I/337256/2023

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

eCF No.279287/447 Dated Dispur, the November, 2023

From : Smti. Neera Daulagupu, ACS,
Secretary to the Govt. of Assam,
Environment and Forest Department.

To : The Deputy Inspector General of Forests (C),
Government of India,
Ministry of Environment, Forest & Climate Change,
Sub office, Guwahati,
4th Floor, Housefed Building,
G.S Road, Rukminigaon, Guwahati-781022

Sub : Forest diversion proposal of 6.09 Ha. of forest land for drilling of exploratory location TNAA in Sonai Reserved Forest under Cachar Division in favour of ONGC –reg.

Ref : Government of India letter F.No.3-AS C/132/2022/GHY/4552-53 dated 18.09.2023.

Sir,

In inviting reference to your letter on the subject cited above, I am directed to furnish herewith the following additional information/document as sought vide letter under reference for favour of your kind information and necessary action: -

Govt. of India letter No 3-AS C/132/2022/GHY/4552-53 dated 18.09.2023	**Information Provided**
Condition No. (1)	The User Agency (ONGC) has submitted the Right of Way (RoW) of proposed approach road vide letter No. ONGC/Sil/TNAA_FC/RoW/2023 dated 4.10.2023 (**copy enclosed**)
Condition No. (2)	The DFO, Cachar Division has submitted the Kml/shape file (CD Format) of the alternate CA site indicating in Laillapur Barman Basti in Inner-line Reserved Forest (**copy enclosed**)
Condition No. (3)	The DFO, Cachar Division has intimated that no other proposal applied and approved near proposed project vide letter No. A/35/ONGC

	Diversion/1637-38 dated 6.10.2023. The cumulative impact on flora and fauna is submit herewith (**copy enclosed**)

Enclo : As stated above.

Yours faithfully,

Signed by
Neera Daulagupu
Date: 14-11-2023 16:30:00

Secretary to the Govt. of Assam
Environment and Forest Department

Memo eCF No.279287/447-A Dated Dispur, the November, 2023

Copy to:-

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

e-signed
Secretary to the Govt. of Assam
Environment and Forest Department

GOVERNMENT OF ASSAM
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS AND
HEAD OF FOREST FORCE, ASSAM
ARANYA BHAWAN, PANJABARI, GUWAHATI-37

Email: addlpccf.nodal@gmail.com

No. FG.27/FCA/Proposal/ONGC/Drilling location TNAA/Cachar Divn. *Dated 4.11.2023*

To,

The Additional Chief Secretary to the Government of Assam,
Environment and Forest Department, Dispur, Guwahati-6.

Sub: **Proposal for diversion of 6.09 Ha. of forest land for drilling of exploratory location TNAA in Sonai Reserved Forest under Cachar Division in favour of ONGC.**

Ref: Government of India letter No. 3-AS C/132/2022/GHY/4552-53 dated 18.9.2023

Sir,

With reference to the above, I am submitting herewith the information/documents as sought by the Government of India, MoEF &CC, Sub Office, Guwahati vide their letter No. 3-AS C/132/2022/GHY/4552-53 dated 18.9.2023 as under-

Govt. of India letter No 3-AS C/132/2022/ GHY/4552-53 dated 18.9.2023	**Information Provided**
Condition No. (1)	The User Agency (ONGC) has submitted the Right of Way (RoW) of proposed approach road vide letter No. ONGC/Sil/TNAA_FC/ RoW/ 2023 dated 4.10.2023 **(copy enclosed)**
Condition No. (2)	The DFO, Cachar Division has submitted the Kml/shape file (CD Format) of the alternate CA site indicating in Laillapur Barman Basti in Inner-line Reserved Forest (**copy enclosed**)
Condition No. (3)	The DFO, Cachar Division has intimated that no other proposal applied and approved near proposed project vide letter No. A/35/ONGC Diversion/1637-38 dated 6.10.2023. The cumulative impact on flora and fauna is submit herewith **(copy enclosed)**

The above-mentioned information may kindly be sent to the Government of India, MoEF&CC, Sub Office, Guwahati (Under Regional Office, Shillong), Guwahati accordingly.

Encl: As stated above.

Yours faithfully

(Dr. C Muthukumaravel, IFS)
Chief Conservator of Forests &
Nodal Officer (FC Act), Assam
O/o the Principal Chief Conservator of Forests and
Head of Forest Force, Assam

Copy to:

1. The Chief Conservator of Forests, Southern Assam Circle, Silchar for kind information.
2. The Divisional Forest Officer, Cachar Division, Silchar for information.
3. The S Geologist, ONGC, AAFB Exploratory Asset ONGC, Srikona Silchar, Cachar-788062 for information.

o/c

Chief Conservator of Forests &
Nodal Officer (FC Act), Assam
O/o the Principal Chief Conservator of Forests and
Head of Forest Force, Assam

GOVT. OF ASSAM

OFFICE OF THE DIVISIONAL FOREST OFFICER ::: CACHAR DIVISION :::

SILCHAR.

Letter No. A/35/ONGC Diversion/ 1637—38 Dtd. Silchar, the 06.10.23

To,

The Chief Conservator of Forests &
Nodal Officer, (F.C. Act,) Assam,
O/o the Principal Chief Conservator of Forests &
Head of Forest Force, Assam,
Panjabari, Guwahati-37.

Sub- Proposal for diversion of 6.09 Ha of forest land for drilling of exploratory location TNAA in Sonai reserved Forest under Cachar Division in favour of ONGC.

Ref- Letter No. FG.27/FCA/Proposal/ONGC/Drilling location TNAA/Cachar Divn. - P. 135 e
Dt. 26-09-2023.

Sir,

With reference to the subject cited above, I have the honour to furnish herewith the point wise information/documents in respect of Proposal for diversion of 6.09 Ha of forest land for drilling of exploratory location TNAA in Sonai reserved Forest under Cachar Division in favour of ONGC as under –

1. A copy of undertaking is enclosed herewith.
2. KML File is enclosed herewith.
3. There is no proposal applied and approved near the proposed project. The cumulative impact on flora and fauna is enclosed herewith.

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

Enclo-As stated above.

Yours faithfully,

Divisional Forest Officer,
Cachar Division : Silchar.

Copy to the Chief Conservator of Forests, Southern Assam Circle, Silchar for favour of kind information and needful.

Divisional Forest Officer,
Cachar Division : Silchar.

ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लिमिटेड
OIL AND NATURAL GAS CORPORATION LIMITED

कार्यालय : भूविज्ञान संचालन के प्रधान
OFFICE OF HEAD FORWARD BASE
असम अराकान वलित पट्टी अन्वेषण परिसम्पत्ति ,सिलचर
AAFB Exploratory Asset, SILCHAR

दूरभाष/Tel: 03842-229420
Mob.: 9435723603

No. ONGC/Sil/TNAA_FC/RoW/2023 Date: 04.10.2023

From: Head Forward Base, AAFB EA, Silchar

Undertaking for Right of Way (RoW) of Proposed Approach Road

It is to mention that demarcated RoW of the proposed approach road varies from 6 meters to 15 meters. However, in projects where minimum RoW is about 6 meters, movements of vehicles are controlled in such way that only one way traffic is allowed at a time. Hence it is requested for exemption of the RoW in case of approach road.

04.10.2023.

(B S Hayong)
DGM (Geology)-Head Forward Base
AAFB-Exploratory Asset
ONGC, Silchar

DRAFT REPORT

ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DRILLING OF EXPLORATORY WELLS (26 NOS.) IN PML BLOCKS OF CACHAR FORWARD BASE, IN ASSAM

ONGC LIMITED
CINNAMARA, JORHAT, ASSAM

PROJECT REFERENCE NUMBER:
IN/ES-EIA/2014-161
(VERSION 2.0)

CONTRACT NO: 5010094119
TENDER NO: L26BC14015

PREPARED BY:

SGS India Private Limited
226 Udyog Vihar Phase I
Gurgaon – 122 016, Haryana, India

Tel: +91 124 6776300
Fax: +91 124 6776403/04

http://www.sgsgroup.in/

WHEN YOU NEED TO BE SURE

ओएनजीसी ONGC

Oil and Natural Gas Corporation Limited

Assam & Assam Arakan Basin

Assam-Arakan Fold Belt
116, Luit Bhavan, ONGC, Cinnamara Complex
Jorhat, Assam - 785704
Phone: 0376-2707030 & FAX: 0376-2360616

UNDERTAKING

I, Shri Somnath Bandyopadhyay of **M/s OIL & NATURAL GAS CORPORATION LIMITED** willing to submit this undertaking with respect to the TOR prescribed by EAC (Industry-2), Ministry of Environment, Forests and Climate Change, Government of India vide letter No. F No. J-11011/229/2012- IA II (I) Dated 11th September 2013 for the proposed Exploratory Drilling of Twenty Six (26) wells in 5 blocks in Cachar & Karimganj district of Assam state.

M/s OIL & NATURAL GAS CORPORATION LIMITED has been complied with and the data/ information submitted are correct to best of knowledge.

For M/s OIL & NATURAL GAS CORPORATION LIMITED

DGM (G), Acreage Manager
Cachar Acreage
AAFB, ONGC, Jorhat

SOMNATH BANDYOPADHYAY, DGM(G), Acreage Manager-Cachar
Authorised Signatory
M/s OIL & NATURAL GAS CORPORATION LIMITED
Jorhat, Assam

Date: 30.11.2015
Place: Jorhat, Assam

SGS

Declaration by SGS India Pvt. Ltd.

M/s. OIL & NATURAL GAS CORPORATION LIMITED (ONGC) has proposed to start Exploratory Drilling of Twenty Six (26) wells in 5 blocks in Cachar & Karimganj district of Assam state. In this regard M/s OIL & NATURAL GAS CORPORATION LIMITED appointed SGS India Pvt. Ltd. to conduct the Environmental Impact Assessment (EIA) study as per the Terms of Reference (TOR) for carrying out the EIA/EMP study vide letter no. F.No. J-11011/229/2012- IA II (I) Dated 11th September 2013 issued by Ministry of Environment & Forest and Climate Change (MoEF&CC).

SGS has taken all reasonable precautions in the preparation of this EIA report. SGS also believes that the facts presented in this report are accurate as on date it was written.

SGS confirm that the mentioned experts prepared the EIA Report for Exploratory Drilling of Twenty Six (26) wells in 5 blocks in Cachar & Karimganj district of Assam state. SGS also confirm that the consultant organisation shall be fully accountable for any misleading information mentioned in this statement.

Name: SANJEEV KUMAR	Mr. Sanjeev Kumar
Designation:	Head, Environment
Name of the EIA Consultant Organisation:	SGS India Pvt. Ltd.

250, Udyog Vihar, Phase IV, Gurgaon, Haryana, Pin Code - 122 015 t +91 124 6135000, [illegible] +91 124 6776403 / 04
[illegible] Mumbai - 400 083 t + 91 022 6640 [illegible] + 91 022 6640 [illegible] www.sgs.com

CONTENTS

ABBREVIATIONS

APHA	:	American Public Health Association
ASTM	:	American Society for Testing and Materials
AWWA	:	American Water Works Association
bbl	:	Billion Barrels
BOD	:	Biological Oxygen Demand
BTEX	:	Benzene Toluene Ethylene Xylene
CAGR	:	Compound Annual Growth Rate
CCoE	:	Chief Controller of Explosives
CF	:	Contamination Factor
CI	:	Corrosion Inhibitor
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board
CRZ	:	Coastal Regulation Zone
DGH	:	Directorate General of Hydrocarbons
DO	:	Dissolved Oxygen
DTS	:	Distributed Temperature System
EC	:	Electrical Conductivity
ECP	:	External Casing Packers
EIA	:	Environmental Impact Assessment
EMARC	:	Environmental Management Apex Review Committee
EMP	:	Environmental Management Plan
GHG	:	Green House Gas
GPS	:	Geographical Positioning System
HAZOP	:	Hazard Operability
HC	:	Hydrocarbons
IPSEM	:	Institute of Petroleum Safety and Environment Management
ISRS	:	International Safety Rating System
MMSCMD	:	Metric Standard Cubic Meters per Day
MOEF	:	Ministry of Environment and Forests
MSDS	:	Material Safety Data Sheet
NABET	:	National Accreditation Board of Education and Training
ND	:	Not Detected
PAH	:	Polycyclic Aromatic Hydrocarbon
PARCOM	:	Paris Commission
PEL	:	Petroleum Exploration License
PFP	:	Flare Platform
PHC	:	Petroleum Hydrocarbon Content
PVC	:	Polyvinyl Chlroide
QCI	:	Quality Council of India
SPCB	:	State Pollution Control Board
SS	:	Suspended Solids

TDS	:	Total Dissolved Solids
TOR	:	Terms of Reference
TPH	:	Total Petroleum Hydrocarbon
TSS	:	Total Suspended Solids
USEPA	:	United States Environmental Protection Agency
UTM	:	Universal Transverse Mercator

LIST OF TABLES

LIST OF FIGURES

Approved TOR

MOEFCC No.- F. No. J-11011/229/2012- IA II (I) dated 11th September, 2013

F. No. J-11011/229/2012- IA II (I)
Government of India
Ministry of Environment and Forests
(I.A. Division)

Paryavaran Bhawan
CGO Complex, Lodhi Road
New Delhi – 110 003

E-mail : vp.upadhyay@nic.in
Telefax : 011: 2436 2875
Dated: 11th September, 2013

To,

Shri S. K. Jain (Basin Manager)
M/s Oil & Natural Gas Corporation Ltd.
Luit Bhawan, ONGC, Cinnamara Complex,
Cinnamara, Jorhat- 785704

E-mail: jain_sk@ongc.co.in ; Fax No. : 0376-2360012

Subject: Drilling of Exploratory Wells (26 Nos.) in PEL & PML blocks of Cachar Forward Base, in Assam by M/s ONGC Ltd. - regarding TORs.

Sir,

Kindly refer to your letter no. nil alongwith project documents including Form-I, Pre-feasibility Report and draft 'Terms of Reference' as per the EIA Notification, 2006. It is noted that proposal is for drilling of Exploratory Wells (26 Nos.) in PEL & PML blocks of Cachar Forward Base, in Assam by M/s ONGC Ltd.

2.0 Draft Terms of Reference (TOR) have been discussed and finalized during the 7th Reconstituted Expert Appraisal Committee (Industry) held during 4th April, 2013-5th April, 2013 for preparation of EIA/EMP report. Following are the 'TORs':

1. A certified report of the status of compliance of the conditions stipulated in the environmental clearance and Consent to Operate for the ongoing / existing operation of the project by the Regional Office of the Ministry of Environment and Forests and SPCB.
2. Executive summary of a project
3. Project description, project objectives and project benefits.
4. Site details within 1 km of the each proposed well, any habitation, any other installation/activity, flora and fauna, approachability to site, other activities including agriculture/land, satellite imagery for 10 km area.
5. Details of forest land involved in the proposed project. A copy of forest clearance letter, if applicable.
6. Permission from the State Forest Department regarding the impact of the proposed plant on the surrounding National Park/Wild life Sanctuary /Reserve Forest/Eco sensitive area, if any. Approval obtained from the State/Central Government under Forest (Conservation Act, 1980 for the forestland should be submitted.
7. Distance from nearby critically/severely polluted area as per Notification dated 13th January, 2010, if applicable.
8. Does proposal involves rehabilitation and resettlement? If yes, details thereof.

9. Details of project cost.

10. Details of all the facilities including CGS, GGS, OCS, produced water treatment etc to be installed. If existing facilities, give details.

11. Environmental considerations in the selection of the drilling locations for which environmental clearance is being sought. Present any analysis suggested for minimizing the foot print giving details of drilling and development options considered.

12. Baseline data collection for air, water and soil for one season leaving the monsoon season in an area of 10 km radius with centre of Oil Field as its centre covering the area of all proposed drilling wells.

    (i) Topography of the project site.
    (ii) Ambient Air Quality monitoring at 8 locations for PM_{10}, SO_2, NOx, VOCs, Methane and non-methane HC.
    (iii) Soil sample analysis (physical and chemical properties) at the areas located at 5 locations.
    (iv) Ground and surface water quality in the vicinity of the proposed wells site.
    (v) Climatology and Meteorology including wind speed, wind direction, temperature rainfall relative humidity etc.
    (vi) Measurement of Noise levels within 1 km radius of the proposed wells.
    (vii) Vegetation and land use; Animal resources

13. Incremental GLC as a result of DG set operation.

14. Potential environmental impact envisages during various stages of project activities such as site activation, development, operation/ maintenance and decommissioning.

15. Actual source of water and 'Permission' for the drawl of water from the Competent Authority. Detailed water balance, waster water generation and discharge.

16. Noise abatement measures and measures to minimize disturbance due to light and visual intrusions in case coastally located.

17. Treatment and disposal of waste water.

18. Treatment and disposal of solid waste generation.

19. Disposal of spent oil and loose materials.

20. Storage of chemicals and diesel at site.

21. Commitment for the use of WBM only

22. Mud make up and mud and cutting disposal – all options considered should be listed with selective option.

23. Hazardous material usage, storage accounting and disposal.

24. Disposal of packaging waste from site.

25. Oil spill emergency plans in respect of recovery/ reclamation.

26. H_2S emissions control.

27. Produced oil handling and storage.

28. Details of scheme for oil collection system alongwith process flow diagram and its capacity.

29. Details of control of air, water and noise pollution in oil collection system.

30. Disposal of produced/formation water.

31. Whether any burn pits being utilized for well test operations.

32. Restoration and decommissioning plans which should include mud pits and wastage restoration also and documentation and monitoring of site recovery.

33. Measures to protect ground water and shallow aquifers from contamination.

34. Risk assessment and disaster management plan for independent reviews of well designed construction etc. for prevention of blow out.

35. Environmental management plan.

36. Documentary proof of membership of common disposal facilities, if any.

37. Details of environmental and safety related documentation within the company including documentation and proposed occupational health and safety Surveillance Safety Programme for all personnel at site. This should also include monitoring programme for the environmental.

38. Total capital and recurring cost for environmental control measures.

39. A copy of Corporate Environment Policy of the ONGC as per the Ministry's O.M. No. J-11013/41/2006-IA.II(I) dated 26th April, 2011 available on the Ministry's website.

40. Public hearing to be conducted and issues raised and commitments made by the project proponent on the same should be included in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made.

41. Any litigation pending against the project and or any direction/order passed by any court of law against the project. If so details thereof.

42. A tabular chart with index for point-wise compliance of above TORs.

The following general points should be noted:

(i) All documents should be properly indexed, page numbered.
(ii) Period/date of data collection should be clearly indicated.
(iii) Authenticated English translation of all material provided in Regional languages.
(iv) The letter/application for EC should quote the MOEF file No. and also attach a copy of the letter.

(v) A copy of the letter received from the Ministry should be also attached as an annexure to the final EIA-EMP Report.

(vi) The final EIA-EMP report submitted to the Ministry must incorporate the issues in this letter. The index of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report where the above issues have been incorporated.

(vii) Certificate of Accreditation' issued by the QCI to the environmental consultant should be included.

3.0 These 'TORs' should be considered for the preparation of EIA / EMP report for drilling of Exploratory Wells (26 Nos.) in PEL & PML blocks of Cachar Forward Base, in Assam in addition to all the relevant information as per the 'General Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. The EIA/EMP as per TORs should be submitted to the **Chairman, Assam Pollution Control Board, (APCB)** for public consultation. The **APCB** shall conduct the public hearing/public consultation as per the provisions of EIA notification, 2006.

4.0 You are requested to kindly submit the final EIA/EMP prepared as per TORs and incorporating all the issues raised during Public Hearing / Public Consultation to the Ministry for considering the proposal for environmental clearance ***within 2 years as per the MoEF O.M. No. J-11013/41/2006-IA.II (I) dated 22nd March, 2010.***

5.0 The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India / National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc.

