Baseline noise conditions

The main noise sources in the construction site of a well pad are considered as: 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)) and Flaring (86.0 dB(A)) which is an emergency activity etc. The typical layout of a drill pad is used to design the noise generating sources within a drill pad.

Model Results and Discussion

The results of the model are presented on noise contour maps that were generated from a colour-coded noise level distribution grid. The colour scale was chosen so that cool colours (green) represent low values of sound pressure and warm colours (deep blue) represent elevated values of sound pressure. Contour lines (isophones) are representative of noise pressure intervals of 5 dB(A). The noise contour maps only represent the SPLs predicted in calculated area as a result of the drilling activities. For this reason, the existing background SPLs considered as the noise from construction equipment for 100% for 24h Time Histogram in the study area and that were added to the SPLs predicted from the proposed construction site to calculate the cumulative noise levels.

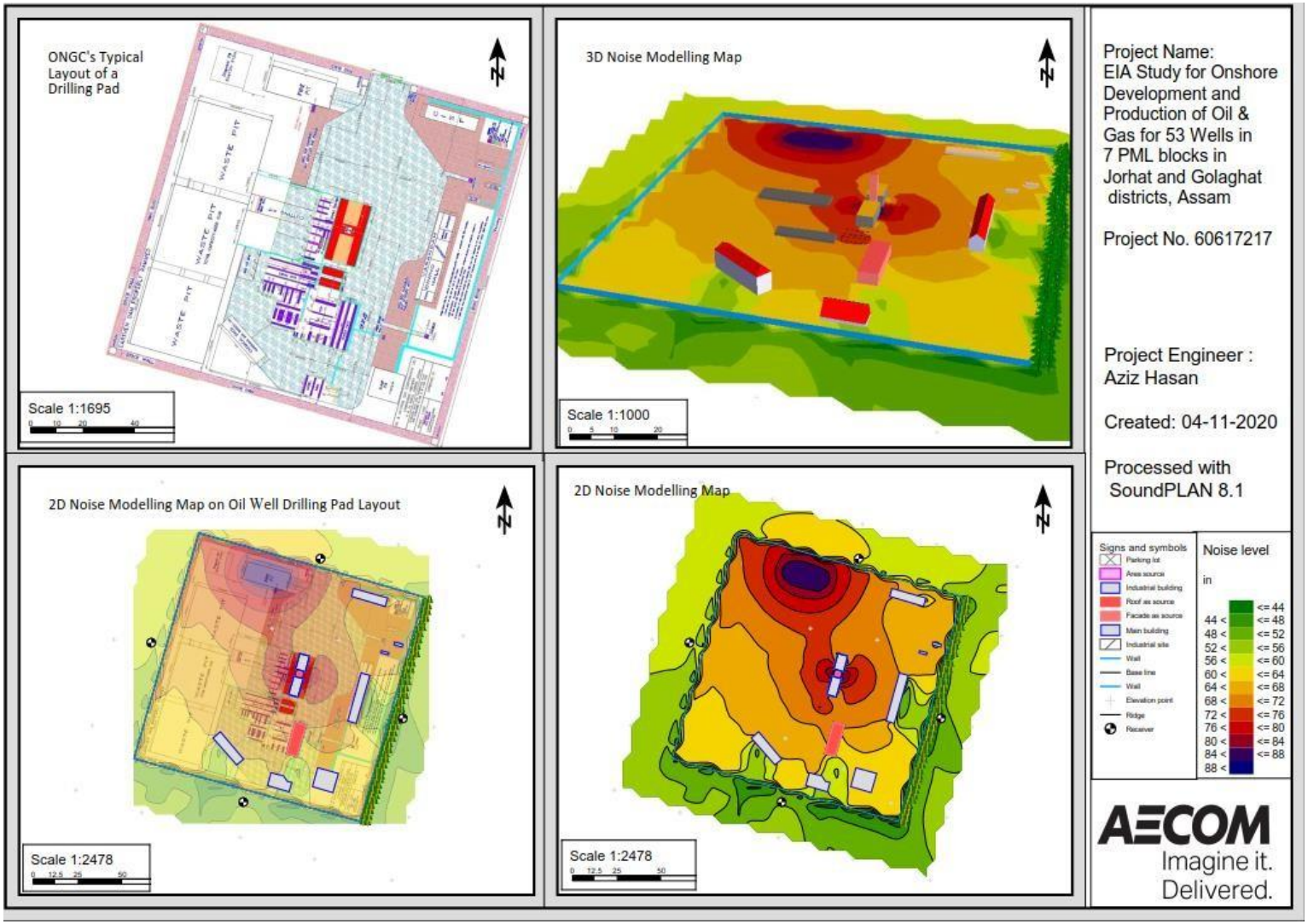


Figure 4-5. Noise level contour in a drill pad

Outcome of this model run indicated that the boundary wall assumed to be a 3m high brick wall and planted vegetation around the site shall act as a noise protection wall. Noise levels calculated just outside of the boundary wall on the south-east and south-west sides of the site varies from 42 to 55 dB(A), whereas, monitored noise levels recorded at north-east and north-west side of the boundary ranges between 51 to 63 dB(A). Outcome of the model indicates the requirement of greenbelt on the north-east and north-west side of the boundary to ensure lower noise level outside the plant boundary.

Mitigation Measures:
Typical mitigation measures for noise will include the following:

- Demarcation of area where high levels of noise is generated
- 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
- 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

GGS, EPS and Pipeline

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 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 not envisaged for pipeline. Adoption of appropriate mitigation measures and considering that the construction activities are 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

ONGC will diligently adhere to providing 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 contaminant. Soil quality impacts have been 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 development 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)					

The mitigation measure proposed for top soil preservation are as follows:

- 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.

Storage and disposal of drill cuttings and drilling mud

It is estimated that nearly about 225 m^3 of drill cuttings and 700 m^3/day of drilling mud is likely to be generated from each well during 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 and handling of chemicals and fuels, spent oil and lubricants are not done properly. Storage of chemicals and fuels spent lubricants on unpaved surfaces in open to sky condition 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 low 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, causing an alteration of vegetation pattern and 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/ strengthening

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 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 (Medium)					

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

Adverse 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 district. 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 15 - 20 m^3/day of drilling wash water 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 use of water based mud, temporarily storage of drilling waste water 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 and Other Wastes (Management and Transboundary Movement) Rules, 2016, 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 from pipeline is not envisaged.

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.
- Proper casing and cementing of the well would be done to prevent the contamination of sub surface aquifers.

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 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 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

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

  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)					

- Ecological productivity in Agricultural fields

Impact on ecological productivity of the agricultural land, which would be leased for the development 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)					

- Influx of Population

Influx of population is anticipated in various stages of the project cycle particularly during development 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)					

- Cultural and Heritage site

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

- Employment Opportunities

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 4-7. Impact significance Matrix (With Mitigation)

Sl No	Aspects	Pre-Drilling /Construction Phase		Operation Phase (Drilling Phase)		Decommissioning phase	
		Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures	Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures	Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures
1	Land Use	Low	Negligible				
2	Topography and Drainage	Low	Negligible			Low	Negligible
3	Soil quality	Low	Negligible	Low	Negligible		
4	Air quality	Low	Negligible	Medium	Low	Low	Negligible
5	Noise and Vibration	Low	Negligible	Medium	Low	Medium	Low
6	Impact on Ground water quality and resources	Low	Negligible	Medium	Low		
7	Impact on surface water quality and resources	Low	Negligible	Low	Negligible		
8	Terrestrial & Aquatic Ecology	Low	Negligible	Low	Negligible		
9	Aesthetic and Visual	Low	Negligible	Low	Negligible		
10	Loss of Livelihood	Medium	Low	Medium	Low		
11	Conflict of Opportunities	Low	Negligible	Low	Negligible		
12	Disruption of Infrastructure	Medium	Low			Low	Negligible
15	Dust and Noise discomfort	Low	Negligible	Medium	Low		
17	Influx of population			Low	Negligible		
18	Cultural and heritage site						

Sl No	Aspects	Pre-Drilling /Construction Phase		Operation Phase (Drilling Phase)		Decommissioning phase	
		Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures	Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures	Impact Significance before Mitigation Measures	Residual Impact after Mitigation Measures
19	Job and Economic opportunity	Positive		Positive			
20	Occupational Health safety	Medium	Low	Medium	Low	Medium	Low
21	Community health safety	Low	Low	Medium	Low	Medium	Low

Negligible		Medium	
Low		Positive	

2. 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:

2.1 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.

2.2 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).

2.3 Alternatives for well location

The proposed development 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.

2.4 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 un useful 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.

2.5 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.

3. 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

RATING	IMPACT ON PEOPLE	IMPACT ON ASSET	IMPACT ON BUUSINESS 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 7.1.:

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 7-1. Risk Matrix

The risk criteria and action requirements are mentioned in Table 7-2

Table 7-2. 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 7-3. 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	3	5	15
	Release from diesel tanks- Catastrophic failure and leaks		3	3	9
	Possible cratering (a		1	3	3

Hazards	Events	Mitigation measures	Risk assessment		
			Likelihood	Impact	Risk potential
	basin like opening in the Earth surface surrounding a well caused by erupted action of gas, oil or water flowing uncontrolled)	fighting system at all potential location • Electrical fittings & cables to be as per specific standards and motor starters to be flame proof			
	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 lifting of heavy equipment including components like draw works, drilling pipe, tubing, drill bits, Kelly, mud equipment, shale shakers, BOP components, power generating	• Imparting training to all personnel regarding safe working practices • Strict adherence to Standard operating Procedure • Provision of barriers to avoid direct impact as applicable	3	3	9

Hazards	Events	Mitigation measures	Risk assessment		
			Likelihood	Impact	Risk potential
	equipment and others.				
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 staticor rotating load, fatigue, construction defect, design defect, earthquakes etc	• Design of all structure as per Appropriate codes and standards	4	4	16

It may be seen from the above table that certain incidents like blow-outs, release of toxic gases or structural collapse have medium to high risk potential that requires necessary engineering controls & mitigation measures to avoid catastrophic consequences

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

Jet Fire

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' 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

Overpressure level, bar	Effect on Assets & human
0.07 – 0.17	Repairable damage to buildings, Chances of effect on human hearing & injuries from flying objects
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)

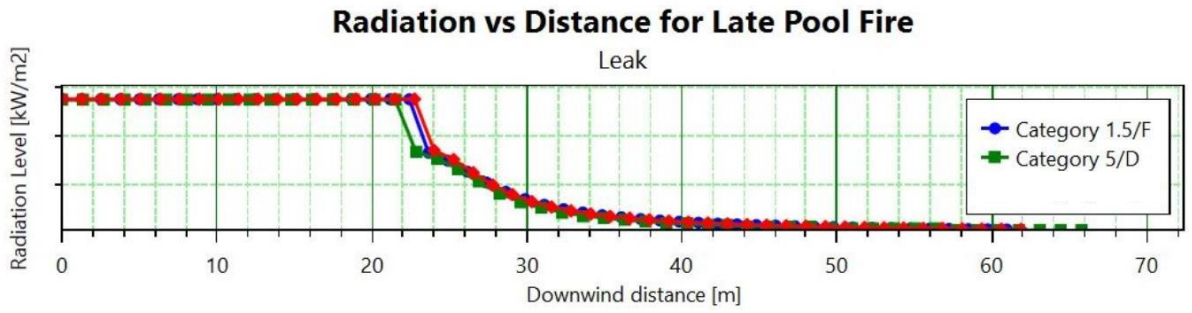
Path	Scenario	Weather	Pool diameter [m]	Distance downwind to intensity level 1 (4 kW/m2) [m]	Distance downwind to intensity level 2 (12.5 kW/m2) [m]	Distance downwind to intensity level 3 (37.5 kW/m2) [m]
Study\Atmospheric storage tank	Leak	Category 1.5/F	37.9973	60.9557	39.3291	29.4669
		Category 5/D	34.3484	57.7986	37.3718	28.7251

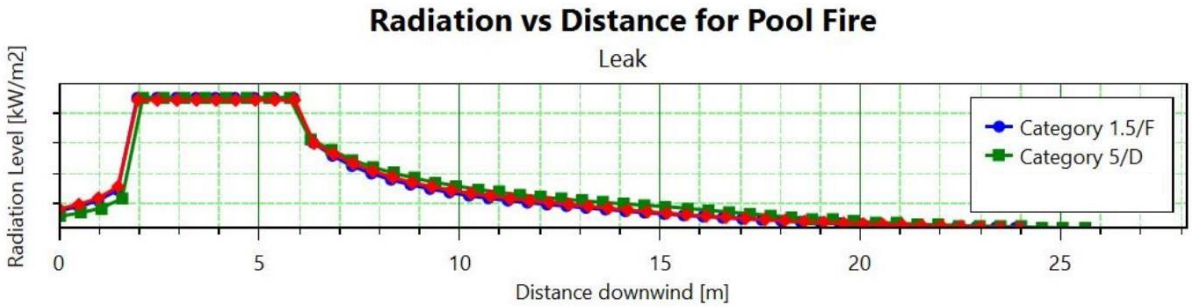
Flash Fire (20 mm leak)

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.



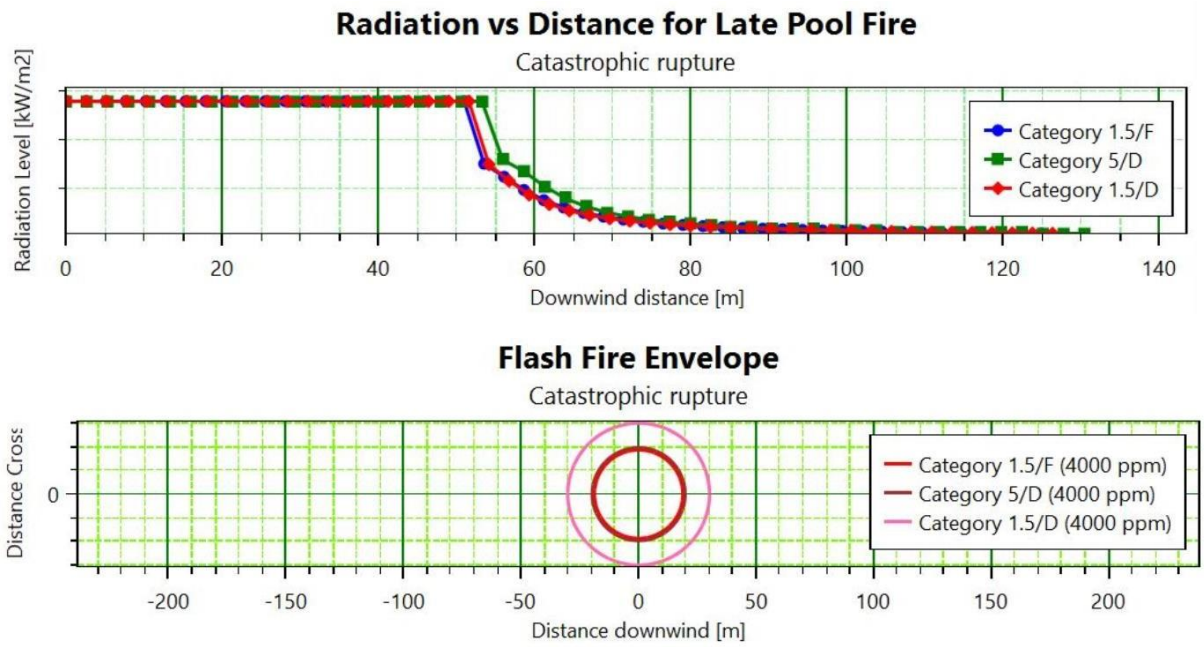


Late Pool Fire (Complete release of containment)

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.