(V. P. Upadhyay)
Director

Copy to : The Chairman, Assam Pollution Control Board, Bahunimatram, Guwahati, Assam. (E-mail: membeersecretary@pcbassam.org)

(V. P. Upadhyay)
Director

NABET Accreditation

Scope of Accreditation **Annexure I**

NAME OF THE CONSULTANT ORGANIZATION: **SGS India Pvt. Ltd.**
250, Udyog Vihar, Phase IV,
Gurgaon - 122015

Sl. No.	Sector number		Name of Sector	Category A/B
	As per MoEF Notification	As per NABET Scheme		
1.	1(a) i)	1	Mining of minerals including Opencast / Underground mining	A
2.	1(b)	2	Offshore and onshore oil and gas exploration, development & production	A
3.	1(c)	3	River Valley, Hydel, Drainage and Irrigation projects	B
4.	1(d)	4	Thermal Power Plants	A
5.	3(b)	9	Cement plants	A
6.	4(a)	10	Petroleum refining industry	A
7.	4(c)	12	Asbestos milling and asbestos based products	A
8.	5(c)	18	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	A
9.	5(e)	20	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	A
10.	5(f)	21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulation; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A
11.	6(b)	28	Isolated storage & handling of Hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	B
12.	7(a)	29	Air ports	A
13.	7(e)	33	Ports, harbours, jetties, marine terminals, break waters and dredging	
14.	7(f)	34	Highways, railways, transport terminals, mass rapid transport systems	A
15.	8(a)	38	Building and large construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions	B
16.	8(b)	39	Townships and Area development projects	B
Total = 16 Sectors *Individual EIA Coordinators approved for different sectors are mentioned in Annexure II*				

(Vipin Sahni)
C.E.O.

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

M/s Oil and Natural Gas Corporation Limited (hereinafter referred as ONGC) has been awarded onshore Blocks within Adamtila PML., North Patharia PML, Cachar Dist. PML and Sector-VC PML blocks in Cachar and Karimgunge district of Assam state for exploration of hydrocarbons. Exploratory drilling of wells at 26 locations has been proposed in these three PML blocks.

As per notification dated 14th September 2006, proposed exploratory drilling of 26 no.s of wells is designated as "Category A" project and requires Environment Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC), Govt. of India, Delhi. **M/s SGS India Private Limited** (hereinafter referred as SGS) Gurgaon, has been engaged by ONGC to carry out an Environment Impact Assessment (EIA) study and to prepare an Environment Management Plan (EMP) for getting environment clearance as per TOR prescribed by MoEF& CC. The study has been carried out as per the guidelines of *Ministry of Environment, Forests & Climate Change (MoEF&CC) and Assam State Pollution Control Board (ASPCB).*

1.2 PROJECT PROPONENT

ONGC is a public sector fully integrated petroleum company in India and operating along the entire hydrocarbon value chain. It produces around 69% of India's crude oil (equivalent to around 30% of the country's total demand) and around 62% of its natural gas.

ONGC founded on August 14th, 1956, as Oiland Natural Gas Commission has been converted to Corporation in 1992, ONGC has been conferred the Maharatna3 status by the Central Government on 16th November 2010 and has been ranked 357th in the Fortune Global 500 list of the world's biggest corporations for the year 2012. It is also among the Top 250 Global Energy Company by PLATTS. Its international subsidiary, ONGC Videsh currently has projects in 15 countries.

ONGC is involved in exploring and exploiting hydrocarbons in about 26 sedimentary basins of India. It owns and operates more than 11,000 kilometers of pipelines in India.

1.3 PURPOSE OF THE REPORT

As per Environmental Impact Assessment EIA Notification dated 14th September, 2006 and amended thereof, exploration of oil & gas falls under Category 'A' under project type 1(b) requires Environmental Clearance (EC) from MoEF&CC before the commencement of activity which is granted based on EIA/EMP report.

1.4 LOCATION AND ACCESSIBILITY

As depicted in Figure 1.1, the details of various blocks under control of ONGC in the region are as per given hereunder:

Sl. No	Name of block	Name of Wells	Coordinates		Area (sq km)	Nearest town/ district	Legal status	Number of wells to be drilled for exploration	Accesibility via Rail/ Road
			Latitude	Longitude					
1	Cachar Dist. PML	N/L 7	24º54'13.55"N	92º35'6.669"E	732	Silchar (Cachar)	GoI approved	11	NH 53 and NH 54 (Mizoram Rd)
		TNAA	24º33'35.53"N	92º53'14.31"E					
		HRAB	24º53'18.73"N	92º34'51.14"E					
		N/L 10	24º59'23.02"N	92º28'22.39"E					
		NTAB	24º59'45.15"N	92º26'23.38"E					
		N/L 12	24º34'13.15"N	92º51'3.459"E					
		RPAA	24º48'21.55"N	93º02'57.85"E					
		BKAD	24º42'45.53"N	92º50'3.668"E					
		N/L 15	24º38'29.88"N	92º48'45.45"E					
		N/L 16	24º37'39.59"N	92º49'54.22"E					
		N/L 17	24º35'42.2"N	92º55'42.51"E					
2	Sector-VC PML	N/L 22	24º54'58.6"N	92º51'43.4"E	497	Silchar (Cachar)	GoI approved	5	NH 54 and Airport road
		N/L 23	24º51'25.5"N	93º04'41.46"E					
		PMAC	24º52'19.65"N	92º57'48.65"E					
		MPM	24º53'58.58"N	92º46'39.8"E					
		TKAD	24º54'50.17"N	93º04'10.83"E					
3	Banaskandi PML	BK3(Sub)	24º43'40.67"N	92º50'32.72"E	15	Silchar (Cachar)	GoI approved	2	Sonai road
		BKAC	24º45'33.04"N	92º51'19.28"E					
4	Adamtila	TIAA	24º32'14.25" N	92º17'25.56"E	148	Patharkandi	GoI	4	NH 44

Sl. No	Name of block	Name of Wells	Coordinates		Area (sq km)	Nearest town/ district	Legal status	Number of wells to be drilled for exploration	Accesibility via Rail/ Road
			Latitude	Longitude					
	PML & EXtn	N/L 2	24º30'8.517"N	92º18'17.39"E		(Karimganj)	approved		(Shillong-Agartala Sabram Rd)
		N/L 3	24º32'54.17"N	92º19'4.955"E					
		N/L 4	24º21'58.0"N	92º16'41.65"E					
5	North Patharia PML	PTAC	24º48'14.06"N	92º19'21.71"E	60	Karimganj	GoI approved	4	NH 151 & Longai Road
		N/L 19	24º49'49.73"N	92º19'58.11"E					
		N/L 20	24º46'41.35"N	92º18'16.66"E					
		PTAB	24º45'45.37"N	92º18'14.9"E					

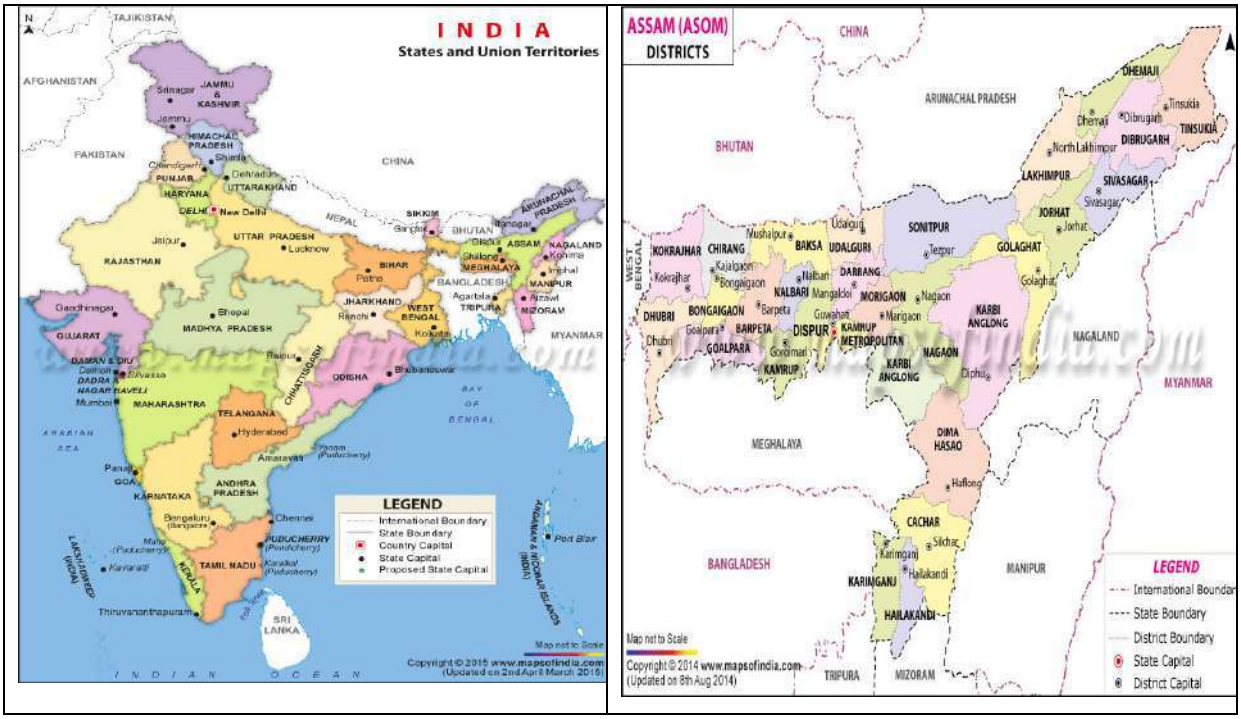

FIGURE 1.1: SITE LOCATION MAP

1.5 SCOPE OF THE STUDY

The EIA/ EMP report termed as draft EIA report is prepared based on the basis of Terms of Reference (TOR) prescribed by the MoEF&CC for public hearing vide F.No. J-11011/229/2012- IA II (I) Dated 11th September 2013 (Enclosed as Annexure I) on the basis of duly filled Form-1 submitted and subsequent presentation made to the Appraisal Committee of the MoEF&CC on 4TH April 2013.

For generation of site specific baseline data, environment monitoring and surveys within the block areas of the 26 exploratory wells have been conducted for three (3) months continuously from 1st January 2015 to 30th April 2015, as per details given hereunder:

1.5.1 BASE LINE DATA GENERATION

- **Ambient Air Quality**

Ambient Air Quality monitoring was carried out at eight (8) locations in and around the Block area for PM10, Sulphur Dioxide, Nitrogen Dioxide, Carbon Monoxide (as CO), hydrocarbons (methane and non-methane) and VOCs. The frequency of monitoring was twice in a week for three (3) months during the study period.

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- **Meteorology at the Site**

Site specific meteorological data was collected near to the site at one (1) location for wind speed, wind direction, temperature, humidity, rainfall and cloud cover on hourly basis during the study period. Details of meteorology of the region have also been collected from the nearest India Meteorological Department (IMD) Observatory at Silchar.

- **Noise Level**

Noise levels were monitored at fifteen (15) locations on hourly basis for 24 hours during the study period. The levels were monitored once during the study period. The results of the finding have been reported in terms of Leq_{Day} and Leq_{Night} for all locations.

- **Traffic Volume Counts**

Traffic volume counts were monitored at five (5) locations on hourly basis for 24 hours, once during the study period.

- **Water Quality**

Samples for surface water from five (05) locations and groundwater from five (05) locations were collected and analyzed for essential parameters as stated in the *BIS 10500:2012*, BIS 2296 and additional relevant parameters. The samples were collected once during the study period.

- **Soil Quality**

Soil samples at nine (09) locations were collected and analyzed for physical and chemical parameters. The samples were collected once during the study period.

- **Biological Environment (Flora and Fauna)**

Survey was undertaken in the study area as per the guidelines of the MOEF&CC. Species of flora have been listed as trees, medicinal plants, bamboos, cane, orchids & ferns and others. Faunal species have been identified as per the *Wildlife Protection Act, 1972* (and as amended subsequently) and associated Schedule.

- **Socio-economic**

Socio-economic survey in the study area was carried out to assess the status of demographic pattern, cropping pattern and general amenities available, based on the Census 2011 and secondary information available with different Government agencies. Primary and secondary information on socio-economic parameters within the study area were collected for the following details:

Household; population; villages and tehsils; population distribution; literacy levels; employment pattern; primary health care facilities available; scheduled castes; scheduled tribes; and transport, communication and welfare facilities were evaluated during the study period.

- **Remote Sensing Study**

This study was carried out based on the satellite imagery of the study area in order to assess the land use pattern, drainage pattern, habitation, vegetation cover, etc of the study area.

1.5.2 IMPACT ASSESSMENT

Considering baseline pollution level due to various existing industrial and domestic pollution sources within the study area; Prediction of incremental levels of pollutants in the study area due to the proposed project activities; Evaluation of the qualitative & quantitave impacts on the various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact assessment methodologies/ models; Identification of mitigation measures for critical environmental attributes as a part of EMP;

1.5.3 RISK ASSESSMENT

Identification and analysis of risk and preparation of disaster management plan to deal with emergency situation.

1.5.4 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

Preparation of Environmental Management Plan (EMP) outlining the measures for environment protection; Details of monitoring, auditing and reporting.

The response to each item as suggested by the EAC (Industry –II), MOEF as per the approved TOR is provided in **Table 1.2** below.

1.6 APPROACH AND METHODOLOGY

SGS followed the standard EIA methodology and technique during the entire study and whenever necessary, it used its own judgment based on its experience and knowledge. During the entire study, appropriate quality checks were taken into consideration and best management practices were followed in order to produce a quality output. Discussions were also undertaken with state-level Government agencies during the survey of the area.

Impacts were identified based on the actual and foreseeable events resulting due to exploratory drilling. Processes that may create risks to the natural environment and socio-economic environment were considered in terms of key potential environmental impacts.

Mitigation measures to be adopted under the EMP for all the specified significant environmental impacts that are likely to result during exploratory drilling are also a part of the EIA/ EMP report.

The identified likely impacts and recommended mitigation measures are based on the following:

- Project information provided by the project proponent;
- Baseline information and reconnaissance survey of the study area conducted by SGS; and
- Standard National/ International environmental management guidelines/ practices.

Details of the methodology and technique used for the study are discussed in the subsequent Chapters. The schematic diagram for approach and methodology adopted for the EIA Study is shown below in Fig 1.2.

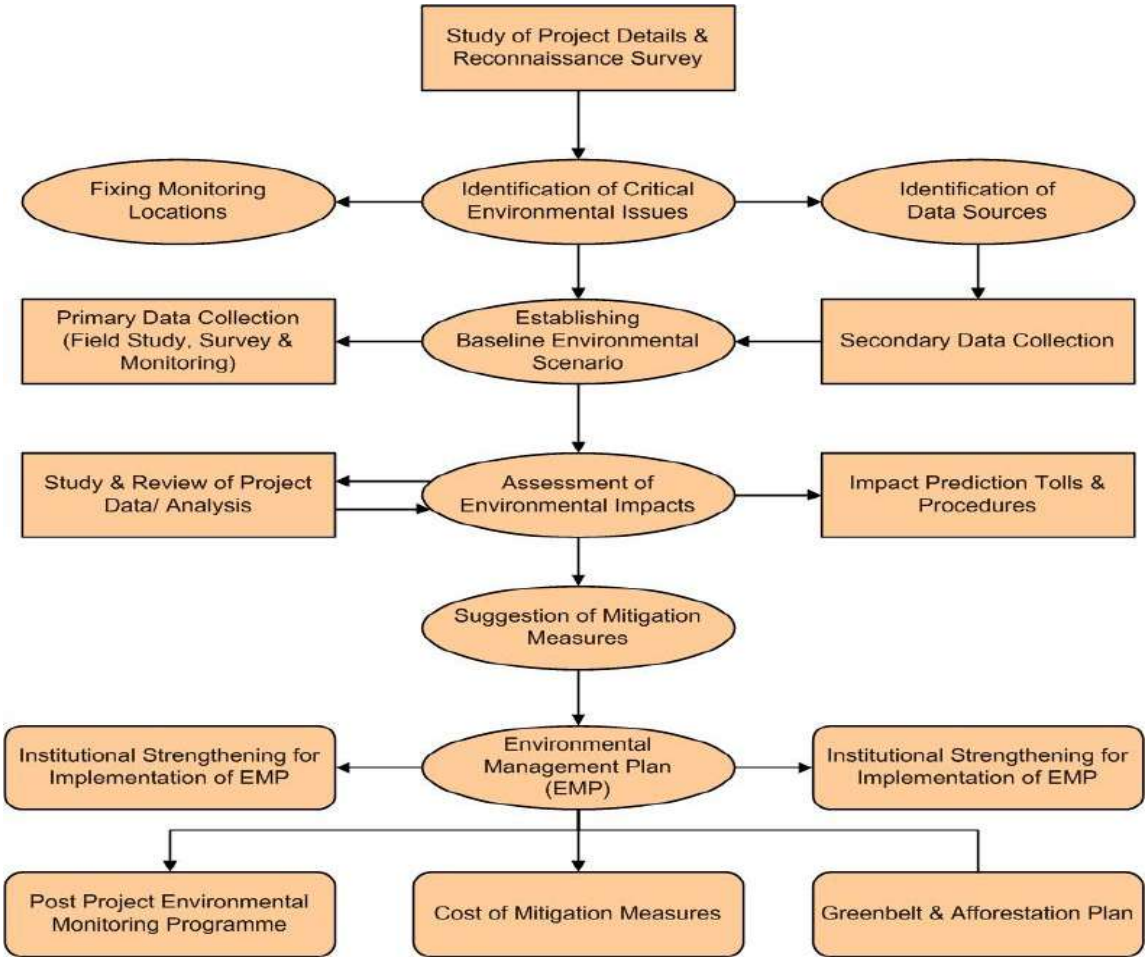


FIGURE 1.2: APPROACH OF EIA STUDY

1.7 STRUCTURE OF THE REPORT

This report is based on the generic structure of EIA report, as suggested in the MoEF &CC Notification dated 14th September 2006. A brief description of each Chapter is presented below:

Executive Summary	Presents the significant findings and recommended actions.	
Chapter 1	Introduction	Presents an introduction of the project along with the scope and objectives of the EIA/ EMP study.
Chapter 2	Project Description	Presents brief project technical details.
Chapter 3	Description of Existing Environment	Presents the baseline status for various environmental parameters in the study area.
Chapter 4	Anticipated Environment Impacts and Mitigation Measures	Presents the identification, prediction and evaluation of environmental impacts due to the proposed project activities and associated proposed mitigation measures.
Chapter 5	Analysis of Alternatives (Technology and Site)	Presents analysis of the alternatives with reference to the site and technology.
Chapter 6	Environment Management Plan & Environment Monitoring Programme	Description of the administrative aspects of ensuring that mitigation measures are implemented and their effectiveness monitored, after approval of the EIA. Presents details of monitoring, audit and reporting.
Chapter 7	Risk Assessment And Disaster Management Plan	Presents details of the Emergency Response plan, as per national and international requirements.

Chapter 8	Project Benefits	Presents project benefits with respect to: • Improvements in the physical infrastructure; • Improvements in the social infrastructure; • Employment potential – skilled, semi-skilled and unskilled; and • Other tangible benefit.
Chapter 9	Summary and Conclusions	Brief summary of the EIA report and conclusion of the study
Chapter 10	Public Consultation	Details of public hearing being conducted by Assam Pollution Control Board (ASPCB) and responses to the issues raised during public hearing
Chapter 11	Details of Consultant	Company's profile with resumes of team members.

TABLE 1.1: TERMS OF REFERENCE (TOR) COMPLIANCE

Sl. No.	Description	Details
1)	A certified report of the status of compliance of the conditions stipulated in the environmental clearance and Consent to Operate for the ongoing I existing operation of the project by the Regional Office of the Ministry of Environment and Forests and SPCB.	New project
2)	Executive summary of a project	Attached Separately
3)	Project description, project objectives and project benefits	Chapter 2 of EIA
4)	Site details within 1 km of the each proposed well, any habitation, any other installation/activity, flora and fauna, approachability to site, other activities including agriculture/land, satellite imagery for 10 km area	Chapter 3, section 3.2, 3.11, 3.12
5)	Details of forest land involved in the proposed project. A copy of forest clearance letter, if applicable	Details of forest land involved is given in Section 2.3.1, Table 2.2
6)	Permission from the State Forest Department regarding the impact of the proposed plant on the surrounding National Park/Wild life Sanctuary /Reserve Forest/Eco sensitive area, if any. Approval obtained from the State/Central Government under Forest (Conservation Act, 1980 for the forestland should be submitted	ONGC has requested State Forest Department to identify the current ownership of Land. Enclosed as Annexure 6

Sl. No.	Description	Details
7)	Distance from nearby critically/severely polluted area as per Notification dated 13th January, 2010, if applicable	No critically/severely polluted area is present within any of the blocks.
8)	Does proposal involves rehabilitation and resettlement? If yes, details thereof.	The proposed project will not require rehabilitation and resettlement
9)	Details of project cost.	Total cost of drilling 26 no.s of wells is 330 Crore INR as given in Section 2.7
10)	Details of all the facilities including CGS, GGS, OCS, produced water treatment etc to be installed. If existing facilities, give details	
11)	Environmental considerations in the selection of the drilling locations for which environmental clearance is being sought. Present any analysis suggested for minimizing the foot print giving details of drilling and development options considered	The environmental considerations are given in Section 2.2
12)	Baseline data collection for air, water and soil for one season leaving the monsoon season in an area of 10 km radius with centre of Oil Field as its centre covering the area of all proposed drilling wells.	Please refer Section 3.7 for baseline air quality, Section 3.9 baseline water quality, and Section 3.10 for baseline soil quality respectively.
i.	Topography of the project site	Chapter 3, Section 3.5.1
ii.	Ambient Air Quality monitoring at 8 locations for PM10, SO2, NOx, VOCs, Methane and non-methane HC	Chapter3, Section 3.7
iii.	Soil sample analysis (physical and chemical properties) at the areas located at 5 locations	Result of Soil Sample Analyses Section 3.10
iv.	Ground and surface water quality in the vicinity of the proposed wells site	Result of Ground and Surface Water given in Section 3.9
v.	Climatology and Meteorology including wind speed, wind direction, temperature rainfall relative humidity etc	Provided in Chapter3, section 3.6
vi.	Measurement of Noise levels within 1 km radius of the proposed wells	Provided in Chapter3, Section 3.8.4
vii.	Vegetation and land use; Animal resources	Provided in Chapter3, section 3.11

Sl. No.	Description	Details
13)	Incremental GLC as a result of DG set operation	Provided in Chapter 4, section 4.2.2.5
14)	Potential environmental impact envisages during various stages of project activities such as site activation, development, operation/ maintenance and decommissioning	Please refer Chapter 4
15)	Actual source of water and 'Permission' for the drawl of water from the Competent Authority. Detailed water balance, waster water generation and discharge	ONGC will buy water from Authorized vendor
16)	Noise abatement measures and measures to minimize disturbance due to light and visual intrusions in case coastally located	Chapter 7, refer table
17)	Treatment and disposal of waste water	Chapter 2, section 2.5.3 (Wastewater treatment scheme)
18)	Treatment and disposal of solid waste generation	Chapter 2, section 2.5.4 (Waste management)
19)	Disposal of spent oil and loose materials	Chapter 2, section 2.5.4 (Waste management)
20)	Storage of chemicals and diesel at site	Chemicals and diesels will be stored on paved areas, Bund wall will be provided to diesel storage area, Spill kits will be made available in chemical and diesel storage area, covered shed will be constructed for storage areas. Details in Chapter 2, table 2.4
21)	Commitment for the use of WBM only	WBM will only be used. Where required eco-friendly synthetic mud will also be used. Chapter 2, section 2.3 (Drilling fluids)
22)	Mud make up and mud and cutting disposal – all options considered should be listed with selective option	Chapter 2, section 2.3 (Drilling fluids)
23)	Hazardous material usage, storage accounting and disposal	Chapter 2, table 2.4, 2.5
24)	Disposal of packaging waste from site	Packaging waste will be given to local waste sellers. Refer Chapter 2,

Sl. No.	Description	Details
		section 2.5.4 (Waste management)
25)	Oil spill emergency plans in respect of recovery/ reclamation	Chapter 6, section 6.3.1, 6.3.2
26)	H2S emissions control	Chapter 6, section 6.6.3
27)	Produced oil handling and storage	Stored temporarily in Oil Pits and later transferred through tankers to the nearest GGS. Chapter 2, section 2.3
28)	Details of scheme for oil collection system along with process flow diagram and its capacity	Chapter 2, section 2.3
29)	Details of control of air, water and noise pollution in oil collection system	Chapter 2, section 2.3
30)	Disposal of produced/formation water	Chapter 2, section 2.3
31)	Whether any burn pits being utilized for well test operations	Burn Pits will not be used.
32)	Restoration and decommissioning plans which should include mud pits and wastage restoration also and documentation and monitoring of site recovery.	Site Closure Plan given Chapter 2, section 2.3
33)	Measures to protect ground water and shallow aquifers from contamination	Measures to protect groundwater and shallow aquifers. Refer Chapter 7, table 7.1
34)	Risk assessment and disaster management plan for independent reviews of well designed construction etc. for prevention of blow out	Please refer Chapter 6
35)	Environmental management plan	Please refer Chapter 7
36)	Documentary proof of membership of common disposal facilities, if any	Common TSDF is not present; therefore this point is not pertinent in this case.
37)	Details of environmental and safety related documentation within the company including documentation and proposed occupational health and safety Surveillance Safety Programme for all personnel at site. This should also include monitoring programme for the environmental	Regular health check up of ONGC personnel conducted as per ONGC HSE Policy. Surveillance safety programs carried at regular intervals and

Sl. No.	Description	Details
		documented. Details in Chapter 7, refer table 7.1
38)	Total capital and recurring cost for environmental control measures	
39)	A copy of Corporate Environment Policy of the ONGC as per the Ministry's O.M. No. J-11013/41/2006-IA.II(I) dated 26th April, 2011 available on the Ministry's website	Refer Chapter 2 and 7
40)	Public hearing to be conducted and issues raised and commitments made by the project proponent on the same should be included in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made	Not yet done
41)	Any litigation pending against the project and or any direction/order passed by any court of law against the project. If so details thereof	Not Applicable
42)	A tabular chart with index for point-wise compliance of above TORs	Provided in Table 1.1 in Chapter 1
43)	The following general points should be noted:	
i.	All documents should be properly indexed, page numbered	Followed
ii.	Period/date of data collection should be clearly indicated	Followed
iii.	Authenticated English translation of all material provided in Regional languages	Followed
iv.	The letter/application for EC should quote the MOEF file No. and also attach a copy of the letter	Followed
v.	A copy of the letter received from the Ministry should be also attached as an annexure to the final EIA-EMP Report	Followed
vi.	The final EIA-EMP report submitted to the Ministry must incorporate the issues in this letter. The index of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report where the above issues have been incorporated	Followed
vii.	Certificate of Accreditation' issued by the QCI to the environmental consultant should be included.	Chapter 10

CHAPTER 2

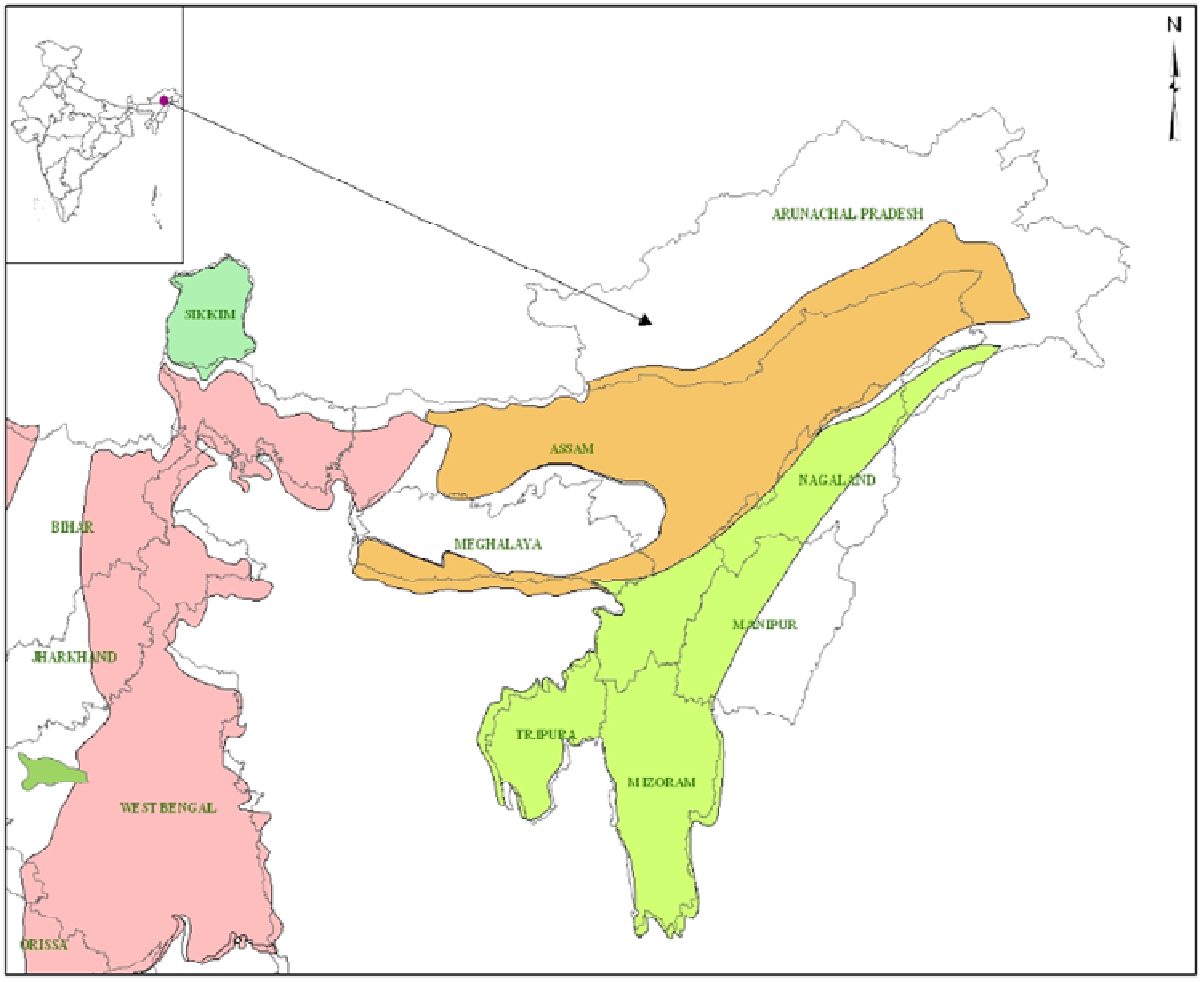
PROJECT DESCRIPTION

CHAPTER 2: PROJECT DESCRIPTION

2.1 PREAMBLE

The identified blocks Cachar Dist. PML, Adamtila PML & EXtn., North Patharia PML, Sector-VC PML, Banaskandi PML lies in the proven petroliferous Assam-Arakan basin as depicted in Figure 2.1. The Assam Shelf, Belt of Schuppen and the Assam-Arakan Fold Belt are the prime geological features of the Assam-Arakan Shelf-slope Basinal system. All blocks primarily fall within the depositional plains of the River Brahmaputra and its tributaries; whilst the southern boundary of the Block is close to the Naga Hills.

FIGURE 2:1: LOCATION OF PROPOSED DRILLING SITE



Source: Hydrocarbon Exploration and Production Activities, India- 2011-12 Published by Director General of Hydrocarbons

2.2 LOCATIONS OF PROPOSED WELLS FOR EXPLORATORY DRILLING

The details of locations of proposed exploratory wells are given in Table 2.1 and depicted in Figure 2.1.

TABLE 2.1: COORDINATES OF THE BLOCKS

SL. No.	Location	PML Blocks	Co-ordinates (WGS-84)							
			Latitude				Longitude			
			Deg.	Min.	Sec.		Deg.	Min.	Sec.	
1	TIAA	Adamtila Ext PML	24	32	14.25	N	92	17	25.56	E
2	N/L	Adamtila Ext PML	24	30	8.517	N	92	18	17.39	E
3	N/L	Adamtila Ext PML	24	32	54.17	N	92	19	4.955	E
4	N/L	Adamtila Ext PML	24	21	58	N	92	16	41.65	E
5	BK3(Sub)	Banskandi PML	24	43	40.67	N	92	50	32.72	E
6	BKAC	Banskandi PML	24	45	33.04	N	92	51	19.28	E
7	N/L	Cachar Distt PML	24	54	13.55	N	92	35	6.669	E
8	TNAA	Cachar Distt PML	24	33	35.53	N	92	53	14.31	E
9	HRAB	Cachar Distt PML	24	53	18.73	N	92	34	51.14	E
10	N/L	Cachar Distt PML	24	59	23.02	N	92	28	22.39	E
11	NTAB	Cachar Distt PML	24	59	45.15	N	92	26	23.38	E
12	N/L	Cachar Distt PML	24	34	13.15	N	92	51	3.459	E
13	RPAA	Cachar Distt PML	24	48	21.55	N	93	2	57.85	E
14	BKAD	Cachar Distt PML	24	42	45.53	N	92	50	3.668	E
15	N/L	Cachar Distt PML	24	38	29.88	N	92	48	45.45	E
16	N/L	Cachar Distt PML	24	37	39.59	N	92	49	54.22	E
17	N/L	Cachar Distt PML	24	35	42.2	N	92	55	42.51	E
18	PTAC	N.Patharia PML	24	48	14.06	N	92	19	21.71	E
19	N/L	N.Patharia PML	24	49	49.73	N	92	19	58.11	E
20	N/L	N.Patharia PML	24	46	41.35	N	92	18	16.66	E
21	PTAB	N.Patharia PML	24	45	45.37	N	92	18	14.9	E
22	N/L	Sector-VC PML	24	54	58.6	N	92	51	43.4	E
23	N/L	Sector-VC PML	24	51	25.5	N	93	4	41.46	E
24	PMAC	Sector-VC PML	24	52	19.65	N	92	57	48.65	E
25	MPM	Sector-VC PML	24	53	58.58	N	92	46	39.8	E
26	TKAD	Sector-VC PML	24	54	50.17	N	93	4	10.83	E

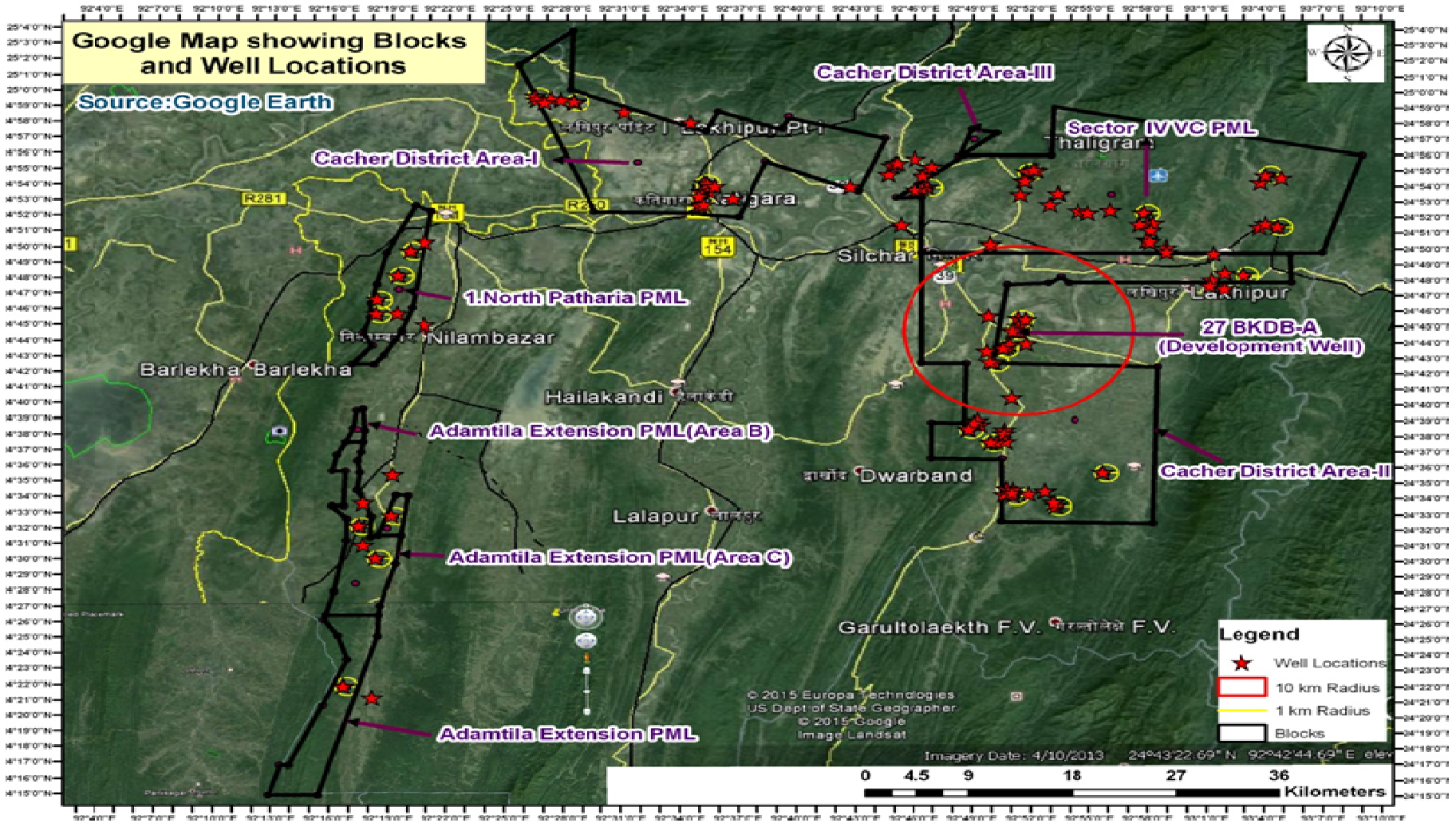
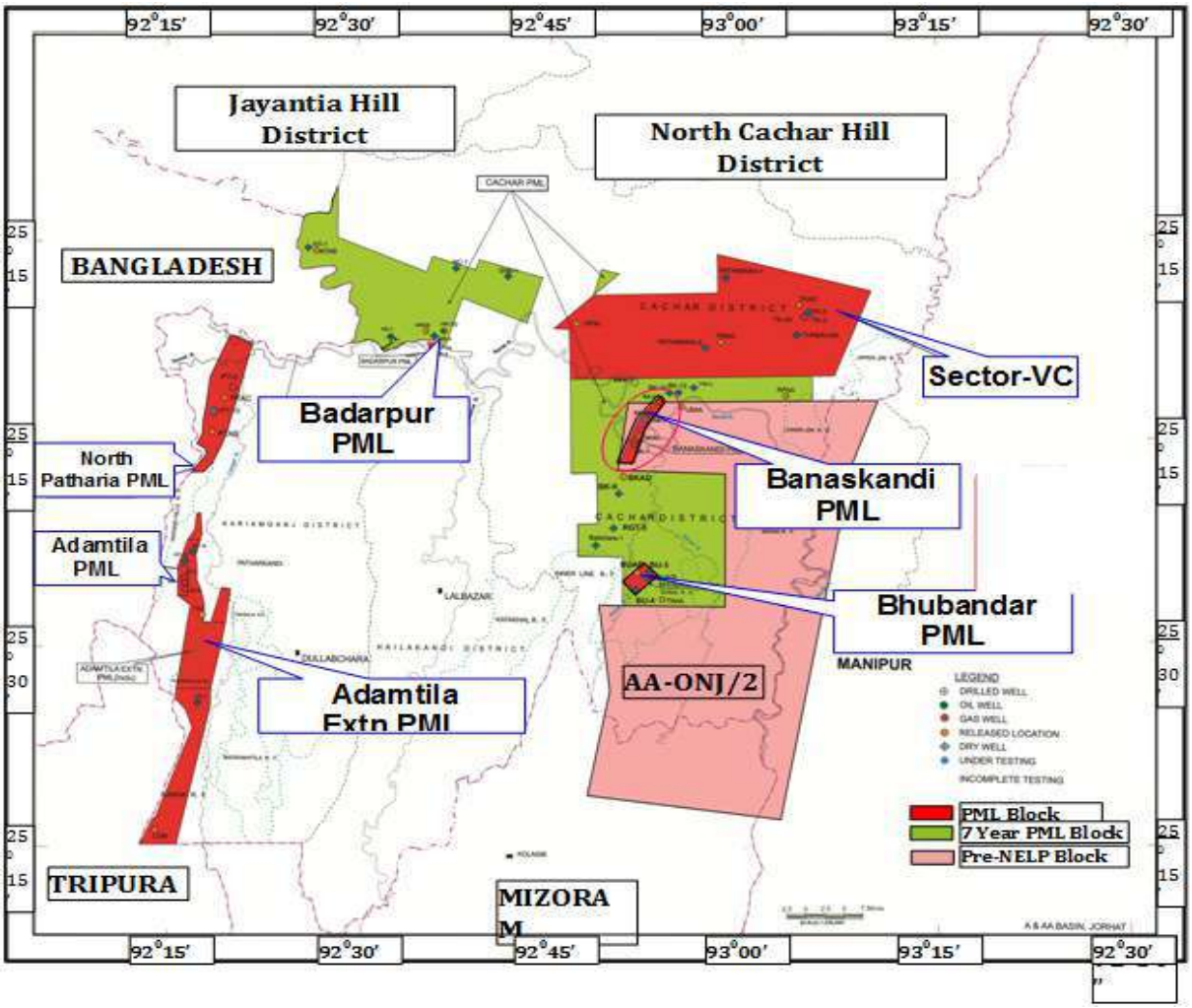


FIGURE 2.2: WELL LOCATION AND BLOCK LOCATION



2.3 NEED AND OBJECTIVES OF PROJECT

India is heavily dependent on the imports to meet the rapidly growing demand of petroleum products. The rising population and the consequent increase in demands on petroleum have put lot of pressure on Indian economy. Despite its best efforts, India has to meet 80% of its total oil and gas demand from international market. Substantial efforts are therefore necessary to boost the exploration activities in the country so that level of crude oil and gas production can further significantly increase to self sufficiency in the years to come.