4. Project Benefit

4.1 Revenue earning of central and state government

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.

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.

4.2 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.

4.3 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.

4.4 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.

5. Environmental Management Plan

5.1 Introduction

The environmental management plan and monitoring framework is a site-specific document, for the purpose of 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.

5.2 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.

5.3 HSE Policy of ONGC

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. ONGC already has an 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. The Corporate Environment Policy and the HSE policy of ONGC is presented in figure 10.1 & 10.2 below.

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.

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. The HSE policy of ONGC is mentioned in Figure 9-1.

शशि शंकर
Shashi Shanker
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

ओएनजीसी
ONGC

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.

(Shashi Shanker)

Dated : 11th December, 2017

दीनदयाल ऊर्जा भवन, 5, नेल्सन मंडेला मार्ग, वसंत कुंज, नई दिल्ली -110 070 (भारत)
Deendayal Urja Bhawan, 5, Nelson Mandela Marg, Vasant Kunj, New Delhi -110070 (India)
दूरभाष (Tel) +91 11 26129001 / 2612 9011, फैक्स (Fax): +91 11 26129021, 2612 9041, ई-मेल (e-mail): cmd@ongc.co.in
वेबसाइट (Website) : ongcindia.com, CIN : L74899DL1993GOI054155

5.4 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 9-2.

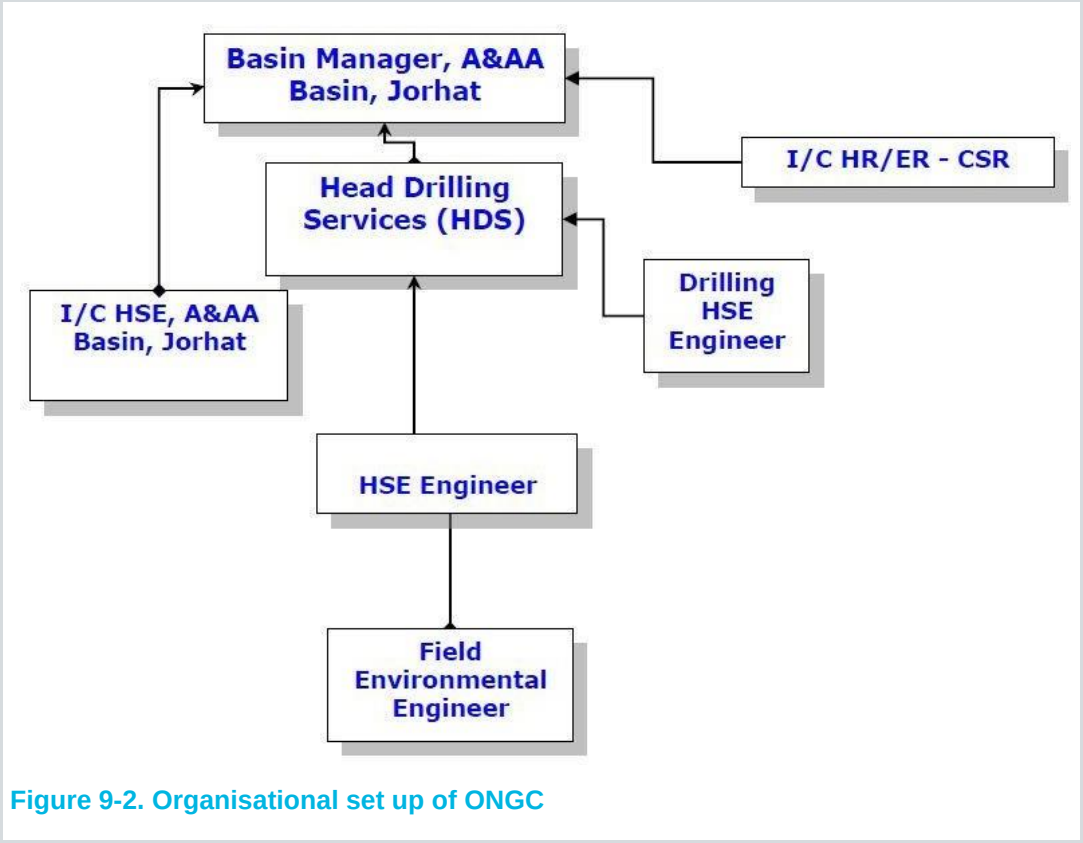


Figure 9-2. Organisational set up of ONGC

5.5 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.

5.6 Air Quality Management Plan

The Air Quality Management Plan (AQMP) encompasses both constructions and drilling phase activities for the proposed project that has the potential to adversely affect ambient air quality. The AQMP establishes specific measures and guidelines aimed at effectively addressing and mitigating the air quality impacts that may arise as result of construction of well sites, production facilities and pipelines, drilling operations, operation of production facilities and decommissioning/site closure of well sites. The plan also details out roles and responsibilities of ONGC and the contractors to ensure effective implementation of the plan.

Table 9-1: Mitigation Measures

Phase	Mitigation Measures
Construction/ drill Site Preparation	**Designing, Planning & Procurement** • Storage and handling of construction material and debris would be carefully managed to prevent generation of fugitive dust; • All vehicles use in transportation of raw material and personnel would have valid Pollution under Control Certificate (PUC). Vehicular exhaust would be complying with the CPCB specified emission norms for vehicular Emission; • The topsoil would be preserved suitably; • Adequate stack height would be provided to DG sets in accordance with CPCB standards. **Dust Suppression** • Sprinkling of water on earthworks, material haulage and transportation routes on a regular basis, especially in dry season.
Drilling Phase	**Operation of Machineries, Vehicle & Drilling Rig** • Exhausts of diesel/Gas generators would be positioned at a sufficient height to ensure dispersal of exhaust emissions; engines would not be left running • Vehicles involved in the transportation of project personnel would have valid PUC Certificate and would be subjected to periodic preventive maintenance; **Periodic Maintenance of Machinery and Vehicles** • Preventive maintenance of GEG/DG sets would be undertaken; • Flaring would be undertaken in accordance with the CPCB Guidelines for Gaseous Emissions for Oil & Gas.

5.7 Waste Management Plan

The Waste Management Plan (WMP) is applicable for all process and non-process waste streams which are generated during various phases of proposed drilling and testing of hydrocarbons. The major waste streams covered under this plan includes drill cuttings, waste drilling mud, drilling wash water, kitchen waste and sewage. In addition, waste oil and lead acid batteries generated from the proposed project operations have also been dealt in this plan.

The WMP establishes specific measures to ensure proper collection, storage, treatment and disposal of the identified process and non-process waste streams in accordance with the applicable national regulations and guidelines and also to ensure compliance with ONGC's HSE Policy. The plan also outlines roles and responsibilities of both ONGC and the contractors involved in the implementation of the plan.