India imports over 1.5 million barrels of oil per day that place the country at the 9th position among the largest importers of the world. Though the Indian production has been increased in the recent times, the imports were also raised by 5% due to the raised Indian demand of around 4.2%. There is a heavy imbalance between oil production and consumption in India. Growth in demand is expected to catapult the overall demand to 196 250 MT in 2024-25, at an annual growth rate of 3.6%. During the same period, domestic production is expected to

grow at about 2.5% from current 0.8 million barrels per day. This shows a widening gap in domestic production and demand for crude oil.

Energy security has become one of the top three goals of the Indian Government. The Indian Government is encouraging exploration and production of oil and gas to a great extent. This would primarily allow India to tap its own resources there by reducing its import bill.

Discovery of viable hydrocarbon reserves in the state can boost the state's economic development to a great extent. It would also catalyse influx of industries in the state. The proposed exploration project is thus of immense significance for the State.

A. Typical Well Site Details

The depth envisaged for drilling of each well is up to 3000 m. The approximate area of well site is dependent on the type of drilling equipment deployed which in turn is dictated by the planned depth of drilling. Minimum land required at each well site during drilling will be 130m X 130m =1.69 ha, including site facilities and camp site is considered as 1.5-2.0 ha. The typical layout of the well site with ancillary structures is provided in Figure 2.3. Each exploratory well drill site will require the following facilities:

- ✓ *Portable office cabins / rest rooms (container type cubicles);*
- ✓ *Drilling rig foundation and celler;*
- ✓ *Foundation / Pits for ancillary equipments;*
- ✓ *Space for drill rig equipment, working area and materials lay down area;*
- ✓ *Waste storage pits;*
- ✓ *Cutting disposal (impervious lined) pits;*
- ✓ *Waste storage pit;*
- ✓ *Septic tank with soak away pits;*
- ✓ *Paved and contained chemical storage area;*
- ✓ *Above ground Diesel storage tanks with paved and bunded area;*
- ✓ *Radio room;*
- ✓ *Storm water drainage system;*
- ✓ *Internal roads and fencing.*

The site will be sized to contain all equipment and buildings, storage, workshops, etc. using distances between various rig components in line with existing rules and regulations for the area of operation and the approved standard operating procedures of the drilling contractor. The proposed drilling sites will be restricted access area and fenced all round with round the clock watch and ward facility. Entry of vehicles into the drilling site area will be prohibited except for material movement. Adequate parking facilities will be provided outside the drilling location.

2.4 PROJECT ACTIVITIES

2.4.1 TYPICAL WELL SITE DETAILS

The depth envisaged for drilling of each well is up to 3000 m. The approximate area of well site is dependent on the type of drilling equipment deployed which in turn is dictated by the planned depth of drilling. Minimum land required for each well site during drilling will be 130m X 130m =1.69 ha, including site facilities and for camp site will be 1.5-2.0 ha. The typical layout of the well site with ancillary structures is provided in Figure 2.3. Each exploratory well drill site will require the following facilities:

- ✓ *Portable office cabins / rest rooms (container type cubicles);*
- ✓ *Drilling rig foundation and celler;*
- ✓ *Foundation / Pits for ancillary equipments;*
- ✓ *Space for drill rig equipment, working area and materials lay down area;*
- ✓ *Waste storage pits;*
- ✓ *Cutting disposal (impervious lined) pits;*
- ✓ *Waste storage pit;*
- ✓ *Septic tank with soak away pits;*
- ✓ *Paved and contained chemical storage area;*
- ✓ *Above ground Diesel storage tanks with paved and bunded area;*
- ✓ *Radio room;*
- ✓ *Storm water drainage system;*
- ✓ *Internal roads and fencing.*

The site will be sized to contain all equipment and buildings, storage, workshops, etc. using distances between various rig components in line with existing rules and regulations for the area of operation and the approved standard operating procedures of the drilling contractor. The proposed drilling sites will be restricted access area and fenced all round with round the clock watch and ward facility. Entry of vehicles into the drilling site area will be prohibited except for material movement. Adequate parking facilities will be provided outside the drilling location.

2.4.2 PRE-DRILLING ACTIVITY

The pre-drilling phase will involve the following activities:

A. Site Selection

All locations were selected on the basis of geological data available and following considerations were made from environmental point of view during selection of drill site:

- ✓ Non-forest area and area with low vegetation.
- ✓ Away from organized human habitats.
- ✓ Easy access to area of interest
- ✓ Away from sensitive ecological habitat and migratory route

Detailed drill site and access road survey have been carried prior to aquire land on lease basis and construction of drill site. The type of land selected for the proposed drill site is presented in Table 2.2.

TABLE 2.2: LOCATION OF EXPLORATORY DRILL SITE WITH RESPECT TO TYPE OF LAND

Sl. No	Name of well	Type of land		Approach Road	Current status of land procurement
		Forest land	Agricultural land		
1	TIAA		✓	NH 44 (Shillong-Agartala Sabram Rd)	Land Acquisition completed
2	N/L 2		✓		Land leasing process will be initiated after getting the Environmental Clearance.
3	N/L 3		✓		Land leasing process will be initiated after getting the Environmental Clearance.
4	N/L 4		✓		Land leasing process will be initiated after getting the Environmental Clearance.
5	BK3(Sub)		✓	Sonai road	Land leasing process will be initiated after getting the Environmental Clearance.
6	BKAC		✓		Land Acquisition completed
7	N/L 7		✓	NH 53 and NH 54 (Mizoram Rd)	Land leasing process will be initiated after getting the Environmental Clearance.
8	TNAA		✓		Land leasing process will be initiated after getting the Environmental Clearance.
9	HRAB		✓		Land leasing process will be initiated after getting the Environmental Clearance.
10	N/L 10		✓		Land leasing process will be initiated after getting the Environmental Clearance.
11	NTAB		✓		Land leasing process will be initiated after getting the Environmental Clearance.

Sl. No	Name of well	Type of land		Approach Road	Current status of land procurement
		Forest land	Agricultural land		
12	N/L 12		✓		Land leasing process will be initiated after getting the Environmental Clearance.
13	RPAA		✓		Land leasing process will be initiated after getting the Environmental Clearance.
14	BKAD		✓		Land Acquisition completed
15	N/L 15		✓		Land leasing process will be initiated after getting the Environmental Clearance.
16	N/L 16		✓		Land leasing process will be initiated after getting the Environmental Clearance.
17	N/L 17	✓			Land leasing process will be initiated after getting the Environmental Clearance.
18	PTAC		✓	NH 151 & Longai Road	Land leasing process will be initiated after getting the Environmental Clearance.
19	N/L 19		✓		Land leasing process will be initiated after getting the Environmental Clearance.
20	N/L 20		✓		Land leasing process will be initiated after getting the Environmental Clearance.
21	PTAB		✓		Land Acquisition completed
22	N/L 22		✓	NH 54 and Silchar Airport road	Land leasing process will be initiated after getting the Environmental Clearance.
23	N/L 23		✓		Land leasing process will be initiated after getting the Environmental Clearance.
24	PMAC		✓		Land Acquisition completed
25	MPM		✓		Land leasing process will be initiated after getting the Environmental Clearance.
26	TKAD		✓		Land Acquisition under process

B. Rehabilitation and Resettlement

All proposed 26 no. of drill sites are away from human habitation. Therefore, any human displacement will not be required. Moreover, it is to be mentioned that, no rehabilitation or resettlement is required during construction or strengthening or widening of approach road to reach to the each of 26 no. of drill sites.

C. Site Preparation and Access

Site preparation activities would involve leveling, filling and consolidation of the site for staging equipment and machinery. Site along with campsite will be duly fenced to a height of about 4ft using chain link and barbed wires. Site preparation will also include all activities required to facilitate the transport and operation of the drilling rig and associated equipments and machinery. Clearance of vegetation is the primary activity that will be undertaken. After clearance of vegetation, top soil will be removed from the drill site and will be stored in top soil storage area for future use. Following this, leveling and compaction of drill site will be done by graders and mechanical rollers. After leveling and compaction, fill material will be used to elevate the drill site in such a manner that it will be 0.5m higher than the High Flood Level (HFL). Fill material will be met by excavated material for pit required for drill site and balance amount will be sourced from authorized quarry area. A garland drain will be prepared to remove the storm water from the drill site. Site preparation will also involve the following:

- ✓ Construction of cellar pit 3m × 3m × 3m for installation of well head and BOP.
- ✓ Construction of HDPE lined pit of 30'×33'×5' dimension at well site for temporary storage and disposal of drill cutting and waste mud.
- ✓ Construction of HDPE lined pit of 30'×33'×5', 38'×33'×5' and 23'×20'×5' dimension for temporary storage and disposal of drilling wash water.
- ✓ Construction of an oil pit of dimension 3'×3'×4' to contain the oil which may generate during the time of well testing.
- ✓ Construction of septic tanks and soak pits to dispose the domestic wastewater at the drill site.

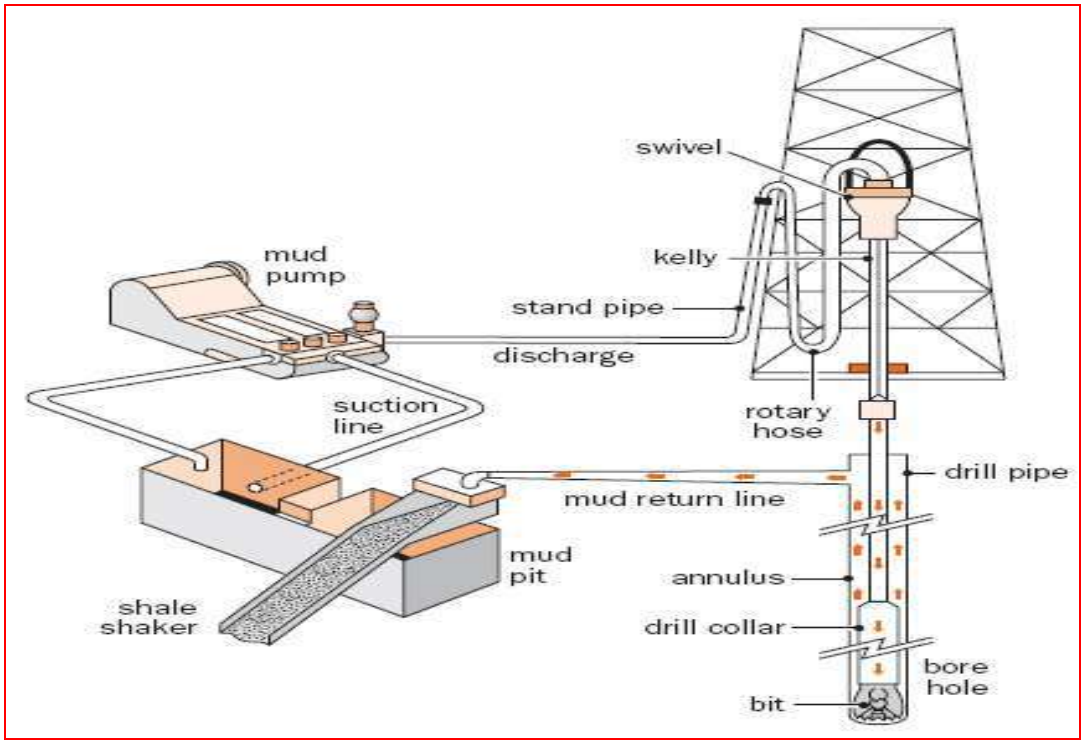


FIGURE2:3: DRILLING RIG (*SOURCE: JOINT E&P FORUM/ UNEP TECHNICAL PUBLICATION*)

The transport of rig including ancillary equipments and camp facilities including truckload requirement during sourcing of fill material to the site is expected to comprise around 60-70 trailer and truck loads for only rig materials. Though the rig and related equipments will be directly brought to site, spares, chemicals and other materials will be received from ONGC base at Silchar. Materials will be intermittently supplied from base to the drilling site, during operations. A provision will be made for temporary storage of materials at the drilling site itself.

D. Rig Mobilization and Rigging up

The details of rig and various allied equipments are as per given hereunder.

TABLE 2.3: EQUIPMENTS AT DRILLING RIG

Type	BRANHAM Electrical AC SCR (Cantilever Swing Lift)
Capacity	4900 m Drilling Depth, Mast Capacity 446 T
Mast Height	142 Ft
Power Packs	Engines: Cummins KTA-50G, 1430 KVA, 50 Hz. 4 Nos. Alternator: BHEL/KATO- 04 Nos.
Draw Works	BHEL, 1400 HP
Wire Line	35 mm
Mud Pumps	BPCL, A-1100 PT Triplex Single Acting Pump, 2 Nos
Crown Block	Make Web Wilson, 500 T
Travelling Block	Make Web Wilson, 500 T
Rotary Table	BHEL, Oilwell, 27-1/2" 500 Ton

Rotary Drive	From Draw Works (Chain & Sprocket System)
Shale Shaker	Kemtron, Linear Motion, KTL-48(PT)
Vacuum Degasser	Geolograph, VACU-FLO 1200
Desander	Reliable Ind. RLL-08, Dual Cone Centrifugal Type
Mud Cleaner	Kemtron, KTL-48B (PT), 1000 GPM
MGS	EXEL Industries Poor Buoy Degasser
BOP System:	
Annular BOP	WGK, 13-5/8" x 5M (Working Pressure) WOM
Double RAM BOP	WU, 13-5/8" x 5M (Working Pressure) WOM Top Blind Ram, Bottom Pipe RAM
Choke Manifold	4-1/16" x 5M (Working Pressure) WOM
Kill Manifold	2-1/16" x 5M (Working Pressure) WOM
BOP Control Unit	KOOMEY, Type-80 Remote PLC Based

2.4.3 DRILLING ACTIVITY

ONGC will appoint a Drilling Contractor or ONGC In-house Drilling Services to carry out the drilling work. To support the drilling operation, the following systems and services will be included at the rig package:

- ✓ Environmental Protection
- ✓ Blow Out Prevention (BOP) system,
- ✓ Wastewater treatment unit,
- ✓ Drill Cuttings handling equipment.

❑ ***Drilling of Well***

The exploitation of hydrocarbons requires the construction of a conduit between the surface and reservoir. This is achieved by the drilling process. The exploration well will be drilled using a standard land rig or a "Mobile Land Rig" with standard water based drilling fluid treatment system. This rig will be suitable for deep drilling up to the desired depth of 3000 meters as planned for the project. The typical configuration of a Drilling Rig is shown in the Figure 2.4. Additionally, there will be other ancillary facilities like Drilling mud system, ETP, Cuttings disposal, Drill Cementing equipment etc. and utilities to supply power (DG sets), water, fuel (HSD) to the drilling process and will be set up as a part of the Project.

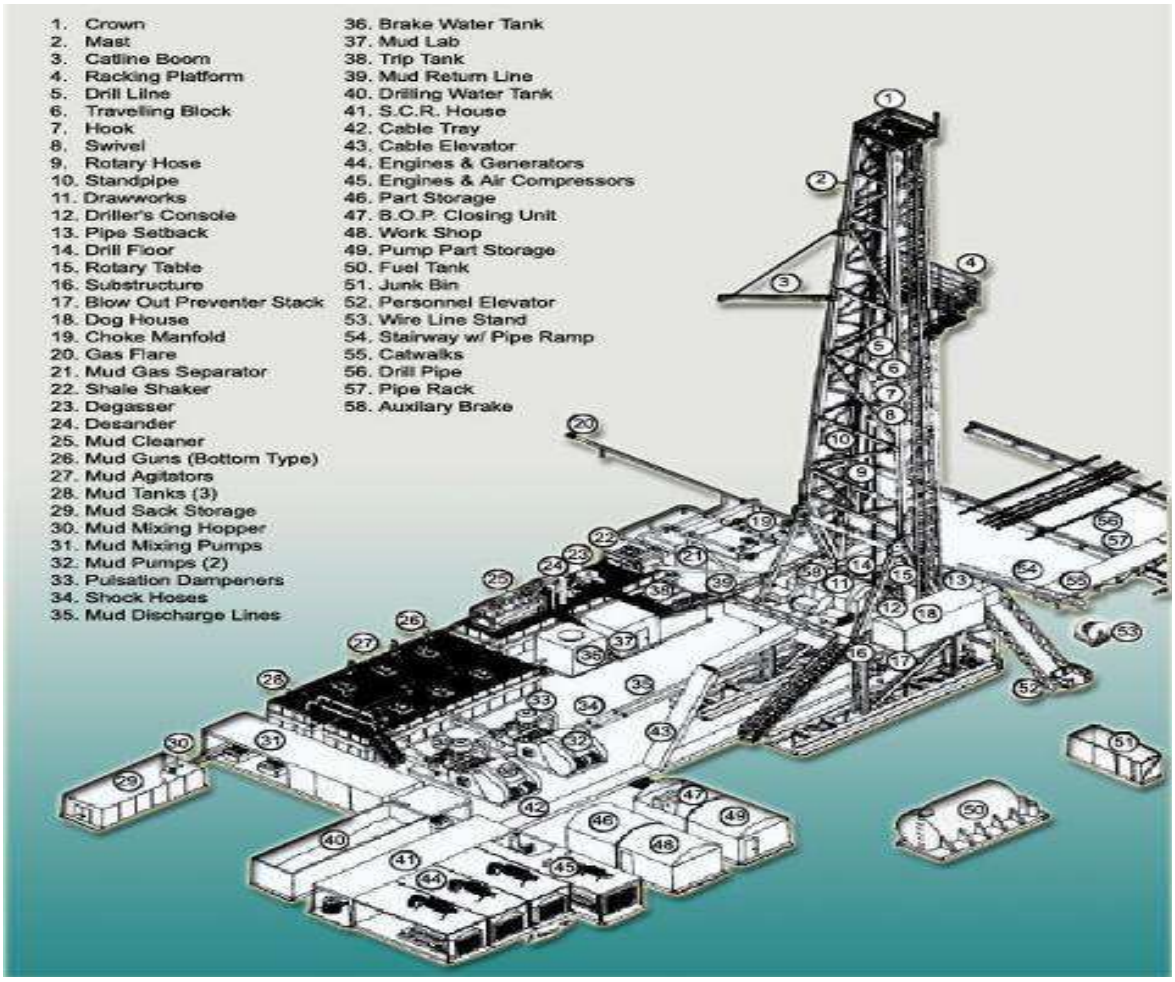


FIGURE 2:4: TYPICAL DRILLING RIG

Well spudding is the start of drilling activity. Top-hole section will be drilled to a desired depth based on well design. After drilling top-hole section, it will be cased with a pipe and this process is called “Casing”. Casing provides support to hole wall and secures hole section. Other than that, it isolates problematic hole sections such as loss zones, shale sections, over pressurized formations etc. After running casing, space between hole wall and “Casing” will be cemented. This process of drilling and casing the hole section continues until the final well depth (target) is achieved. Lengths and diameters of each section of the well are determined prior to drilling and are dependent on the geological conditions through which the well is to be drilled. Once each section of the well is completed, the drill string is lifted and protective steel pipe or casing lowered into the well and cemented into place.

- ***Drilling Fluids (Mud)***

During drilling operations a fluid known as drilling fluid (or ‘mud’) is pumped through the drill string down to the drilling bit and returns between the drill pipe –casing annulus up to surface back into the circulation system after separation of drill cuttings /solids through solids control

equipment. Drilling fluid is essential to the operation and helps in controlling downhole pressure, lift soil/rock cuttings to the mud pit, prevent cuttings from settling in the drill pipe, lubricate, cool and clean the drill bit amongst other functions. About 1500 m^3 drilling fluid is estimated for each well.

Based on geological prognosis and predicted formation pressures, Water Based Mud (WBM) will be used for all the wells considering environmental constraints and hazards. The main components of drilling mud are slurry of inert solids suspended in a liquid phase as per details given in Table 2.4 & 2.5. The main constituents of the WBM are bentonite and barites, both of which are natural minerals. In case the WBM is not able to be used due to geological formation complexities then SOBM (**Synthetic OBM**) will be used generally under specific condition with less than 1% aromatic contents after intimating the MOEF&CC and/or Assam State Pollution Control Board. The vegetable oil i.e; linseed oil or EP lube oil shall be used as lubricating in oil based mud.

TABLE 2.4: CHEMICAL LIST FOR KCL-PHPA POLYMER MUD SYSTEM

Sl.No.	Name of chemicals	Source	Approx. Quantity required per well of 3000 m	Unit	Storage
1	BARYTE	Procured from vendors as per ONGC specification	118.650	MT	Chemicals stored at Central stores and sent to drill sites stores as & when required.
2	BENTONITE		73.000	MT	
3	CAUSTIC SODA		4300.000	KG	
4	CMC (LVG)		1.200	MT	
5	CMC (HVG)		1.375	MT	
6	PHPA		4.775	MT	
7	PAC-LVG		6.0	MT	
8	PAC-RG		7.050	MT	
9	XC POLYMER		5.0	MT	
10	POTASSIUM CHLORIDE		30	MT	
11	POLYOL GD-I		11.200	MT	
12	POLYOL GD-II		2.800	MT	
13	BACTERICIDE ALDEHYDE		0.8	MT	
14	DRILLING DETERGENT		1000	LT	
15	LINSEED OIL		600	LT	
16	EP LUBE		1900	LT	
17	SPOTTING FLUID (NW)		1000 (if required)	LT	
18	ALKALI SODA ASH		400	KG	
19	SODA ASH		150	KG	
20	SODIUM SULPHITE		100	KG	
21	SULPHONATED ASPHALT		8	MT	
22	LIMESTONE POWDER		15	MT	
23	SODIUM CHLORIDE		10000	KG	
24	ALUMINIUM STEARATE		10.000	KG	

TABLE 2.5: FUNCTIONS OF SPECIAL ADDITIVES IN WBM

Sl.No.	Chemicals	Functions
1	Sodium bicarbonate	Eliminate excess calcium ions due to cement contamination
2	Sodium chloride	Minimize borehole washout in salt zone
3	Groundnut shells, mica of cellophane	Minimise loss of drilling mud to formation
4	Cellulose polymers or starch	Counter thick, sticky filter cake, decrease filter loss to formation
5	Aluminium stearate	Minimize foaming
6	Vegetable oil lubricant	Reduce torque and drag on drill string
7	Potassium chloride	Stabilisation of shale

The drilling fluids circulation system consists of several items of equipment. The mud pump takes in mud from the mud pits and sends it out a discharge line to a standpipe. The standpipe is a steel pipe mounted vertically on one leg of the derrick. The mud is pumped up the standpipe into a flexible reinforced rubber hose called the Kelly hose. The Kelly hose is connected to the swivel; goes down the Kelly, drill pipe and drill collars and exits at the bit. The mud then does a sharp U-turn and heads back up the hole in the annulus. The annulus is the space between the outside of the drill string and the wall of the hole. Finally, the mud leaves the hole through a steel pipe called the mud return pipe and falls over a vibrating screen like device called the shale shaker. The shale shaker screens out the cuttings from the mud. The mud drains back into the mud tanks and is recycled back into the well via the mud pump, while the drill cuttings which are inert materials of shale, sand, and clay fall into the lined waste pits. The drilling fluids left over at the end of the particular well will be discharged into the imperviously lined waste pit and dried. The pits will be provided with impervious liners to maintain integrity and prevent any leakage. The drill cuttings cut by the bit are removed from the mud by the shale shakers and other solids removal equipment and transferred to the waste pits. Once the mud is cleaned it is pumped down the drill string again.

The drilling mud, which is pumped through the drill string, through the drill bit and then returns up the annulus between the drill string and bore hole, serves a number of important functions, including:

- Removal of drilled solids (i.e. cuttings) from the bottom of the hole and their transport to the surface for separation from the mud;
- Lubrication and cooling of the drill bit and string;
- Deposition of an impermeable cake on the well bore wall to seal the formation being drilled; and

- Countering the natural formation pressures and preventing uncontrolled flow of fluid from the formations.

At the end of drilling of each well, whatever the fluid left in the pits will be treated & transported to the next drilling location or disposed off in pit lined with HDPE sheet.

The whole process by which the drilling fluid will be reused during the drilling operation is commonly known as a "Closed Loop System." This system is ideal for drilling operations in sensitive environments as it cuts down immensely on the total water consumption for the formulation of drilling mud and also saves on the consumption of chemicals. Figure 2.5 shows the schematic layout of the drilling waste management. Figure 2.7 shows the drilling fluid circulation system which is designed to enable the drilling fluid to be recycled and maintained in good condition throughout the operation.

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

Chemicals required for the preparation of drilling fluid will be centrally stored in Srikona. Additionally, chemicals will also be stored in the drill site. The storage area will be paved and bunded and will be provided with a shed.

❑ ***Drill Cutting***

Mud to be used during the operation will flush out formation cuttings from the well hole @ 225 m^3/well. These cuttings will be separated from the drilling mud using a solids-control and waste management package and will be thoroughly washed. Cuttings will then be stored in the HDPE lined pits and after completion of the drilling activities; cuttings will be tested for hazardous nature. Based on nature of drill cuttings, final disposal pathway will be finalized by ONGC. The total amount of drill cuttings produced during the entire drilling period is projected to be about 225m3 which will be stored in an impervious pit with liner at the site and the pit will be covered or treated as per waste disposal guidelines for such wastes. At the end of drilling of each well, dried cuttings will be disposed off in secured HDPE lined pit.

Once the cuttings have been separated, the drilling fluid will be reused or processed after further treatment in a Chemically Enhanced Dewatering (CED) system designed to remove suspended solids that are too fine for mechanical separation in solids control package producing inlet particles called 'flocs'. The flocs will be removed in the decanting centrifuges and the resultant sludge disposed off in High Density Polyethylene (HDPE) lined pits. The

cleaned waste water will also be stored in HDPE lined pits and disposed off, after testing and any necessary treatment, to meet the regulatory requirements.

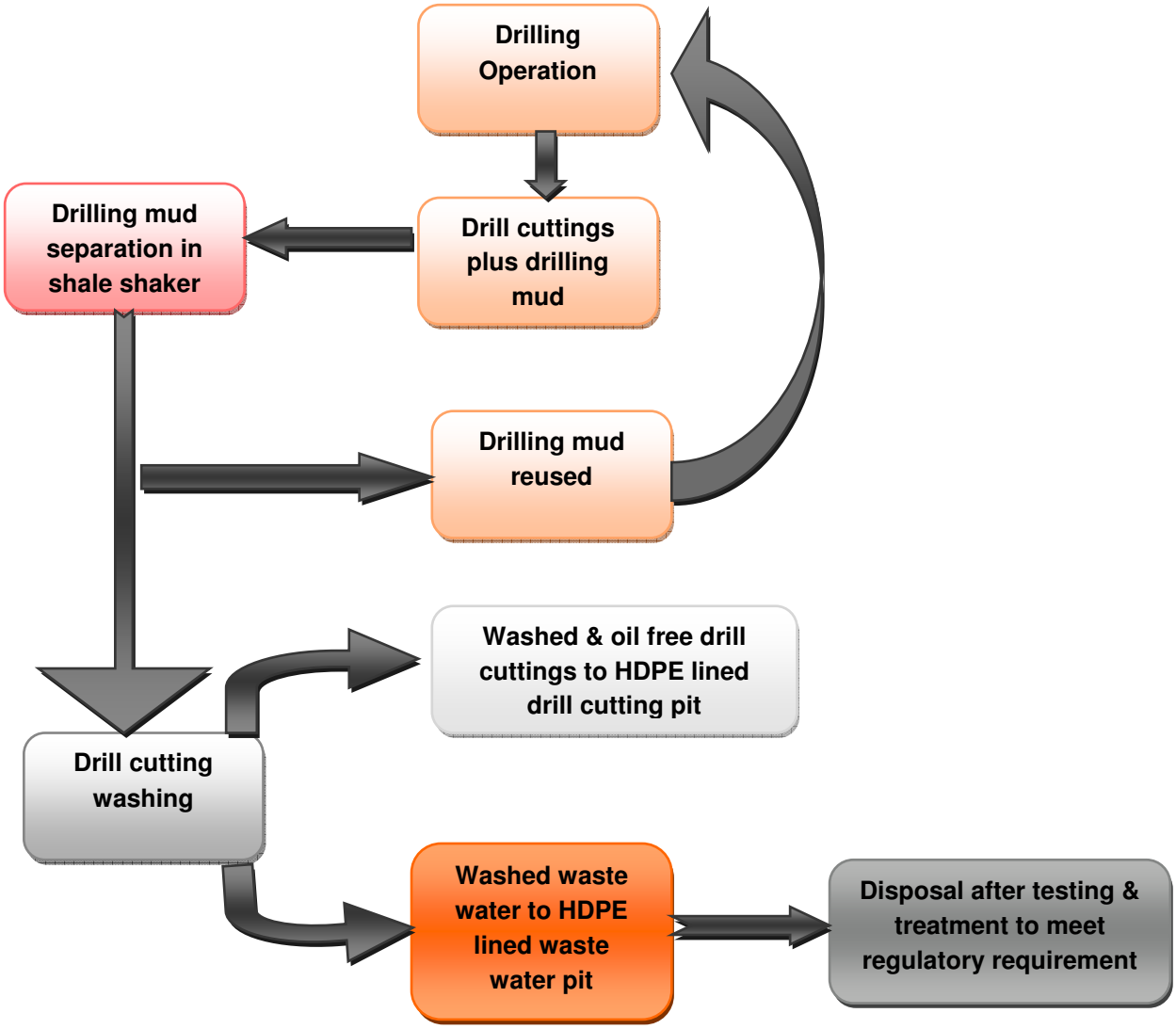


FIGURE 2.5: SCHEMATIC LAYOUT OF THE DRILLING WASTE MANAGEMENT SYSTEM

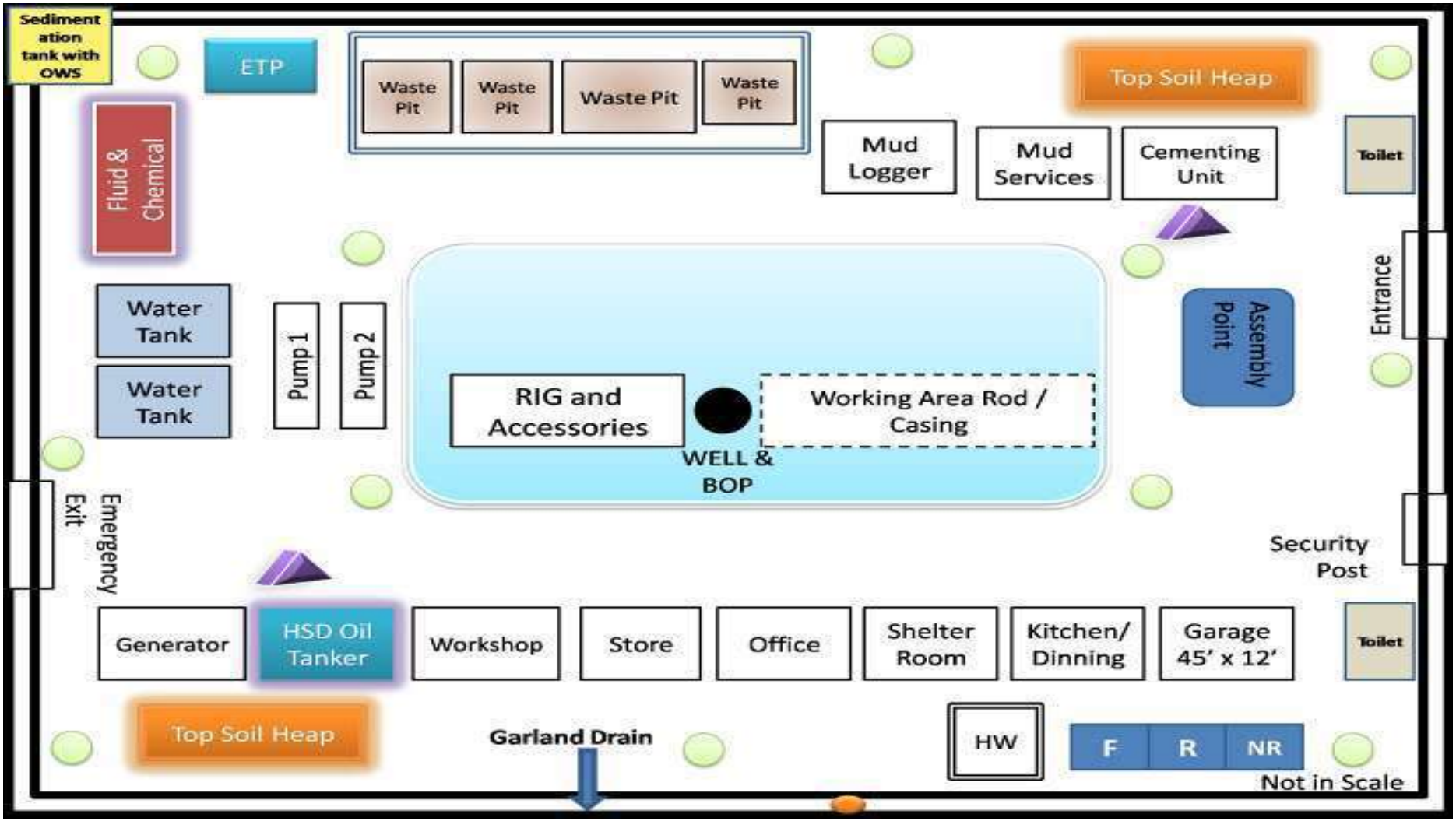


FIGURE 2.6: DRILLING SITE LAYOUT

- ***Cementing Programme***

Cement is used to

- ✓ *Secure/support casing strings*
- ✓ *Isolate zones for production purposes*
- ✓ *Solve various hole problems*

Cementing generally utilizes Portland cement (API Class G Oil Well Cement) with various additives in small quantities as accelerators/retarders, density adjusters, dispersants, fluid loss additives, anti gas migration additives, etc.

- ***Surface Testing & Flaring***

In case hydrocarbons are detected in the well, the quantity and quality for commercial production will be tested. The gases coming out from the well will be flared. The flaring will be intermittent and last only for few days. However, for flaring all the flaring guidelines for onshore wells will be followed and the design, size and location of flaring stack will be decided based on surrounding habitations and the flaring guidelines.

Extremities of flare lines will be located at least 90 m from roads, public works, processing units or tanks. They will be at least 50 m from a well, gas/oil separator, site drainage or other possible source of ignitable vapours. It should be ensured that a flare line will be:

- Equipped with a pilot flame or other ignition device to ensure continuous Ignition of vented gas; and
- Equipped with a guard to protect the flame from being extinguished by the wind.

The zones expected to be Oil and Gas bearing will be identified based on the wire line log data and same will undergo testing to confirm the same.

Approximately duration of the test flaring is around six hours per day and for four days during exploratory drilling. Temporary test separators with facilities for flow metering will be provided which will separate oil, gas and water.

- ***Well logging***

Drilling operations continue until the predetermined total depth of the well is reached. The drill string is removed from the well bore to allow the insertion of logging tools, which are lowered all the way to the bottom of the hole by means of a special cable. This cable contains numerous electrical circuits. Signals detected by the tools are recorded in a recording truck at the surface by means of the electrical circuits contained in the cable.

Electrical logs measure the natural electric potential and the effect of induced electricity on the formations. Radioactivity logs measure the natural radioactivity and the effect of induced radioactivity on the formations. Sonic logs measure the velocity of sound waves in the formations. By analyzing these logs, experienced geologists and engineers can determine the depth from the surface to various formations and intervals, formation characteristics such as rock type and porosity, and indications of the presence of oil or gas and quantity.

2.4.4 WELL DECOMMISSIONING

- ***Completing the well***

When drill-stem testing and well-logging operations have been completed and the results have been analyzed, the company management must decide whether to complete the well as a producing well or to plug it as a dry hole. If the evidence indicates that no oil or gas are present, or they are not present in sufficient quantity to allow for the recovery of drilling, completion, and production costs and provide a profit on investment, the well will probably be plugged and abandoned as a dry hole. If, on the other hand, evidence indicates the presence of oil or gas in sufficient quantity to allow the recovery of these costs and provide a profit to the company, an attempt will be made to complete the well as a producer.

If the well is to be plugged and abandoned as a dry hole, the well bore is filled with drilling fluid, which contains additives which give it special properties that prevent its movement from the well bore into the surrounding rock. Cement plugs are required within the well bore at intervals where porosity has been detected to isolate these porosity zones and prevent the movement of formation fluids from one formation to another. The cement is pumped into the well bore through the drill string. The cement is mixed at the surface in special trucks which are equipped with high-volume pumps. The pumps are connected to the drill string which has been inserted into the well bore to a predetermined depth. A quantity of cement is pumped into the well bore through the drill string and displaced out of the bottom of the drill string with drilling fluid. The drill string is then pulled up to the next interval that is to be cemented. This process is repeated until all the required plugs have been set. A cement plug is also set at the base of the surface casing, which remains in the hole, and another plug is set at the surface. In cultivated areas the surface casing is cut off below plow depth. A steel plate is welded at the top of the surface casing. All drilling equipment and materials are removed from the drill site. The pits are allowed to dry up and are backfilled and the site is restored as nearly as possible to its original condition.

If a decision is made to attempt to complete the well as a producer, casing is delivered to the site. The well bore is filled with drilling fluid that contains additives to prevent corrosion of the

casing and to prevent the movement of the fluid from the well bore into the surrounding rock. The casing is threaded together and inserted into the well bore much in the same manner as the drill string. Casing may be inserted to a total depth of the hole or a cement plug may have been set at a specific depth and the casing set on top of it. Cement is mixed at the surface just as if the well were to be plugged. The cement is then pumped down the casing and displaced out of the bottom with drilling fluid or water. The cement then flows up and around the casing, filling the space between the casing and the well bore to a predetermined height.

- ***Restoration of Cutting Containment Area***

At the conclusion of well testing at each drilling site, solar drying will dewater the waste pits. All residual solids and liner will be covered with thick column of native soil. The cutting mud is inert and with HDPE (High Density Poly-ethylene) linings of the pit in place it will not pose any scope of environmental hazard. Grading will take place to ensure natural run-off. Any remaining topsoil that has been stocked during the site clearance will be re-spread over appropriate portions of the site. Plantation of saplings will be commenced during the next rainy seasons to restore the site and conduct afforestation in and around the site.

- ***Site Closure and Decommissioning***

After completion of the drilling activity, partial demobilization of the drilling rig and associated infrastructure will be initiated. As discussed earlier, well testing may be carried out immediately after the drilling is completed depending on initial evaluation timing. The complete demobilization of the facilities on site will happen after well-testing has been completed. This will involve the dismantling of the rig, all associated equipments and the residential camp, and transporting it out of the project area. It is expected that, demobilization phase will last about 10-15 days and will involve the trucking away of materials, equipments and other materials from site to bring it back to original condition. It is estimated that about 60-70 truckloads will be transported out of site during this period.

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

- ✓ *All concrete structures will be broken up, and the debris disposed off as per the regulatory requirements.*
- ✓ *All other waste products, solid and liquid, will be disposed off in accordance with the requirements of the EIA as specified in table 2.8 & 2.9 and will be treated to render them harmless as per Sl.No.72, Schedule I – Standards for Emission or Discharge of*

Environmental Pollutants from Oil Drilling Gas Extraction Industries. All fencing and access gates will be removed.