Mitigation Measures

The following mitigation measures need would be adopted and implemented by ONGC and its contractors for the major waste streams identified in the plan

Waste	Mitigation Measure
Drill Cuttings	• Drill cuttings separated from drilling fluid would be adequately washed and temporarily stored and disposed in an impervious pit lined by High Density Poly Ethelyn (HDPE) • All drill cuttings would be disposed as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016;
Spent WBM	• The mud will be disposed as per CPCB standard prescribed for Oil and Gas industry or as specified by ASPCB
Waste oil/ Used oil	• Hazardous waste (waste and used oil) would be managed in accordance with Hazardous Waste (Management, & Transboundary Movement) Rules, 2016. • This oil would be sent to authorized recyclers.
Municipal Solid waste	• The waste would be segregated at source (organic/inorganic) and disposed as per Solid Waste Management Rules, 2016 • All kinds of waste would be disposed in accordance with the requirement of CPCB/ASPCB.
Recyclables *viz*. paper, plastic, packaging waste etc	• Proper segregation and storage of recyclable waste in designated bins. • Recyclables would be periodically sold to local waste recyclers.
Non-combustible waste containing metallic residue	• To be analysed for the trace/heavy metals content before disposing suitably
Left over chemicals and materials, scrap metal	• Scrap metal and recoverable material to the salvages before disposal of balance material through the registered vendors
Cement grit, blasting and painting wastes	• To be disposed of their registered vendors on periodic basis

5.8 Soil Quality Management Plan

Soil Quality Management Plan would be applicable during construction of well sites, drilling operations, pipe laying and decommissioning/site closure that has the potential to adversely impact the soil quality.

Mitigation Measures

Phase	Mitigation Measures
Construction/ drill Site Preparation	• Site preparation and road strengthening/widening activities would be restricted within defined boundaries. • Top soil will be stored properly for preservation. • Drip trays would be used during vehicular/equipment maintenance and during refueling operations.
Drilling	• Fuel and chemical storage areas would be paved and properly bunded. • Spill kits would be made available at all fuel and chemical storage areas. All spills/leaks contained, reported and cleaned up immediately. • Drip pans/trays would be used in areas identified having spillage potential but not limited to drill rig engine; electric generator engine; pumps or other motors; maintenance areas; fuel transfer areas. • Management of drill cuttings, waste drilling mud, waste oil and domestic waste would be made in accordance with “Waste Management Plan”
Decommissioning/Site Closure	• Decommissioning at the end of project life/drilling would have some adverse impacts in terms of increase in soil erosion and would require adequate mitigation measures to minimize any adverse impacts. The mitigation measures would be similar to those outlined for construction phase activities as discussed earlier.

5.9 Spill/Release Management Plan

Potential spill / release scenarios

Spill incidents from drilling activities can be classified into three types based on the level of response required. A description of the three types are as follows:

Type 1

A small oil or chemical spill incident which can be responded to and controlled with the existing resources, equipment and resources at the site and without any further escalation. Most of the potential drill stage spill risks are Type 1 spill / release incident as the volumes involved are limited due to the extent of hydrocarbons or chemicals used or stored at site. Such possible incidents are likely to include:

- Diesel spills from refuelling i.e., drill rig - hose leaks, overfilling or connection/disconnection incidents.
- The use of liquid chemicals i.e., during drilling the volumes are limited by the storage containers used, drums etc.
- Hydraulic oil spill resulting from a split hydraulic hose or failed connector (moderate pressure, low volume lines).
- Drilling fluid leaks from tanks, pumps or other associated equipment within the closed loop recirculation

  system.

Type 2

Type 2 spill / release incidents are those that are beyond capability of the immediate resources on-site to effectively manage and contain, requiring additional external resources to assist with the response to the spill incident. Type 2 spill incidents may require initiation of Emergency operations and would involve calling out the Fire Service (in the event of danger to people) and/or regional resources. For such potential spill incidents, the resources of the local administration or suppliers may be required. Such possible incidents are likely to include:

- Transportation incidents associated with the delivery of diesel or drilling fluids to site i.e., truck rollover or
  collision from external suppliers (drilling fluids and diesel).
- Complete failure of an on-site drilling fluid (base oil) storage tank(s).

Type 3

Type 3 spill / release incidents are significant spill incidents that escalate from a Type 1 or 2 and exceed the capabilities of the on-site and local administrative resources to respond, requiring a State /National response. An uncontrollable well blow out scenario would fall into this category.

Spill / Release Response Strategies

Spill / release response strategies for combating spill / release incidents include:

- Prevent or reduce further spillage.

- Monitoring and evaluation (no active intervention but the spill is under observation).
- Mechanical containment and recovery.
- Any combination of the above strategies.

A brief explanation of these various response strategies is provided in the following sections.

Prevent or reduce a spill / release incident

One of the first response actions, if safe to do so, is the isolation or prevention of the source of the spill / release to limit any further discharge. Such first response actions can involve an emergency shutdown of the particular equipment, isolation of a valve or line causing the spill or providing some immediate containment to prevent the further spread of a spill / release. Such measures are only a first immediate response prior to a more coordinate effort being planned and undertaken.

Monitoring and Evaluation

– Knowing the position of spillage / release source and having the ability to forecast its movement or direction is an essential component of spill response. Monitoring and evaluation are used to:

- Determine the location and movement of the spill / release (if any).
- Describe its appearance.
- Estimate the size and quantity of the spill / release
- Note changes in the appearance and distribution of the spill over time.
- Assess the potential threat to the environment and the resources required to combat the spill / release (more effective and coordinate response)

Mechanical Containment and Recovery

Mechanical containment and recovery are the restriction of a spill / release movement through the use of booms or some other form of physical barriers and its subsequent removal using skimmers and other mechanical means. These operations may be required for large spills or spills / release which may impact environmentally sensitive areas. This response option would be used if the spill / release:

- Threatens environmental sensitive areas, or
- The spill is unlikely would be removed by natural processes.

The feasibility of a containment and recovery response is dependent upon having surface pollution that is capable of being contained and recovered and having suitable conditions for equipment deployment. The spill containment plan has been addressed in line with the recommendation of QRA analysis as prescribed in chapter 7.

Clean-up

Oil or chemical spills may be allowed to collect or strand on a specific location in order to assist with clean-up operations. Regardless of land type the spill impacts on, the method of clean-up is usually labour intensive. Once a spill is controlled in terms of isolating the source, a response to a spill normally changes from an emergency to a project and needs would be managed as such. This may involve earthmoving equipment used to recover the absorbed spill and contaminated soil. Such operations usually involve the collection of significantly greater volumes of material than was originally spilt.

Waste Management

Solid waste due to clean up operation would be collected and treated and disposed in line with the prevalent Hazardous Waste Guidelines.

5.10 Noise Quality Management Plan

The noise control plan would be applicable during the phases of construction of well sites, drilling operations and decommissioning/site closure of well sites. The noise control plan to ensure specific measures to minimize noise levels in the project site as 75 dB(A) per CPCB noise rules. The plan also outlines roles and responsibilities of both ONGC, and the contractors involved in the implementation of the plan.

Mitigation Measures

Phase	Mitigation Measures
Construction/ drill Site Preparation	• Selection and use of low noise generating equipment equipped with engineering controls viz. mufflers, silencers etc. • Periodic preventive maintenance of vehicles • Periodic maintenance of equipment. • Engines of vehicles and construction equipment would be turned off when not in use for long periods
Drilling	• Siting of drilling rig and facilities at safe distance from sensitive receptors viz. schools, settlements, etc. • Installing acoustic enclosures and muffler on engine exhaust of DG sets to ensure compliance with generator noise limits specified by CPCB.
Decommissioning /Site Closure	• Management measures to address noise impacts with respect to operation of heavy equipment/machinery and movement of vehicles during decommissioning/site closure

Phase	Mitigation Measures
	phase are similar to those discussed in the "Construction/site preparation Phase" of this section

5.11 Surface Water Quality Management

The Surface Water Quality Management Plan would be applicable during construction of well sites, drilling operations and decommissioning/site closure of well sites that has the potential to adversely affect the surface water quality.