- ✓ *All pits whose contents will show regulatory compliance for on-site disposal, at the time of site closure, will be backfilled and closed out as per the legal requirements.*
- ✓ *Restoration of unusable portion of the access track, removal of pilings and Landscaping.*

❑ ***Site Restoration***

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

2.5 UTILITIES

i) Power Requirement

The power requirement of drill rig will be met by Four (04) x 1430 KVA DG sets with a diesel consumption of about 6 KL/day. At a time, Maximum three during drilling, 01 standby. . During well testing/flaring one auxiliary 250 KVA DG Set. The exhaust stacks of the DG sets are likely to vent the emissions.

ii) Water Requirement

Water is basically required for preparing drilling mud, direct washing of drill cuttings, cooling of gas engines and for meeting domestic needs of the campsite. Typically, the water consumption for each well will be 25 kilolitres per day (KLD) for 75-90 days per well. The camp will normally operate with around 50 personnel and will consume water @ 5 KLD for domestic purpose only. However, the drilling and domestic water requirement would depend on the time required to drill the well, which is primarily dependent on the proposed depth. The water requirement will be met from the local sources through water tankers. Suitable water transport arrangement will be made to transfer water for both drilling and domestic purposes.

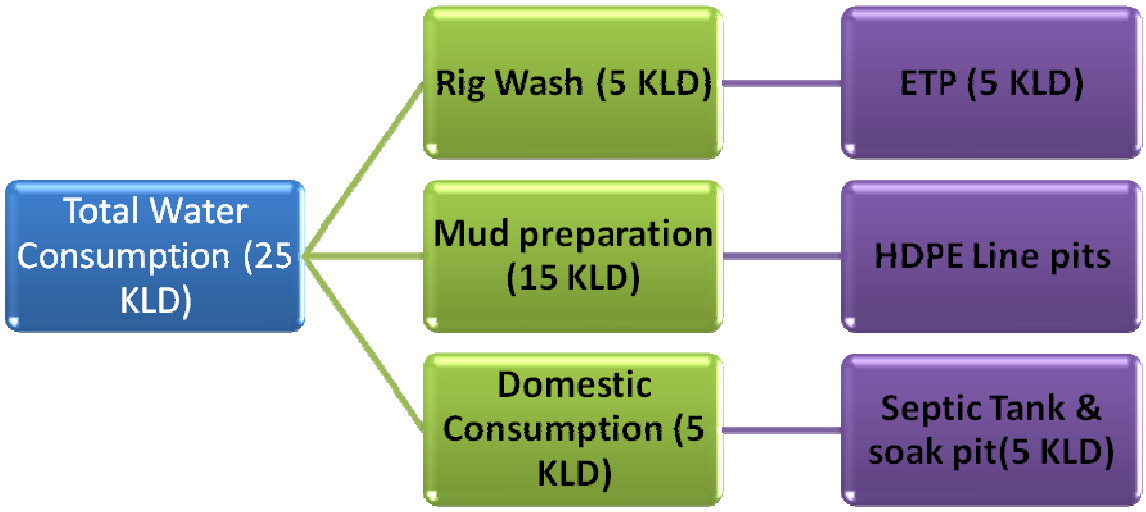


FIGURE 2.8: WATER BALANCE DIAGRAMME

iii) Fuel Requirements & Storage

Estimated consumption of HSD shall be about 6 KL/day and majority of it will be used for power generation via DG sets and stored temporarily only during site preparation or rig building phase. HSD reserve tanks will be installed of capacity 40 KL. Also consumption is much less than 6 KL during this period.

During the drilling phase, the consumption of diesel by the drilling rig will be about 6 KL/day. 85% of the fuel will be used for rig operation and 15% will be used in the campsite. Two reserve tanks with 40 Kl each capacity are installed at site. These are surrounded by dyke wall as a means for containment in case any emergency.

iv) Manpower availability

The project will be employing considerable manpower for all the phases. During the site preparation, 50 workmen will be employed per drill site in two shifts.

During the drilling phase, about 50 workmen in two shifts will be employed on site. This will include technical experts, who will be responsible for various drilling related activities and some Technical manpower engaged are either from ONGC drilling services or contractor's crew as applicable. It is also anticipated that, at any given time, there will be 50 personnel working on site including technical staff, drilling crew, security staff etc.

v) Staffing and Project Employment

The overall management and coordination of the exploration drilling of wells program will be the responsibility of the head office. Local staff will comprise individuals hired for different project activities. The head office will be responsible for:

- Providing all necessary backup information to the Contractor;
- Logistical details;
- Providing spare parts, food and all necessary equipment;
- Data shipments;
- Liaison with the contractor's office;
- Taking care of other administrative matters such as flight authorizations, import licenses, etc.

Around 50 personnel including technical and other labors will be involved during drilling phase.

❑ **Base camp**

The staff will be housed in one base camp established at a convenient location for the program. Typically, such camps have trailer and tented accommodation for staff, storage space for equipment, parking spaces for the vehicles and cooking facilities. Small secondary or field camps may be set up for limited periods of time as the need arises. Arrangement shall be made for 90-100 personnel.

2.6 SOURCES OF POLLUTION

2.6.1 AIR POLLUTION

Air emissions from point sources are expected mainly from combustion of diesel in the diesel engines for power generation. The principal pollutants will comprise of Particulate Matter (PM), Sulphur dioxides, Nitrogen oxides and other hydrocarbons (HC). Additionally, flaring of gas during testing of the well will also lead to release of some pollutants such as Nitrogen Oxides and un-burnt hydrocarbons to the atmosphere. SO_2 is not anticipated as H_2S presence in gas to be flared is nil. Some fugitive emissions of dust and air pollutants from vehicular exhaust will also happen during the project lifecycle, mostly during the construction and decommissioning activities.

2.6.2 NOISE POLLUTION

Noise will be emitted from exploratory drill site during site preparation, drilling and decommissioning phases. The major noise generating operations from the proposed activity includes during drilling are operation of rotary drilling equipment as part of rig, diesel engines for power generation, mud pumps and operation of vehicles. Noise during the site

preparatory phase will primarily be contributed by heavy construction machinery operating on site and vehicular sources. Average noise emission ranges for different types of drilling rig and its equipments are shown in the Table 2.6.

TABLE 2.6: CONSTRUCTION EQUIPMENT NOISE LEVEL

Equipment	Equivalent Noise Levels dB(A)	
	Average	Range
Drilling Rig	88	85-91
Mud Pumps	86.5	79-89
Diesel Generators	96	89-103
Shale Shakers	90	79-93

2.6.3 WASTE WATER TREATMENT AND DISPOSAL

During drilling operations, approximately 5 KLD of drilling waste water will be generated as a result of rig wash and dewatering of spent mud, effluents from washing of drill cuttings, floor washings, pump, seal leakages etc. The characteristics of drilling and wash wastewater will be primarily dependent on type and composition of drilling fluid used for drilling. As ONGC is proposing the use of water-based drilling mud, the potential for contamination of such waste water is significantly lower. The drilling wastewater will contain spent drilling fluid generated as a result of washings. The rig wash water and drilling wastewater generated is proposed to be recycled through a mobile Effluent Treatment Plant installed at the drilling site. The plant will be capable of handling 10 KLD of drilling effluents. Domestic waste water generated (about 5 KLD for the drilling camp) will be treated through a soak pit/septic tank arrangement. The quantities of the liquid wastes, their characteristics and anticipated disposal methods are given in Table 2.7.

TABLE 2.7: LIQUID WASTES GENERATED DURING DRILLING AND DISPOSAL

Type of wastewater	Amount (KLD)	Disposal method
Drilling and rig wash Wastewater	10	The water will be adequately treated in a mobile ETP to ensure conformance to The water will be adequately treated in a mobile ETP to ensure conformance to the S No. 72 A (ii) Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB
Domestic Wastewater (Sewage)	5	Soak pit/septic tank arrangement

- **Effluent Treatment scheme**

Stage 1 - From the Raw Effluent Collection Pit, the liquid Effluent is lifted by a centrigual pump and chemically treated with coagulants in a flash mixing chamber (coagulation method) and then flocculated in a flocculation chamber (flocculation method).

State 2- The flocculated particles are separated next in clarification units where the separated solids are collected at the bottom of the unit, and discharged to Sludge Pit.

Stage 3 - The separated effluent coming from the previous process are further processed in a Corrugated Plate Interceptor (CPI). This CPI unit removes all the free and floating oil and settlable fine solids from the effluent. The low density oil floats on the tank surface and collected through an Oil Skimmer channel. The heavy solids are collected at the bottom of the unit, and discharged to Sludge Pit.

Stage 4 - The clarified effluent coming from the previous process is filtered through a multi-media filter for removing all the colloidal fine particles from the effluent. In this filteration process the solid particles from the previous stage are arrested.

Stage 5 - The treated effluent is collected in a treated water collection tank, from which it is re-circulated for drilling equipment washing, plantation and dust suppression purposes.

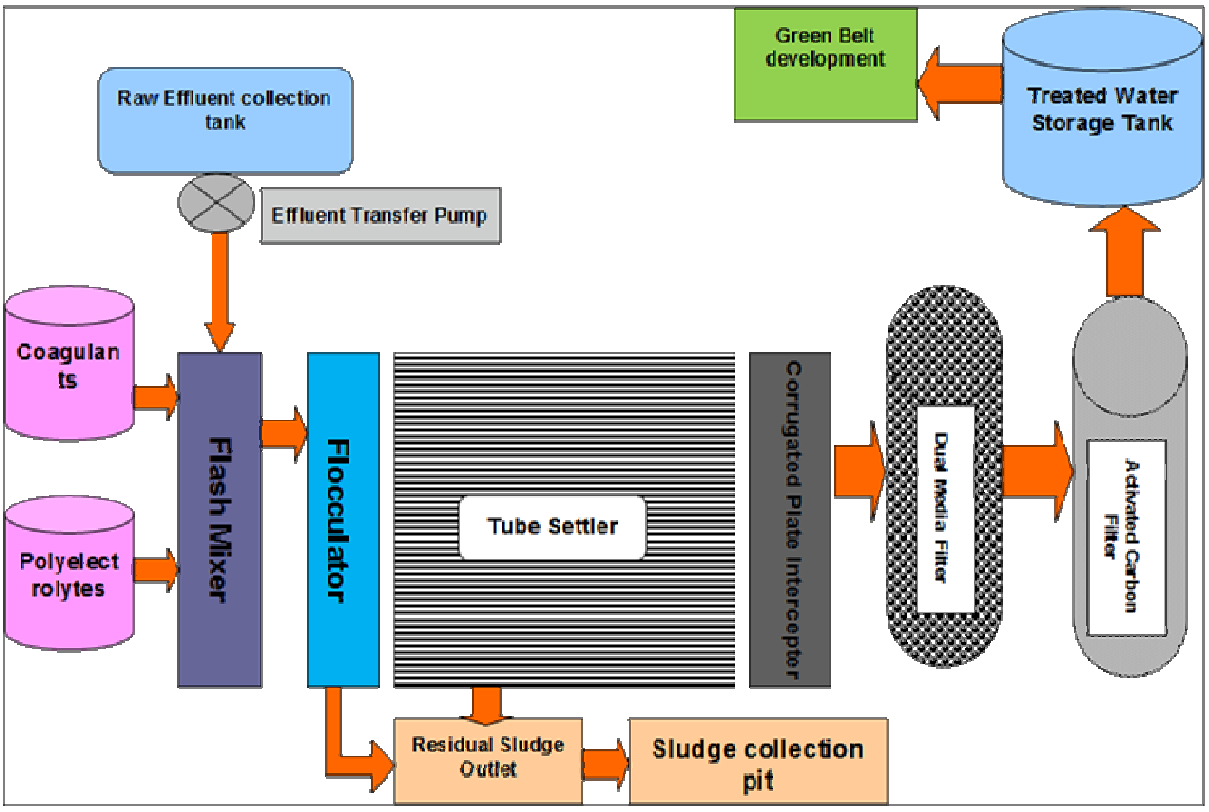


FIGURE 2.5: MOBILE ETP LAYOUT

Components of Effluent Treatment Plant (ETP):

1	**Effluent transfer pumps**	
	Numbers offered	*1 (in use) + 1 (Standby)*
	Type	*Centrifugal*
	Power rating	*3 HP – 2.2 Kw*
	Rated Speed	*2900 RPM*
2	**Coagulation Process**	
	Type	*Static vortex Flash mixer within tank for mixing*
3	**Chemical solution preparation tank for alum, lime, polyelectrolyte etc.**	
	Type	*HDPE tanks*
4	**Flocculation Process**	
	Type	*Static Tapered Velocity Gradient Flocculator*
5	**Sedimentation Process**	
	Type	*Tube settler with hopper bottom sludge collection including sludge draining valves*

Concrete pads will be built to collect wastewater from kitchens, toilets, bathing and washing areas. Wastewater from toilets shall be sent to soak pit after passing through Septic tank while same from other sources shall be sent to soak pit for final disposal.

On completion of the exploration activities, all the installations will be removed without leaving debris. Kitchen waste will be dumped in humus pit for its future use as manure. Other solid wastes such as plastics, metals, and workshop waste will be removed by a contracting agent.

2.6.4 WASTE MANAGEMENT

The estimated details of waste that would generate from each type of well is given in Table 2.8 & Table 2.9.

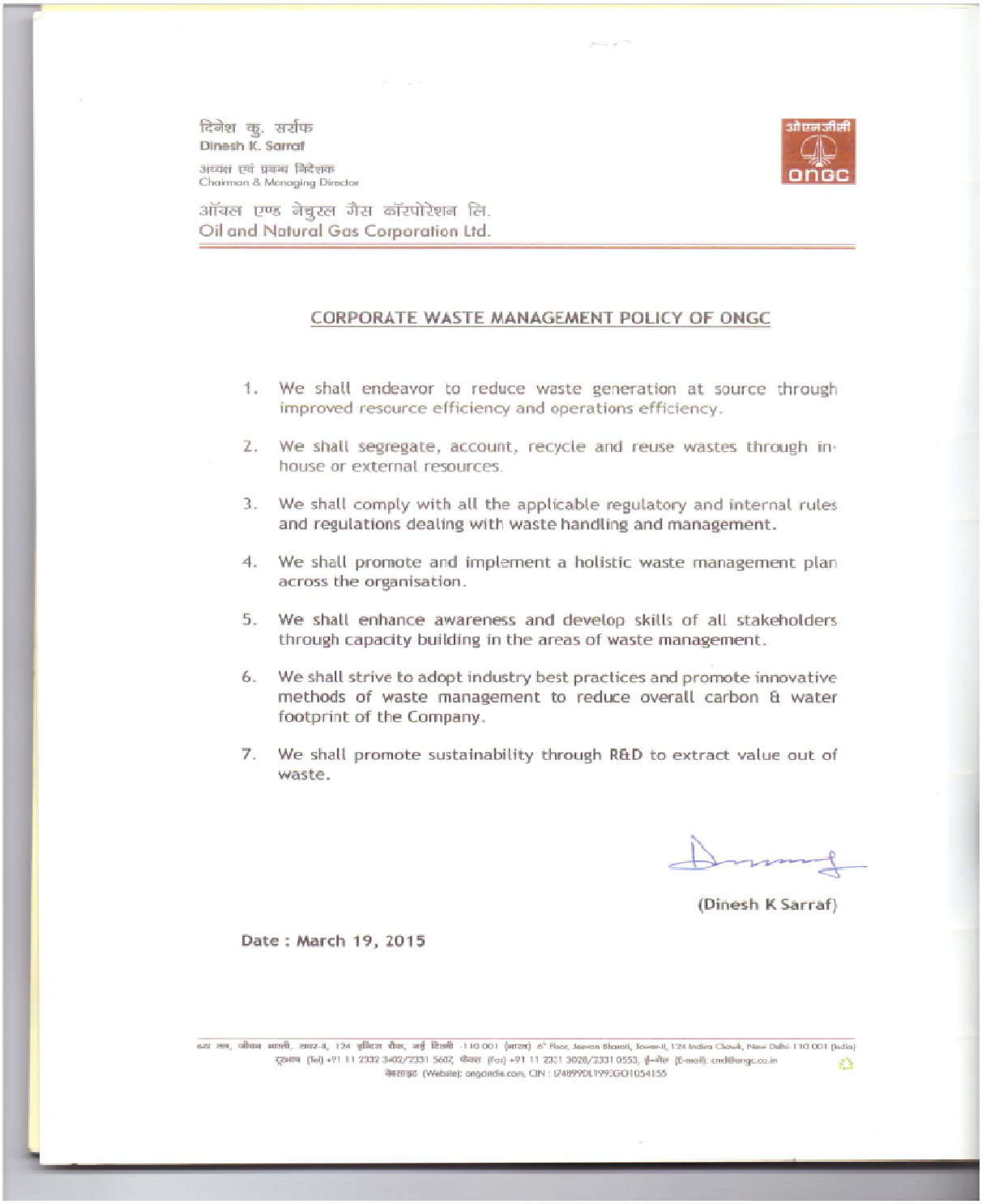
TABLE 2.8: HAZARDOUS WASTE DETAILS PER WELL

Sl.No.	Hazardous waste	Category	Quantity	Method of disposal
1	Sludge containing oil	2.2	Generation is dependent on type and duration of testing operations and well kick / blowout situations (10 – 15 m3)	Disposed to ASPCB/ CPCB registered waste oil reprocessor
2	Drill Cutting	2.1	225 m3 /well	Drill cuttings will be disposed off in

				a well designed pit lined with impervious liner located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.
3	Drilling mud	2.3	Drilling Mud : 1500 m3/well	Drilling mud will be analysed through MoEF/ ASPCB authorised laboratory and then disposed on-site in HDPE lined pits located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.
4	Used/ spent oil	5.1	2-3 KL per well	Used oil will be collected in metal drums kept in secured dyked area and will be disposed to CPCB/ ASPCB registered used oil reprocessor
5	Wastes/ residues containing oil	5.2		Disposed on-site in HDPE lined pits located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.
6	Lead Acid batteries	17 (Schedule IV)	2-3 Batteries per drilling of well	Will be recycled through the vendors supplying acid – lead batteries as required under the Batteries (Management & Handling) Rules, 2001 and amended thereof.

TABLE 2.9: NON HAZARDOUS WASTE DETAILS AND DISPOSAL METHODS

Sl.No.	Non Hazardous waste	Quantity	Method of disposal
1	Kitchen Waste	10 – 20 kg per day	Will be stored in compost pits on a daily basis
2	Recyclable waste like papers, plastics,	Small	Proper segregation and storage of recyclable waste in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.
3	Packaging wastes	Small	Proper segregation and storage at designated stackyard onsite. Packaging wastes will be periodically sold to local waste recyclers.



दिनेश कु. सर्राफ
Dinesh K. Sarraf
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

ओएनजीसी
ONGC

ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लि.
Oil and Natural Gas Corporation Ltd.

CORPORATE WASTE MANAGEMENT POLICY OF ONGC

1. We shall endeavor to reduce waste generation at source through improved resource efficiency and operations efficiency.
2. We shall segregate, account, recycle and reuse wastes through in-house or external resources.
3. We shall comply with all the applicable regulatory and internal rules and regulations dealing with waste handling and management.
4. We shall promote and implement a holistic waste management plan across the organisation.
5. We shall enhance awareness and develop skills of all stakeholders through capacity building in the areas of waste management.
6. We shall strive to adopt industry best practices and promote innovative methods of waste management to reduce overall carbon & water footprint of the Company.
7. We shall promote sustainability through R&D to extract value out of waste.

(Dinesh K Sarraf)

Date : March 19, 2015

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FIGURE 2.9: WASTE MANAGEMENT POLICY OF ONGC

2.7 PROJECT COST

The total cost of drilling of wells including daily drilling rates, consumables, well accessories etc. is approximately Rs. 780 Crores.

CHAPTER 3

DESCRIPTION OF ENVIRONMENT

CHAPTER 3: DESCRIPTION OF ENVIRONMENT

3.1 INTRODUCTION

To assess the baseline environmental status within the study area, a comprehensive primary and secondary data collection programme was undertaken during the study period i.e., from 26th January 2015 to 17th April 2015. The environmental baseline monitoring of Micrometeorology, Ambient Air quality, Ambient Noise quality, Surface and Ground water monitoring, Soil quality monitoring has been done.

The impact identification starts with the collection of baseline data for ambient air quality, water quality, noise levels, land use patterns, flora & fauna and the socio-economic profile within the study area from primary via monitoring and surveys. Relevent data from secondary data has also been collected from authentic sources viz. Government/Non Government agencies, universities, Irrigation Department, Indian Meteorological department (IMD), Ground water board, Census department etc. Reconnaissance field survey and consultations were also carried out with local people and government departments/agencies to understand and record the biological and social environment prevailing in the study area to make data published information and literature more site specific. The detailed information on the geology, hydrogeology, prevailing natural hazards of the area have been collected from literature reviews, past studies and information made available by government departments/local agencies.

3.2 ENVIRONMENTAL SETTING

The details of environment setting within study area and within an area of 1 km radius around proposed location of each well are as per given below:

TABLE 3.1: ENVIRONMENTAL SETTING OF EACH BLOCK

Sl. No.	Environmental Features	Details of Blocks				
1	Name of Block	**Adamtila Ext PML**	**Banskandi PML**	**Cachar Dist. PML**	**N.Patharia PML**	**Sector-VC PML**
2	Presence of Wildlife Sanctuary/ National Park/ Reserve/ Protected Forests/ Wetland	Tilbhum Hills RF, Churaibari Reserve Forest	None	Sonai RF	None	None
3	Migratory route for Wild animals	None	None	None	None	None
4	Major River/ Tributaries / other water bodies	Phuri Ganga, Langai river	Sonai River, Barak River,	Barak River, Puni Khal, Surma River, Rukni River, Mathura Khal	Langai River	Larsing River, Diksa river, Bali gang, Barak river, Diglang Nadi
5	Other Water Bodies	Small ponds	Algapur Bill, Satkarkandi anua bill,	Ranga bil, Ghagta bil, Bar bil, Rina bil, Talkar bil, Mokachari bill, Katakhal, Katakhal, Dharmi Khal	Small ponds	Jhulan khal
6	Road Infrastructure (name of approach road)	NH 53 and NH 54 (Mizoram Rd), NH 44 (Shillong-Agartala Sabram Rd), Isarpar Road	Mizoram Road (West), Silchar road (East), Gobindapur-Sonabarighat Road	NH 44 (Shillong-Agartala Sabram Rd), Mizoram Road (West), NH 53, NH 54 (Mizoram Rd), Amraghat Road	NH 151 & Longai Road	NH 54, Joypur Road, Udarbandh Road, Harinagar Road
7	Archeological monuments	None	None	None	None	None
8	Defense installations	None	None	None	None	None
9	Major habitations	Paschim Salgoi, Dakshin Balaigaon, Pecharghat, Dakshin Hatikhir, Hatairbond, Baithakhal basti,	Dhanehari,Satkarakandi, Dungripar, Majhirgram, Dhanehari, Baghpur, Satkarakandi, Tundurkandi,	Niz Katigorah, Siddeswar, Katigara, Mohanpur. Noon nagar, Hilara Bubandhar, Mahadevpur Pt I, Rajyeswarpur Pt I & II	Kulcherra, Krishnanagar, Ranibari, Brahmanshashan, Dasgram, Meda,	Japirband, Larsingpar grant, Pangram Budhan nagar, Dikcha Punji,

Sl. No.	Environmental Features	Details of Blocks				
		Ankapai punjee, Dakshin Balaigaon, Zahanpur, Kalanpur, North Maguna, Maguna punjee	Sonabarighat, Dhanipur	Biswambarpur, Tarapur, Digor Natanpur, Karabella grant, Nishchintapur Saptagram, Debipur, Safagram, Gajalghat Lalang Kitta Labocpar, Nurnagar, Digor Fulertal, Roujabad, Chalitartol, Khairabad Kajidahar Pt III, Menipur, Dhanehari Palai, Barjalenga Palai, Barjalenga Pingthal, Tupidahar, Darmitol, Bharampur	Surigram, Umarpur Nagkapan, Bhagichagi, Chandpur, Jinahabra, Mubarakpur, Bargool, Panchas Nayagram Hizim, Hizim Madanpur, Chandkhani Chak, Hizimangura, Dalgram, Chandkhani, Nandibari, Angura Parbat Hizim, Ghugrakhona, Saidpur, Kayasthgram, Nayagram, Dubri	Dikcha basti, Kamranga punji Monipur Kitta Uttar, Narainpur Grant Masimpur Bagicha, Dudhpatil Pt III, Ardhaballi Kanakpur Pt III, Baladhan grant, Doiloichera, Chatridoyal, Kalapur
10	Other establishments (Tea garden/ historical monuments/ schools/ colleges etc)	Chandkhira Railway stn, Lalkhim TE, Shephinjuri TE, Sonakhira TE, Baithakal TE, Hatikhira TE, Baithakal TE, Isabeel TE	Madhav Chandra Das College	Silchar Railway station, Badarpur TE, Jalalpur TE, Palai TE, Maniarkhal TE, Cachar College, R.K.Degree college, G.C. College, H.D. Memorial College, Radhamadhav college, Silchar Polytechnic college, NIT-Silchar	Longai Railway Stn, Jalalnagar TE, Ayalabari TE, Madanpur TE, Promodnagar TE	Hatichhare TE, Barasingha TE, Chandighat TE Baiddhan TE Udarband TE, Dayapur TE Kharil TE

TABLE 3.2: ENVIRONMENTAL SETTING OF EACH IDENTIFIED WELL (WITHIN 1 KM RADIUS)

Name of Well	PML Blocks	Coordinates of well		Road Infrastructure (name of approach road)	Distance and direction of RF/ Wildlife Santuary	Distance and direction of nearest river	Habitation details (major human establishments etc.)	Villages/ teagarden/ historical monuments/ schools/ colleges etc	Other Water bodies
		Latitude	Longitude						
TIAA	Adamtila Ext PML	24º32'14.25" N	92º17'25.56"E	NH 53 and NH 54 (Mizoram Rd)	-	-	Paschim Salgoi, Dakshin Balaigaon	Lalkhim TE, Sonakhira TE	Pond located SE at ~300m
N/L 2	Adamtila Ext PML	24º30'8.517"N	92º18'17.39"E	NH 44 (Shillong-Agartala Sabram Rd)	-	-	Pecharghat, Dakshin Hatikhir, Hatairbond	Baithakal TE, Hatikhira TE	Stream located South at ~250m & Pond located WSW at ~50m
N/L 3	Adamtila Ext PML	24º32'54.17"N	92º19'4.955"E	NH 44 (Shillong-Agartala Sabram Rd)	Tilbhum Hills RF(South West/ 1 km)	-	Baithakhal basti, Ankapai punjee, Dakshin Balaigaon	Baithakal TE	2 ponds located South at ~700m & 2 ponds located SE at ~850m
N/L 4	Adamtila Ext PML	24º21'58.0"N	92º16'41.65"E	Isarpar Road	-	-	Zahanpur, Kalanpur, North Maguna, Maguna punjee	Isabeel TE	A number of ponds located S & SE at ~ 300m & 600m

BK3(Sub)	Banskandi PML	24º43'40.67"N	92º50'32.72"E	Mizoram Road (West), Silchar road (East)	-	-	Dhanehari,Satkarakandi, Dungripar, Majhirgram	-	Barnal Khal (Stream) located East at ~300m
BKAC	Banskandi PML	24º45'33.04"N	92º51'19.28"E	Gobindapur-Sonabarighat Road	-	Barak River is located at ~600m west)	Dhanehari, Satkarakandi, Tundurkandi, Sonabarighat	--	-
N/L 7	Cachar Dist. PML	24º54'13.55"N	92º35'6.669"E	NH 44 (Shillong-Agartala Sabram Rd)	-	-	Niz Katigorah, Siddeswar, Katigara, Mohanpur. Noon nagar, Hilara	-	Kinna Khal (Stream) located North ~950m
TNAA	Cachar Dist. PML	24º33'35.53"N	92º53'14.31"E	Mizoram Road (West)	Well is located in Sonai RF	-	Bubandhar	-	Pond located ~600m NW
HRAB	Cachar Dist. PML	24º53'18.73"N	92º34'51.14"E	NH 44 (Shillong-Agartala Sabram Rd)	-	Barak River is located at ~1200m South)	Katigara, Mohanpur. Noon nagar, Hilara	Badarpur TE	-

N/L 10	Cachar Dist. PML	24º59'23.02"N	92º28'22.39"E	NH 44 (Shillong-Agartala Sabram Rd)	-	-	Mahadevpur Pt I, Rajyeswarpur Pt I & II	Jalalpur TE	Talkar bil/pond located at ~400m SW
NTAB	Cachar Dist. PML	24º59'45.15"N	92º26'23.38"E	NH 44 (Shillong-Agartala Sabram Rd)	-	-	Mahadevpur Pt I, Biswambarpur, Tarapur, Digor Mahadevpur, Natanpur, Karabella grant, Nishchintapur	-	Small stream located West at ~50m & ultimately joining Surma River at 2km west.
N/L 12	Cachar Dist. PML	24º34'13.15"N	92º51'3.459"E	Mizoram Road (West)	-	Rukni River is located at 700m west	Saptagram, Debipur, Mahadevpur, Safagram, Gajalghat	-	-
RPAA	Cachar Dist. PML	24º48'21.55"N	93º02'57.85"E	NH 53	Lower Jiri RF is located ~ 1km South	-	Lalang Kitta Labocpar, Nurnagar, Digor Fulertal, Roujabad, Chalitartol, Khairabad	Bamboo forest	-
BKAD	Cachar Dist. PML	24º42'45.53"N	92º50'3.668"E	Mizoram Road (West)	-	-	Kajidahar Pt III, Menipur, Dhanehari	-	Mathura Khal (Stream) located adjacent to the

									well & Mokachari bill (Pond)
N/L 15	Cachar Dist. PML	24º38'29.88"N	92º48'45.45"E	NH 54 (Mizoram Rd)	-	-	Palai, Barjalenga	Palai TE, Open mixed jungle	Pond is located ~ 700m SW
N/L 16	Cachar Dist. PML	24º37'39.59"N	92º49'54.22"E	NH 54 (Mizoram Rd)	-	-	Palai, Barjalenga	Palai TE, Open mixed jungle	-
N/L 17	Cachar Dist. PML	24º35'42.2"N	92º55'42.51"E	Amraghat Road	-	-	Pingthal, Tupidahar, Darmitol, Bharampur	Maniarkhal TE	Dharmi Khal (Stream) running at ~500m East
PTAC	N.Pathari a PML	24º48'14.06"N	92º19'21.71"E	NH 151 & Longai Road	-	-	Kulcherra, Krishnanagar, Ranibari, Brahmanshashan, Dasgram, Meda, Surigram, Umarpur	Jalalnagar TE	Pond located at ~400m west
N/L 19	N.Pathari a PML	24º49'49.73"N	92º19'58.11"E	NH 151 & Longai Road	-	-	Nagkapan, Surigram, Bhagichagi, Chandpur, Jinahabra,	Jalalnagar TE, Ayalabari TE	-

							Mubarakpur, Bargool, Panchas		
N/L 20	N.Pathari a PML	24º46'41. 35"N	92º18'16.6 6"E	NH 151 & Longai Road	-	-	Nayagram Hizim, Hizim Madanpur, Chandkhani Chak, Hizimangura, Dalgram, Chandkhani, Nandibari, Angura	Madanpur TE	-
PTAB	N.Pathari a PML	24º45'45. 37"N	92º18'14.9" E	NH 151 & Longai Road	Patharia Hills RF located ~900m west	-	Parbat Hizim, Ghugrakhona, Saidpur, Kayasthgram, Nayagram, Dubri	Promodnagar TE	-
N/L 22	Sector-VC PML	24º54'58. 6"N	92º51'43.4" E	NH 54	-	-	Japirband, Larsingpar grant, Pangram	Hatichhare TE, Barasingha TE, Chandighat TE	Larsing Nadi is located at ~500m SE
N/L 23	Sector-VC PML	24º51'25. 5"N	93º04'41.4 6"E	Joypur Road	-	Diksa river is located at ~1 Km west	Budhan nagar, Dikcha Punji, Dikcha basti, Kamranga punji	Baiddhan TE	Jhulan khal(stream) connecting Diksa river is flowing at ~500m North

PMAC	Sector-VC PML	24º52'19.65"N	92º57'48.65"E	Udarbandh Road	-	-	Monipur Kitta Uttar, Narainpur Grant	Udarband TE, Dayapur TE	-
MPM	Sector-VC PML	24º53'58.58"N	92º46'39.8"E	NH 54	-	-	Masimpur Bagicha, Dudhpatil Pt III, Ardhaballi	Kharil TE	Pond located at ~900m West
TKAD	Sector-VC PML	24º54'50.17"N	93º04'10.83"E	Harinagar Road	Chiri River located ~750m west	-	Kanakpur Pt III, Baladhan grant, Doiloichera, Chatridoyal, Kalapur	-	-

3.3 LAND ENVIRONMENT

3.3.1 GEOLOGY

Geologically, the district of Cachar can be divided into two major groups, i.e. unconsolidated deposits comprising alluvial deposits of Sub-Recent to Recent age and semi-consolidated Tertiary deposits of Bhaban, Bokabil, Girujan/ Tipam, Dupitila and Dihing formations of Miocene to Pliocene age. The alluvial deposits containing in the central parts mainly comprises of sand, silt and clay with gravel and occasional coal bands. The semi-consolidated rocks are exposed in the form of hillocks comprising shale, sandstone, ferruginous sandstone, mottle clay, pebble bed and boulder beds etc.

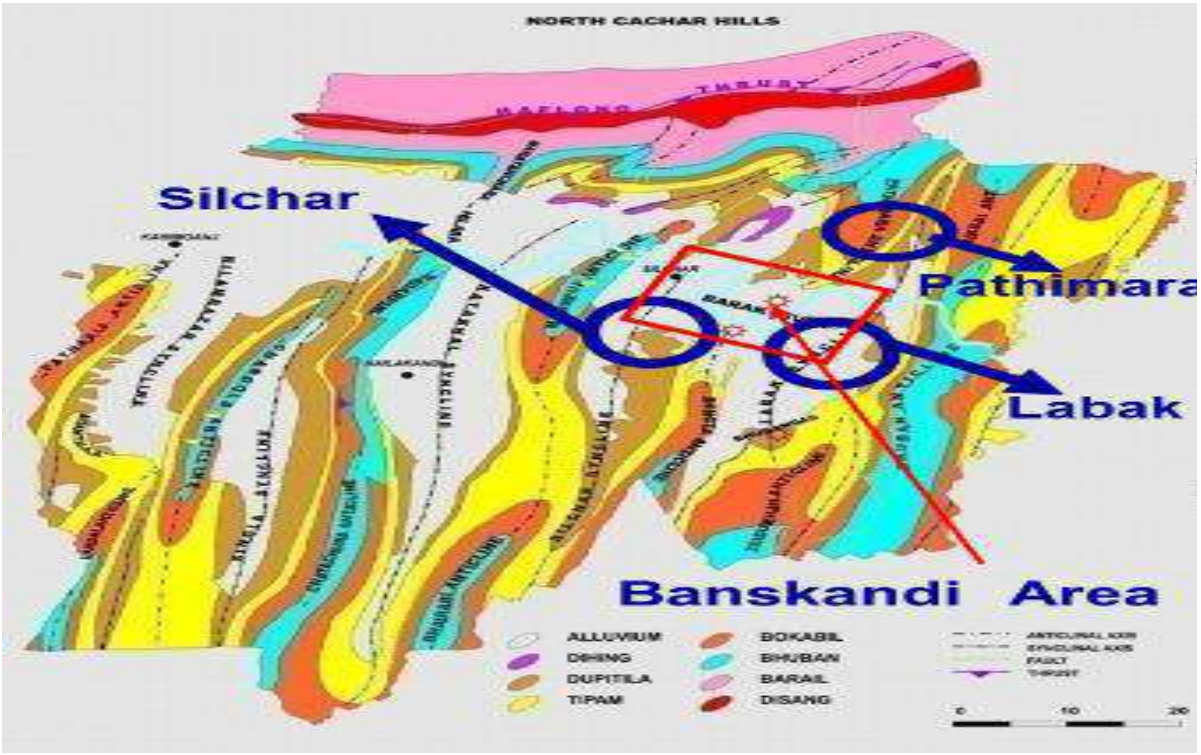


FIGURE 3.1: GEOLOGY OF THE CACHAR FOLD BELT

The Cachar area comprises a part of the frontal thrust and folded belt of the Assam-Arakan Basin. The area exposes a series of sub-parallel, arcute, elongated, doubly plunging folds arranged in en echelon pattern trending N-E in the north to N-S in the central part than swings to NW-SE in the south, with convexity towards west. The structures are tight and affected by thrust either on one side or both limbs. The crestal parts of the structures are exposed by older Tertiary sediments while the flanks are covered by younger sediments. The intervening synclines are relatively broad and covered by younger, softer sediments and alluvium.

The details of block wise exposed structures area as per given below:

Cachar Distt PML:

In this PML block, three exposed structures have been mapped viz. the conjugate structures of Rengte – Balichara, Bhubandar-Teidukhan structures in the southern part of the block and Ramphan anticlines in the eastern part of the block. Further, the drainage anomaly brought out the Banaskandi and Bhubandar Geomorphic Highs which has been proved by seismic mapping and drilling, leading to discovery of gas in these structures. The broad Silchar syncline and the Labak Syncline lies in the western and eastern flank of the Banaskandi structure are proved the source kitchen for this producing gas fields. The Upper Bhuban pays are the producers in these fields. Indication of gas from Middle Bhuban Formation also been indicated in this area, which needs to be established by future exploration thrust for deeper stratigraphic plays.

Sector VC PML:

The PML area falls in the north of the Barak River. The main structures from the west to east are the Indernagar, Rangamati, Pathimara and Tukbai Anticlines. The anticlines are intervened by synclines from the west are Germadisa, Goabari and the Labak synclines. In this part, the structures are developed only in the southern plunges, the northern plunges of these anticlines are cut by faults or absent. The structures trend in NE-SW direction. The exposures in this block are mainly Dupitila, Tipam and Bokabil Formations. Gas indication has been observed from middle Bhuban formation in Pathimara area from the drilled wells. Recent well Tukbai-2, indicated gas from Upper Bhuban formation in logs, which is to be established by drilling new location and testing.

Banaskandi PML:

The Banaskandi PML block covers the Banaskandi gas field. Banskandi anticline is a concealed structure flanked by Silchar syncline towards west and Labak syncline towards east. It is a doubly plunging anticline trending NE-SW in the north and NNE-SSW in the south and follows the trend of Pathimara and Rengte anticlines respectively. It is a narrow elongated anticline bounded by two reverse faults. The area is mostly covered by alluvium except for small patches of Dupitila outcrops to the north, west and south of the structure. This structure has three gas producer wells from Upper Bhuban Formation. Presence of gas has also been indicated from Middle Bhuban in this structure.

Adamtila and N. Patharia PML:

This PML area comprises the Adamtila gas field in the south and the newly discovered gas field of Patharia in the northern plunge of Patharia structure within Karimganj Dist. PML block. The producing pays are mainly from Bokabil formation and one well in Adamtila (AT-9), is producer from Tipam formation. Prospects in Upper Bhuban reservoirs also identified in the recent well Adamtila-15, and on testing gave gas, which will be expanded in future locations to be drilled in this area and field growth.

3.3.2 SEISMICITY AND FLOODS

- **Seismicity:**

As per the seismic hazard map(depicted in figure given below), Cachar & Karimganj district falls in the high hazard zone with Seismic Zone V category.