The Surface Water Quality Management Plan establishes specific measures and guidelines aimed at addressing and mitigation of surface water quality impacts that may arise at different phases of the project.

Mitigation Measures

Phase	Mitigation Measures
Construction/ drill Site Preparation	• During site preparation, surface water run-off would be managed through design of proper drainage system.
Drilling	• Drip trays would be used during preventive maintenance of rig installations, vehicles and machinery. • Hazardous chemicals and fuel container would be stored in bunded and appropriately lined area equipped with proper spill control equipment and secondary containment.
Decommissioning/Site Closure	• No significant impacts to surface water quality can be associated with activities during decommissioning/site closure phase. Any possible impacts that may arise due to surface run-off would be mitigated in manner similar to that discussed during construction/site preparation phase activities.

5.12 Ground Water Quality Management

Ground Water Quality Management Plan is applicable for construction of well sites and drilling operations and decommissioning/site closure of well sites that has the potential to adversely affect the ground water quality.

Mitigation Measures

Phase	Mitigation Measures
Construction/ Drill Site Preparation	• Storage of wastes and design of concrete drains to prevent contamination of aquifers
Drilling	• Storage of wastes and design of concrete drains in accordance to Management Plan to prevent contamination of aquifers
Decommissioning/Site Closure	• No significant impacts to ground water quality can be associated with activities during decommissioning/site closure phase. Any possible impacts that may arise would be mitigated in manner similar to that discussed during construction/site preparation phase activities.

5.13 Storm Water Management Plan

The following mitigation measures need would be adopted and implemented by ONGC and its contractors in construction, operation and decommissioning phases of the project:

- Necessary measures would be undertaken during construction/site preparation phase to prevent earth and stone material from Blocking cross drainage structures.
- Periodic cleaning would be undertaken to cross drainage structures and road drainage system to maintain uninterrupted storm water flow.

5.14 Road Safety & Traffic Management Plan

Road Safety & Traffic Management Plan outlines specific measures would adopt and implemented to mitigate any potential impact on community health and safety arising out of movement of vehicles and transportation of drilling rig and other heavy equipment during construction, drilling and decommissioning of well sites.

Mitigation Measure

- Proper signage would be displayed at important traffic junctions along the predefined access routes.
- Traffic flows would be scheduled wherever practicable during period of increased commuter movement;
- Adequate training on traffic and road safety operations would be imparted to the drivers of project vehicles.

5.15 Occupational Health & Safety

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. drilling and testing, operation of construction machinery/equipment, storage and handling of fuel and chemicals and decommissioning/site closure.

Mitigation Measures

- All workers would be provided with appropriate PPEs viz. safety boots, masks, protected glass etc.
- Provision of ear plugs/ear muffs etc. and rotation of workers operating near high noise generating areas, would be ensured.
- Hazardous and risk prone areas, installations, materials, safety measures, emergency exits, etc. would be appropriately indicated in every conspicuous location.
- All chemicals and hazardous materials storage container would be properly labelled 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.
- Workplace to be equipped with fire detectors, alarm systems and fire-fighting equipment as per the requirement. Equipment shall be periodically inspected and maintained to keep in good working condition.
- Adequate sanitation facilities would be provided.
- Garbage bins would be provided in the camp and regularly removed, and the garbage disposed of in a hygienic manner.
- Training programs would be organized for the operational workforce regarding proper usage of PPEs, handling and storage of fuels and chemicals, response to emergency, etc.

ONGC Periodic Medical Examination Policy

ONGC has formulated a Periodic Medical Examination (PME)policy, effective from 5th July 2007, some important features of which are detailed below Table 9-2:

Table 9-2: ONGC Periodic Medical Examination

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

Type of PME	Employees to be covered	Periodicity
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. The Procedure adopted for carrying out the medical examination is as follows:
  - 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 Center.

Illumination Management Plan

The glare from the illumination & Flaring would have adverse visual as well as ecological impacts.

Work Zone Illumination

Low height (less than 8 m), sodium vapour lamp that are most energy efficient can help to reduce the ecological impacts. Further, illumination would be provided only in required locations and has placed UV filters on lamps. Such UV filtered lights have been found would be less distractive to migrating birds.

5.16 Site Closure Plan

The site closure plan identifies all the activities which would be performed during the restoration of a well site, in case the well is not economically viable, and no further use of that particular well bore is envisaged. Along with the well site the approach road connecting the well would be restored accordingly. The following activities would be considered in the closure plan:

- Plugging & Abandonment of well: Close the well head properly to prevent any further leakage
- Decommissioning Phase: Removal of the materials form the site

- Waste/mud pit closure and reclamation
- Reinstatement Phase: regeneration of the land
- Handover Phase: Returning the land to the original owner

Plugging & Abandonment of well

As and when the well would be declared as unsuccessful / to be suspended /non-productive, plugging of the well would be performed to close and abandon the well to prevent any leakage of oil or gas.

Decommissioning

The decommissioning phase includes activities dismantling and removal of surface facilities from the well site and storage in the Material Dumping Area. The activities which are envisaged during this phase are:

Waste Management: Cleaning up the site and removal of all waste materials e.g. HDPE liners, any waste material etc and disposal in the designated area as per the guidelines of ASPCB

Road Restoration: Removal of fill materials and restoration of the site to previous conditions or as per recommendation of administrative department of Tehsil.

Waste and Mud Pit Closure and Reclamation

Following decommissioning and abandonment of the well site, the waste and mud pits would be subject to closure through onsite burial of solids in accordance with lease & obligations and with local, state and national regulations.

Reclamation of closed pits or any other temporary retaining pits, including reserve pits, would be carried out within a period of one year from well closure/abandonment. All such reclamation activities would be carried out based on the climatic conditions.

Reinstatement

The reinstatement phase includes all activities for preparation of the soil for plantation of trees at the concerned site. The preparation of topsoil and fertility regeneration of topsoil would be same as Please referred earlier. Site restoration shall be taken up matching to the surrounding land use pattern.

Selection of plants for plantation would be undertaken based on the species that were cut down at the time of site preparation activities.

5.17 Environment Management Plan

The overall EMP for mitigation of identified impacts along with the responsible personnel/authority for its implementation is presented in the Table 9-3 below:

Table 9-3 : EMP of the Proposed project

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
Land Procurement	• Loss of income • Grievances related to compensation issues	• If the identified lands are of private landowners then land lease mode would be applied and in case of govt. land, land allotment from Govt. would be applied. • Initially temporary and short-term lease would be taken for 3 - 5 years for exploration purpose and in case of commercially viable discovery of hydrocarbon resources, the land lease would be converted into long term lease up till life of the project. • For sites selected are having any settlements, Resettlement & rehabilitation (R&R) plan would be developed and implemented as per the applicable State/ Central Govt. policy. Compensation to affected landowners for any loss of land would be ensured would be ensured • The livelihood of local community, if affected by the proposed land take, would be identified and compensated through adequate compensation and other livelihood restoration activities directly or indirectly through CSR activities	• ONGC – Project team
Site clearance and Grading	• Dust Generation • Loss of top soil • Increased runoff	• The final site selection would be done for site with minimum trees, and involving minimum cutting;	• ONGC – Project team

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
	• Loss of vegetation	• Top soil would be properly stored for future use. • Water sprinkling would be carried out while working in proximity of agricultural fields or settlements/habitations;	
Construction of drill site	• Handling of excess earth material • Noise generation • Increase in traffic volumes • Health & Safety risks	• Temporary storage sheds would be provided for construction material such as cement; • Excavated soil would be used during site preparation; • Provision and usage of adequate PPEs to workers as applicable and identified for the respective activity. .	• ONGC – Project team & Civil Contractor
Construction of camp of site	• Crane overturning/Collapse • Falling Objects • Health & Safety risks • Congestion of roads	• Surface conditions would be examined prior to movement of crane; • Provision and usage of adequate PPEs to workers as applicable and identified for the respective activity.	• ONGC – Project team & Civil Contractor
Transportation of drilling components and rig	• Road accidents • Vehicular emissions • Damage to road conditions • Oil leaks	• Only trained drivers with expertise in defensive driving would be involved in the movement of rigs. • All movement of major equipment would be scheduled in the lee hours in consideration of the traffic movement in the connecting major arterial road. • Local administration and village administration as applicable would be informed during movement of rigs through village roads;	• ONGC – Project team & Contractor - HSE

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
Drilling & well testing	• Additional stress on the local water • Potential for contamination due to handling, storage and transportation of wastes	• Water would be sourced from the locally approved source or ground water would be withdrawn prior approval of CGWA • Two separate Drill cutting disposal pits would be provided for WBM and SBM cuttings; • Drill waste pits would be provided with HDPE lining on bottom and side surfaces; • Used hazardous chemical barrels, used oil and other hazardous waste would be sent to ASPCB authorized recyclers; • Possibility for co-processing drill cuttings as alternate fuel and or raw material (AFR) in cement industry based on suitability and availability would be explored	• ONGC – Project team & Contractor - HSE
	• Generation of Noise	• Equipment upkeep and regular maintenance to minimise noise generation from all rotary equipment; • PPE's such as ear plugs, muffs would be provided to workers at site; • Periodic maintenance of vehicles and machinery would be undertaken; • DG sets would be provided with acoustic enclosures as per requirements under CPCB guideline.	• ONGC – Project team & Contractor - HSE
	• Air emissions	• All the emitting stacks shall be positioned orthogonal direction to the	• ONGC – Project team & Contractor - HSE

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
		prevailing wind direction; • Cold venting of gas not would be carried out, as per requirement. • Adequate stack heights would be providing for generators, adhering to the CPCB standards for diesel generators;	
	• Influx of migrant labour • Conflict with local community	• Migrant labour would be sensitized towards customs and traditions of the local population;	• ONGC – Project team & Contractor - HSE
	• Occupational health & safety risks	• Blowout preventers would be provided; • Firefighting measures would be provided near all welding operations;	• ONGC – Project team & Contractor - HSE
Operation of Campsites	• Stress on water resources; • Potential contamination from generation of biomedical waste • Wastewater generation • Waste generation	• Safe drinking water to be provided at campsites; • All waste would be collected in bins located near each set of porta cabins. Segregation of waste at the source of generation would be put in practice. • •All hazardous waste would be collected and stored on secure and paved area, and subsequently sent to authorised recyclers • Food waste would be stored in a closed container; • STP would be provided for campsites.	• ONGC – Project team & Contractor - HSE
Operation of WBM plant	• Waste generation • Potential contamination due to mud preparation • Dust due to stacking of the materials	• Effective stacking of the materials would be followed to protect from scenarios such as wind, rain and sunlight	• Drilling Warehouse Manager • Drilling Logistics Manager

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
	• Emission due to the forklifts and crane usages	• If area not paved, then periodic sprinkling shall be carried out • Waste shall be effectively segregated at the source of generation and disposed as per the waste management plan • All the vehicles would be operated inside the mud plant and warehouse shall follow all the HSE requirements to protect environment and have safety operations such as load test, proper maintenance etc.	
Decommissioning and Abandonment	• Demolition of drill cutting pits	• A site restoration approved plan shall be prepared with the detailed checklist; • All drill cuttings, spent mud, waste oil and other waste would be completely removed from the site and sent to designated disposal place prior to commencement of demolition work; • All concrete or steel installations would be removed to at least 1 m below ground level, so as to ensure that there would be no protruding surface structures. The casing wellhead and the top joint of the casings would be cut below the ground level and capped with a cement plug. • Prior to commencement of any demolition, a planned programme of site	• ONGC – Project team & Contractor - HSE

Activity	Potential Impact	Management/Mitigation Measure	Responsibility
		clearance would be formulated. All pits, cellars and holes would be removed and filled to ground level, any oil or otherwise contaminated soil would be removed and disposed to suitably.	

Annexure-IV

सार्थक पत्र
Working Paper

File No. ONGC/JA/SST/KHDI/FC/2021

Date: 19/08/2021

Sub: Approved Mining Plan for Proposed Six Development Locations (KHDI, KHEC, KHED,KHEE,KHEF,KHEG) from new Cluster in Khoraghat field

Oil and Natural Gas Corporation Limited, Jorhat Asset is planning to drill Six development locations in Khoraghat area of Golaghat District. The said land falls under Khoraghat Extension-1 ML and total granted ML area is 88.97 square Kilometers. These Six proposed locations are planned to be drilled from the fresh land of Khoraghat field.

Each of the six locations (KHDI, KHEC, KHED, KHEE, KHEF & KHEG) is expected to contribute Oil and Gas on an average rate of 10 tons per day and 2,000m3/day. The envisaged Mining Plan for the six locations is as below:

YEAR	Oil (tons/annum)	Gas (1000m3/annum)
2023-24	3650	730
2024-25	3285	657
2025-26	10257	2051
2026-27	9231	1846
2027-28	15608	3122
2028-29	14047	2809
2029-30	16292	3258
2030-31	14663	2933
2031-32	13197	2639
2032-33	11877	2375
2033-34	10689	2138
Total, tons/MMm3	**122796**	**24.5**

K Bhaskar 19/08/2021

K Bhaskar
General Manager (Reservoir)
SSM, Jorhat Asset

GGM-Asset Manager, Jorhat Asset, PI

19/8

सतीश कुमार द्विवेदी/Satish Kumar Dwivedi
परिसंपति प्रबंधक /Asset Manager
ओ एन जी सी, जोरहाट परिसंपति
ONGC, Jorhat Asset

Annex - V

CERTIFICATE FROM COMPETENT AUTHORITY REGARDING SUITABILITY OF THE AREA IDENTIFIED FOR COMPENSATORY AFFORESTATION

Certified that the proposed site for 5.166hect. Compensatory Plantation against the diversion proposal of 2.583hect. of forest land for drilling locationsKHDI, KHEC, KHED, KHEE, KHEF&KHEG of ONGC, Jorhat has been taken inside the Kundil Kalia Reserve Forest under Sadiya Range of Doomdooma Division and as such the same is suitable for raising plantation and management point of view.

15/6/22

Divisional Forest Officer
Doomdooma Division,
Doomdooma.

Annexure-VII

OIL AND NATURAL GAS CORPORATION LIMITED
LUIT BHAVAN, CINNAMARA COMPLEX,DIST - JOHRAT 785704
PH: 0376-2360020-25 2361531 - 45, FAX:0376-2360014&61

ADHOC CAMPA,

OFFICE OF PCCF AND HEAD OF FOREST FORCE, ASSAM PANJABARI

GUWAHATI 781307

PAYMENTADVICE
Your Account with us:161017
Bank Account No :037100101025200
Bank :CORPORATION BANK
IFSC code :CORP0000371
PaymentDate:30.09.2016
Payment Reference :795131

Subject : Payment Advice

DEAR SIR / MADAM,
This is to inform you that instructions have been sent to our banker for the credit of Rs.747,392,940.00 (RUPEES SEVENTY-FOUR CRORE SEVENTY-THREE LAKH NINETY-TWO THOUSAND NINE HUNDRED FORTY ONLY) to your account as mentioned above.
Kind Regards,
ONGC LIMITED

PAYMENT DETAILS

Document	Invoice No	Reference	Amt passed
2516003228	1610170690000001	PAYMENT FOR RTG	747,392,940.00
		Net Amount	747,392,940.00

Total Amount Paid Rs : 747,392,940.00

This is a system generated document and does not require any signature.
TDS certificate(s) , wherever applicable , will be issued in due course.

5402003.10.201615:57:34

As per recommendation of Chief legal and duly endorsed by Director(Exploration) and Director(Onshore),the payment of 2% NPV for the Forest area within extent of PMLs falling under Jorhat work centre (Basin and Asset) as per Table-1 is to be made based on the demand raised by Govt. of Assam.

As per the Chief Legal advice NP-8 Para-3

QUOTE

...............there are different Classes of Forest like open Forest, dense Forest and very dense Forest and whether the said amount of Rs. 20,860/-per hectare is applicable to all kind of Classes of Forest or to Class-I Forest.........

UNQUOTE

In view of this because of paucity of time for clarification from Forest department in this regards and keeping in view the implications of noncompliance of payment of NPV by 30.09.2016, It is proposed to make a provisional payment under protest and without prejudice to the rights and remedies available to ONGC. The total extent of the PML area is 1225.5 Sq. KM out of which 358.29 Sq. Km. (35829 Ha) falls under Forest Area as worked out in Table-1 . Going by the rate communicated by the Government of Assam i.e. Rs. 20, 860 per Ha, the 2% NPV amount is worked out is Rs.74,73,92,940/. As per the information provided by Finance Section (Copy of SAP mail attached) Service Tax is also applicable. Details of calculation tabulated below:

Payment Details:			
Names of PML	Area (Ha.)	Statutory Payments	Amount (Rs.)
As per attached Table-1	35829	@20,860/Ha	74,73,92,940
		Service Tax @ 15%	11,21,08,941
		Total	85,95,01,881

It is therefore requested to accord Administrative Approval and Expenditure Sanction for a sum of Rs.85, 95, 01,881/- (Rupees Eighty Five Crores, Ninety Five Lakhs, One Thousand, Eight Hundred and Eighty One only) inclusive of Service Tax towards payment of 2% NPV @ Rs. 20,860/-per Ha of total Forest area under PMLs of Jorhat work centre ONGC (Basin and Asset) to the State Government of Assam under Cl. 5.3a (FCNR) of BDP 2014.

28/09/16

(D.C. Pant)
DGM (Geol.)-Head BMG

ED- Basin Manager Pl.
(On-tour)
I/c Finance

AA & ES Accorded.

Basin Manager (Offtg)
A&AA Basin, ONGC, Jorhat

Payment made as per sanction. Copy of payment advice and all relevant financial documents placed in file.

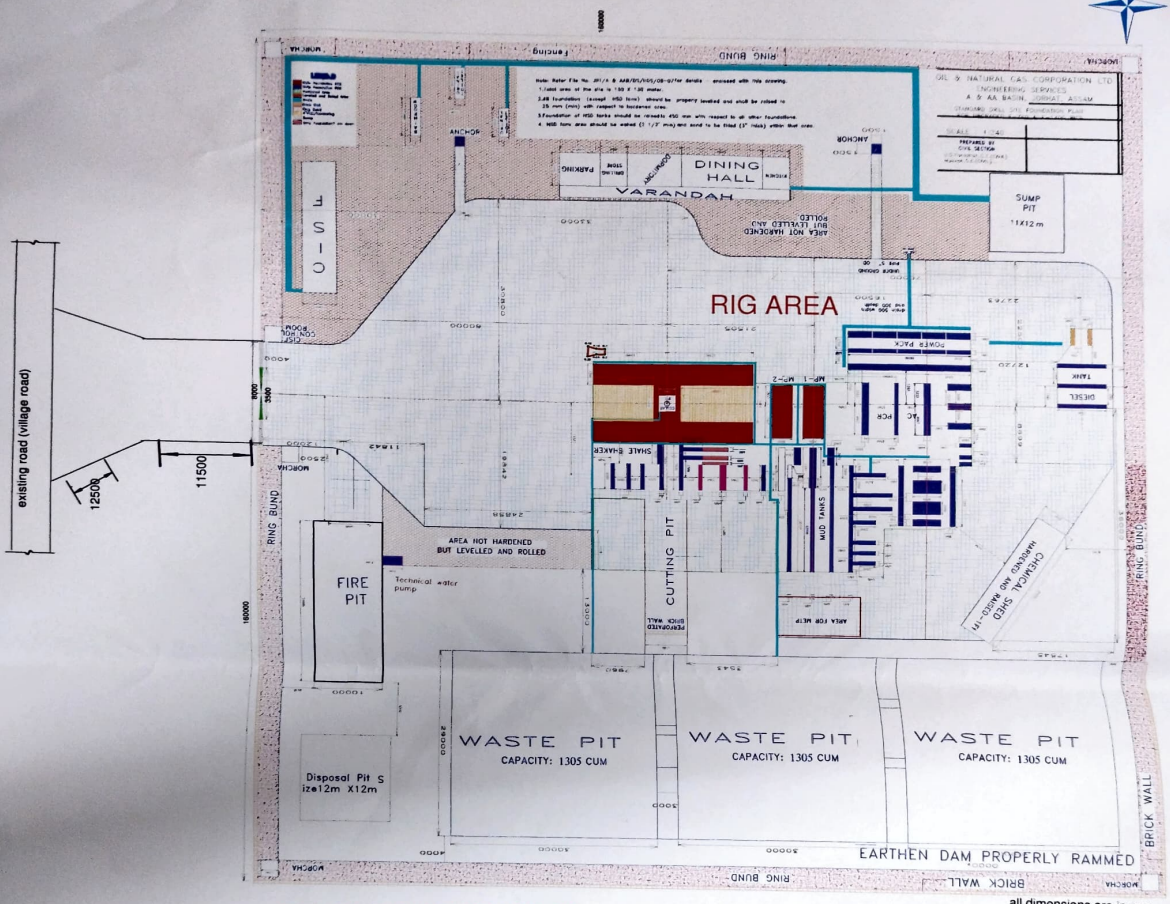
29/9/16

Head (BMG)

Table-1

Details of PMLs held by ONGC under A&AA Basin and Jorhat Asset in Assam State						
Sl No	Area	Validity of PML		Area of PML (Sq. Km.)		Remarks.
		From	To	Overall	Forest Cover	
JORHAT ASSET						
1	Borholla	17.06.1998	16.06.2018	32.12	0	Jorhat Dt.
2	Mekrang	19.09.1997	18.09.2017	16.00	0	Jorhat Dt.
3	Titabar	24.12.2008	23.12.2023	10.00	0	Jorhat Dt.
4	Nambar (Forest Area)	05.09.1999	04.09.2019	26.00	26.00	Golaghat Dt.
5	Khoraghat (Extn-1)	17.07.2000	16.07.2020	83.00	80.50	Golaghat Dt.
6	East Lakhibari	23.07.2003	22.07.2023	8.50	8.50	Golaghat Dt
7	Khoraghat	26.07.2009	25.07.2024	3.00	3.00	Golaghat Dt
8	Golaghat Ext II A	09.12.2009	08.12.2024	24.00	0	Golaghat Dt.
9	Kasomarigaon	09.12.2009	08.12.2025	20.00	20.00	Golaghat Dt.
10	Kalyanpur	13.04.2007	12.04.2027	40.00	37.50	Golaghat Dt.
	Total for Jorhat Asset			**262.62**	**175.50**	
BASIN (Jorhat + Cachar)						
1	Badarpur	01.08.2009	31.07.2019	2.3	0	Hailakandi Dt
2	Adamtila	24.11.2014	23.11.2034	4.00	0	Karimganj Dt
3	Adamtila Extn.	03.03.2012	02.03.2032	148.00	84.37	Karimganj Dt
4	North Patharia	30.03.2012	29.03.2029	60.00	3.12	Karimganj Dt
5	Banaskandi	21.07.1997	20.07.2017	15.00	0	Cachar Dt
6	Bhubandar	22.12.2002	21.12.2022	6.00	0	Cachar Dt
7	Sector VC	30.11.2014	29.11.2034	497.00	0	Cachar Dt
8	Cachar	04.01.2013	03.01.2020	732.00	31.30	Cachar Dt (7 yr PML)
9	Kasomarigaon (Add)	06.07.2016	05.07.2023	56.00	56.00	Golaghat Dt (7 Yr PML)
10	Golaghat Ext II A (Add)	21.11.2012	20.11.2019	61.00	0	Golaghat Dt (7 Yr PML)
11	East Lakhibari Extn.	10.10.2013	09.10.2020	59.00	8.00	Golaghat Dt (7 Yr PML)
	Total for A & AA Basin			**1640.3**	**182.79**	
	Total for Jorhat Work Centre (Asset + Basin)			**1902.92**	**358.29**	

Layout plan of KHDI Cluster site with Approach Road



DETAILED LAYOUT PLAN

Area of waste pits area = 30m x 29 m = 870 sq meter
Volume of each pit = 30m x 29m x 1.5 m = 1305 CUM
Total volume of all the pits = 3915 CUM

TOTAL STATION COORDINATE READINGS OF PROPOSED APPROACH ROAD

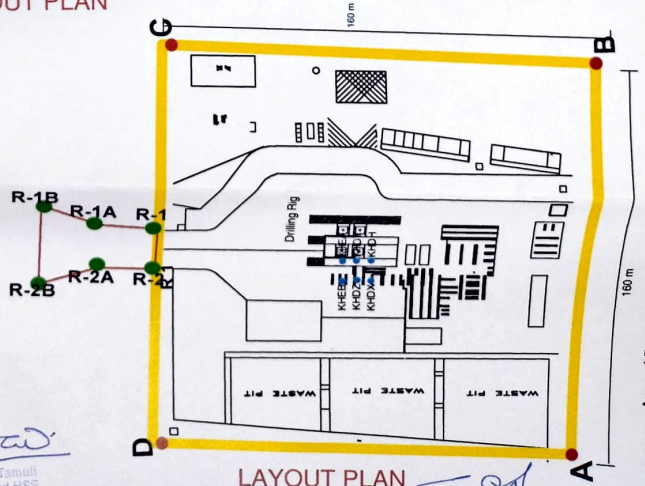
TOTAL STATION POINT	LATITUDE	LONGITUDE	NAME OF COMPONENT	AREA (Ha)	NAME OF DRILLING SITE	NAME OF RF	NAME OF FOREST DIVISION
R-1	26° 5' 46.579" N	93° 57' 49.763" E					
R-1A	26° 5' 46.590" N	93° 57' 49.134" E					
R-1B	26° 5' 46.705" N	93° 57' 48.908" E	APPROACH ROAD	0.023	KHDI CLUSTER	RENGMA RF	GOLAGHAT DIVISION
R-2	26° 5' 46.319" N	93° 57' 49.754" E					
R-2A	26° 5' 46.330" N	93° 57' 49.324" E					
R-2B	26° 5' 46.227" N	93° 57' 48.886" E					

TOTAL STATION COORDINATE READINGS OF WELL LOCATIONS

TOTAL STATION POINT	LATITUDE	LONGITUDE	IDENTITY	NAME OF DRILLING SITE	NAME OF RF	NAME OF FOREST DIVISION
KHDI	26° 5' 46.370" N	93° 57' 52.640" E	Proposed Well			
KHEC	26° 5' 46.080" N	93° 57' 52.630" E	Proposed Well			
KHED	26° 5' 46.370" N	93° 57' 52.440" E	Proposed Well			
KHEI	26° 5' 46.080" N	93° 57' 52.440" E	Proposed Well	KHDI CLUSTER	RENGMA RF	GOLAGHAT DIVISION
KHEJ	26° 5' 46.370" N	93° 57' 52.250" E	Proposed Well			
KHEG	26° 5' 46.080" N	93° 57' 52.250" E	Proposed Well			

TOTAL STATION COORDINATE READINGS OF WELL LOCATIONS

TOTAL STATION POINT	LATITUDE	LONGITUDE	IDENTITY	NAME OF DRILLING SITE	NAME OF RF	NAME OF FOREST DIVISION
KHDI	26° 5' 46.370" N	93° 57' 52.640" E	Proposed Well			
KHEC	26° 5' 46.080" N	93° 57' 52.630" E	Proposed Well			
KHED	26° 5' 46.370" N	93° 57' 52.440" E	Proposed Well			
KHEI	26° 5' 46.080" N	93° 57' 52.440" E	Proposed Well	KHDI CLUSTER	RENGMA RF	GOLAGHAT DIVISION
KHEJ	26° 5' 46.370" N	93° 57' 52.250" E	Proposed Well			
KHEG	26° 5' 46.080" N	93° 57' 52.250" E	Proposed Well			



Area of Purposed diversion site = 2.56 Ha
Area of Approach Road = 0.009 Ha

LAYOUT PLAN

Annexure-III

Niva Moni Tamuli
GM (P) Head HSE
ONGC, JORHAT ASSET, ASSAM

सुरजीत सिंह
अधीक्षण अभियंता
ओएनजीसी,

Annex - VIII

SCHEME FOR COMPENSATORY AFFORESTATION (PLANTATION) SCHEME AGAINST THE LAND PROCURED BY ONGC FOR DIVERSION PROPOSAL OF SIX (06) DEVELOPMENT WELLS FROM KHDI cluster viz., KHDI, KHEC, KHED, KHEE, KHEF & KHEG WITHIN RENGMA RESERVE FOREST UNDER GOLAGHAT DIVISION

NAME OF THE RESERVED FOREST	AREA IN HECT
Kundil Kalia RF	5.166 Ha.
Area of Afforestation	2.583 Ha. X 2 = 5.166 Ha. in Kundil Kalia RF with the following GPS location under Doomdooma Forest Division. a) Lat = : 27°56'3.864" N; Log = : 95° 55'49.217" E b) Lat = : 27° 56'16.458" N; Log = : 95° 55'43.665" E c) Lat = : 27° 56'15.191" N; Log = : 95° 55'39.548" E. d) Lat = : 27°56'2.446" N; Log = : 95°55'44.300" E;

ESTIMATE

I)	Area to be taken for plantation = 5.166 ha.	=	50,09,049.00
II)	NPV @ Rs. 11,16,900.00/Ha x 2.583 ha.	=	28,84,952.70
	Total	=	78,94,001.70

Submitted

Divisional Forest Officer
Golaghat Division
Golaghat

Annex-IX

अजम असम ASSAM

28AA 463354

UNDERTAKING BY USER AGENCY (ONGC) FOR CLUSTER DRILLING LOCATIONS KHDI, KHEC, KHED, KHEE, KHEF, and KHEG: GOLAGHAT (ASSAM)

FOR NPV and CA:

ONGC is liable to pay Compensatory Afforestation (CA) and NPV as per the demand note to be issued by the Government. While processing the proposal, if there is any increase in NPV and afforestation Cost decided by the Government, ONGC is ready to pay the increased amount thereof.

Niva M. Tamuli
GM (P), Head HSE
ONGC, Jorhat Asset