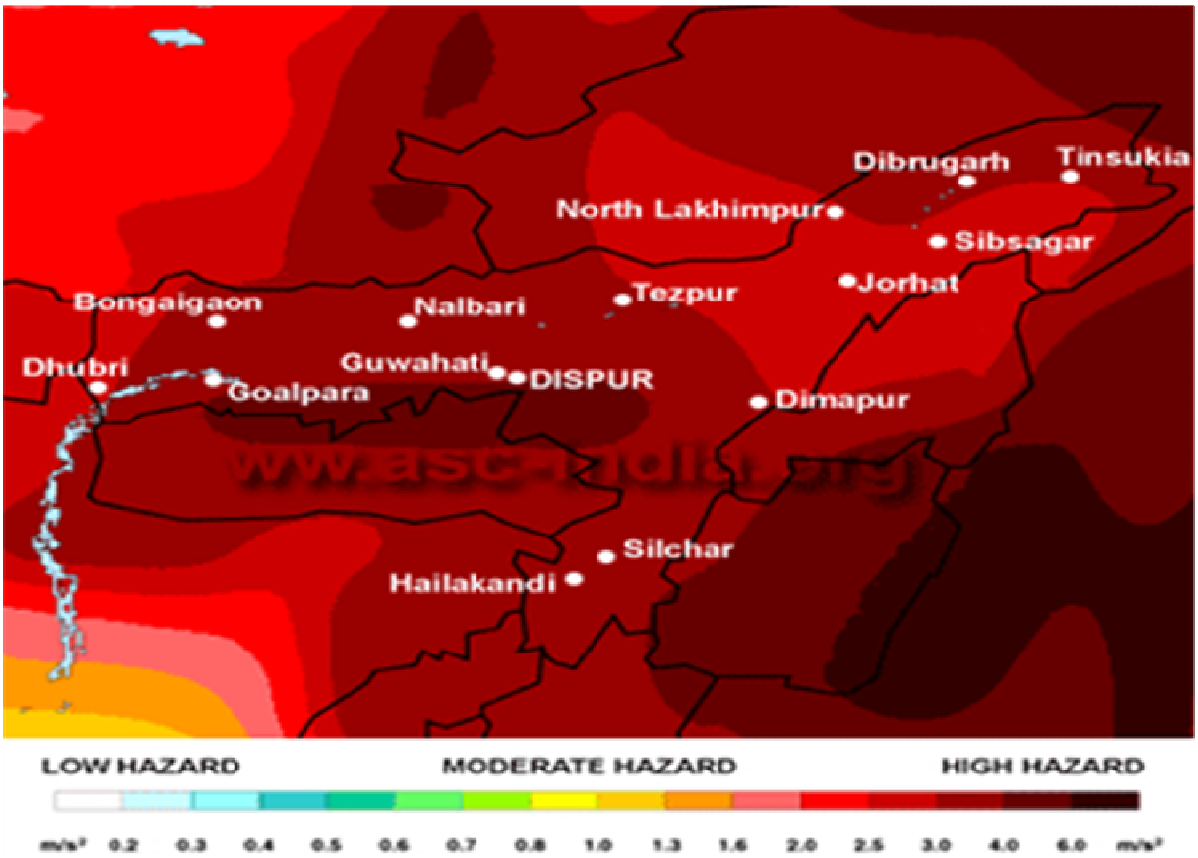


FIGURE 3.2: SEISMIC ZONE MAP OF ASSAM

- **Floods:**

All the rivers in Assam are liable to floods, mainly because they receive heavy rainfall within a short time. These rivers are in their early stage of maturity and are very active agents of erosion. The river waters collect a tremendous amount of silt and other debris and raise the

level of the river beds. Therefore, it becomes impossible for the main channel to cope with the vast volume of water received during the rains. Being on the south eastern part of Assam, Cachar & Karimganj district are highly prone to flooding due to Barak River with varying magnitude.

The frequent flood in the district spoils the quality of soil resulting water logging. Presently, this problem of water logging in the district creates hazards for irrigation of land during cultivation.

From the proposed 26 exploratory wells, one well (BKAC) is located at about 500m away from the high flood line of Barak River and another well (TKAD) is at 750m away from the high flood line of Chiri River. The rest of the wells are located more than 1km from the water course. However some of the wells (N/L7, N/L10, N/L12, N/L15, N/L16, N/L20, TKAD, NTAB, MPM, HRAB and PTAC) located in Adamtila extension PML Block, Cachar district area and Patharia PML blocks are prone to the inundation during the heavy rains as these wells are located in flood plain area.

3.3.3 HYDRO-GEOLOGY

The entire areas of Cachar & Karimganj district are represented by i) unconsolidated, ii) semi-consolidated and iii) consolidated (Compact formation of Tertiary) formations with following properties:

1. Very compact formations comprising the Surma and Dihing series of rocks,
2. Semi-consolidated rocks comprising Tipam and Dupitila formations, and
3. Unconsolidated formation of alluvial deposits.

The semi-consolidated Tipam sandstones form good repository in the area. The depth to water level varies from a few metres to 4 m bgl in alluvial sediments particularly in north and south of Silchar and in western parts while it varies from a few metres to 2 m bgl in the central parts. The hydraulic gradient of ground water is from North to South in northern parts and ground water flows from South to North-West in southern parts. The static water level in shallow aquifers (within 5 m) is within 1.3 to 4.0 m bgl in the north of the Barak River and it varies from 1.8 to 2.22 m bgl in southern parts. Discharge of tube well varies from 5.5 to 8 m3/hr with drawdown of 6.0 m.

In the deeper aquifer, the granular zone occurs below a confining layer of clay, thus it is a confined aquifer. The static water level ranges from 1.92 to 6.88 m bgl in northern parts and from 0.50 to 8.50 m bgl in the southern parts of the River Barak. The yield of the tube well varies from 33 to 88 m3/hr with drawdown varying between 9.9 to 32.65 m.

The water level fluctuation, in general, is less than 1 m, however, in places like Mohanpur, Srikona, Kashipur, Rajabazar etc. it is from 4.52 to 7.0 m. In the central parts of the cachar district around Dholai, Palanghat etc. it is only 0.20 m indicating low fluctuation in fine grained deposits.

The ground water levels measured in the study area during the primary survey are as given in Table 3.2

TABLE 3.2: GROUNDWATER LEVEL MEASURED AT STUDY AREA DURING THE PRIMARY SURVEY

Sl.No.	Location	Water level (m bgl)	Total well depth	Remarks
1	Dayapur village	0.93	1.5	Dug well
2	Dolagram	0.85	-	Dugwell
3	Govindapur Katigara	1.02	6.0	Dugwell

From the above groundwater level measuring data, the ground water trends indicate conform to the above CGWB study results with respect to the ground water level variations in the Cachar and Karimganj Districts.

Ground water is mainly utilized for domestic purposes. It has little industrial use as there is no major industry in the district. Dug well of 10 to 15 m depth and shallow tube well (STW) can be constructed along the fringe area of the district.

3.3.4 LAND USE AND LAND CLASSIFICATION

As per the mandatory requirements, the mapping of Land use and land cover of the area falling within the 10 sq. km of study area is to be undertaken with the help of Topographical data, Satellite data and Field studies. However, due to disposition of proposed exploratory well locations scattered, the block area is considered as a study area for land use classification.

The land use and land cover (LULC) map for blocks wise is prepared by adopting the interpretation techniques of the image in conjunction with collateral data such as Survey of India topographical maps, census records, LANDSAT Imagery and ground truth.

Using the standard land use classification system proposed by NRSC, about five classes of level I, twelve of level II and four of level III land use and land cover classes were identified and mapped using satellite data in the present study. The imagery is interpreted and ground checked for corrections.

Below Table 3.3 to 3.7 shows the area under each category and the percentage of each category with respect to the block wise study area. The google image indicating the block area is given in Figure 3.4 and a FCC of satellite image covering the all the block areas are given as Figure 3.5.

- **Block area (Cachar Dist. PML) - 732 Sq. km.**

As per table given below, land use shows that majority of the land (46.82%) within the Block is used for agriculture purpose with paddy as the primary produce. The forest land cover is about 15.62% followed by 12.30% vegetation. Homestead land plantation associated with settlements cover 7.62% of the total Block area. Open mixed jungle and open scrub cover an area of 7.24% of the total Block area. The rivers, streams and village ponds within the block cover about 10.40% of the total area.

TABLE 3.3: LAND USE CLASSIFICATION OF THE BLOCK AREA

Sl.No	Class	Area	
		Sq km	%
1	Agricultural land	343.2	46.82
2	Vegetation	90.16	12.30
3	Forest land (RF)	114.5	15.62
4	Settlement	55.85	7.62
5	Open mixed jungle and open scrub cover	53.07	7.24

Sl.No	Class	Area	
		Sq km	%
6	Water body(River, pond, streams)	76.23	10.40
	Total	732	100

- **Block area (Sector VC PML) - 497 Sq. km.**

As per table given below, land use shows that majority of the land (29.1%) is forest followed by agriculture land (23.8%). Open mixed jungle & scrub cover an area of 20.5% of the total Block area. The river, pond and streams within the block cover about 10.4% and the settlements cover about 7.1% of the total area. Homestead land plantation associated with settlements cover 9.1% of the total Block area.

TABLE 3.4: LAND USE CLASSIFICATION OF THE BLOCK AREA

Sl.No	Class	Area	
		Sq km	%
1	Agricultural land	118.3	23.8
2	Vegetation (homestead plantation with settlement)	45.2	9.1
3	Forest land (RF)	144.6	29.1
4	Settlement	35.3	7.1
5	Open mixed jungle and open scrub cover	101.9	20.5
6	Water body (River, pond, streams)	51.7	10.4
	Total	**497**	**100**

- **Block area (Adamtila Ext PML) - 383.5 Sq. km.**

As per table given below, land use shows that majority of the land is forest land (47.1%) followed by agriculture land (16.5%). Open mixed jungle & scrub cover an area of 15.4% of the total Block area. The rivers and streams within the block cover about 4.3% and the settlements cover about 6.9% of the total area. Homestead land plantation & tea plantation cover 9.8% of the total Block area.

TABLE 3.5: LAND USE CLASSIFICATION OF THE BLOCK AREA

Sl.No	Class	Area	
		Sq km	%
1	Agricultural land	63.3	16.50
2	Vegetation/ Tea Plantation	37.6	9.80
3	Forest land (RF)	180.6	47.08
4	Settlement	26.5	6.91
5	Open mixed jungle and open scrub cover	59.1	15.41

Sl.No	Class	Area	
		Sq km	%
6	Water body(River, pond, streams)	16.5	4.30
	Total	**384**	**100**

- **Block area (North Patharia PML) - 67 Sq. km.**

As per table given below, land use shows that majority of the land (29.2%) within the Block is used for agriculture purpose with paddy as the primary produce followed by forest land about 22.9%. Open mixed jungle and open scrub cover an area of 11.1% and the homestead land plantation associated with settlements cover 22.5% of the total Block area. The settlements cover about 6.96 % of the total area. The rivers and streams within the block cover about 7.34% of the total block area.

TABLE 3.6: LAND USE CLASSIFICATION OF THE BLOCK AREA

Sl.No	Class	Area	
		Sq km	%
1	Agricultural land	19.6	29.25
2	Vegetation (Homestead plantation associated with settlement)	15.1	22.54
3	Forest land (RF)	15.3	22.84
4	Settlement	4.7	7.01
5	Open mixed jungle and open scrub cover	7.4	11.04
6	Water body (River, pond, streams)	4.9	7.31
	Total	67	100

It is evident from the above table that the majority of the study area falls under agriculture followed by forest land, homestead plantation associated with settlement and open mixed jungle & scrub cover.

- **Block area (Banaskandi PML) - 15 Sq. km.**

As per table given below, land use shows that majority of the land (57.63%) within the Block is used for agriculture purpose followed by homestead plantation/vegetation about 21.92%. The settlements cover about 8.16 % of the total area. Open mixed jungle and scrub cover an area of 6.57% of the total Block area. The rivers, streams & village ponds within the block cover about 5.73% of the total area.

TABLE 3.7: LAND USE CLASSIFICATION OF THE BLOCK AREA

Sl.No	Class	Area	
		Sq km	%
1	Agricultural land	8.64	57.60
2	Vegetation	3.29	21.93

Sl.No	Class	Area	
		Sq km	%
3	Settlement	1.22	8.13
4	Open mixed jungle and open scrub cover	0.99	6.60
5	Water body (River, pond, streams)	0.86	5.73
	Total	15	100

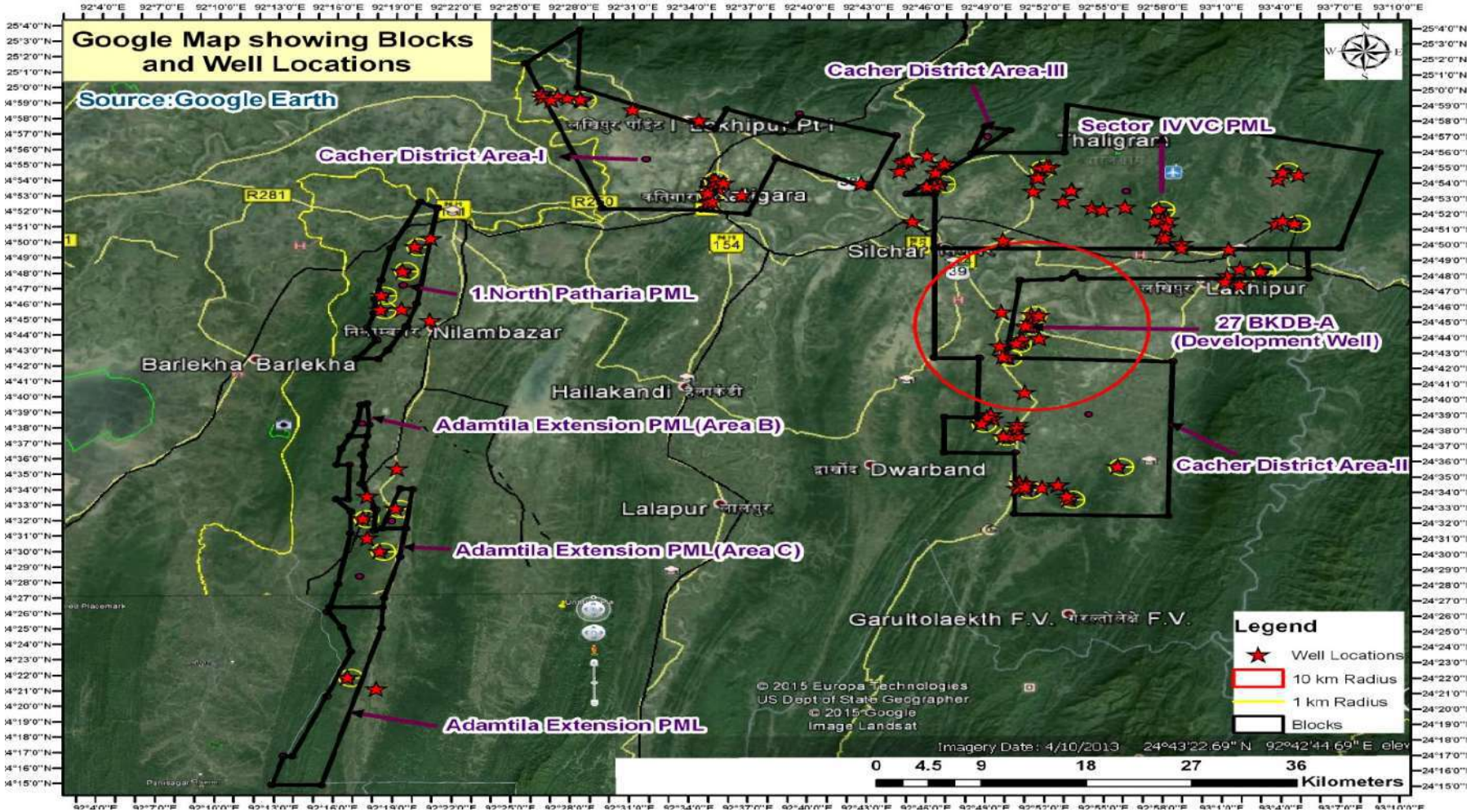


FIGURE 3.3: GOOGLE IMAGE SHOWING BLOCK AREA WITH WELL LOCATIONS

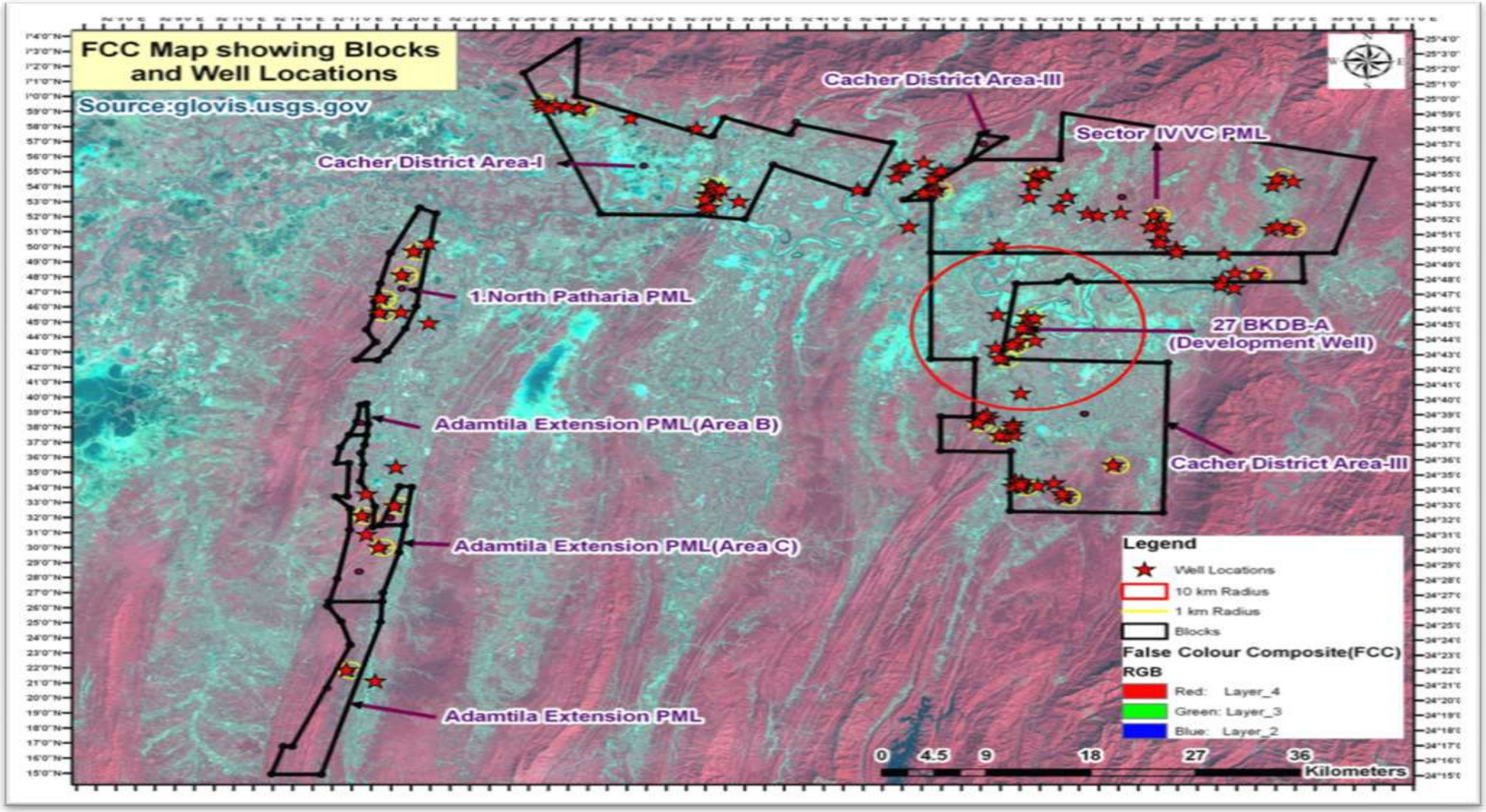


FIGURE 3.4: SATELLITE IMAGE (FCC) SHOWING BLOCK AREAS WITH WELL LOCATIONS

3.4 METEOROLOGY AND CLIMATE

3.4.1 CLIMATIC CONDITION

The climate of the region is governed by geographical configuration forming Barak valley. The region experiences subtropical climate with high rainfall spread over a long period and high temperature without much variation.

The following are the well-defined seasons of the region:

- Winter (Dry): November to February,
- Summer (Hot Dry): March to late May, and
- Monsoon (Wet): late May to October.

3.4.2 REGIONAL METEOROLOGY

The regional climatological summary details (from 1954 to 1975) of parameters like temperature, relative humidity, rainfall, cloud cover, wind speed and wind direction monitored at nearest IMD station at Silchar described hereunder.

TABLE 3.8: CLIMATOLOGICAL SUMMARY AT IMD SILCHAR (1954 – 1975)

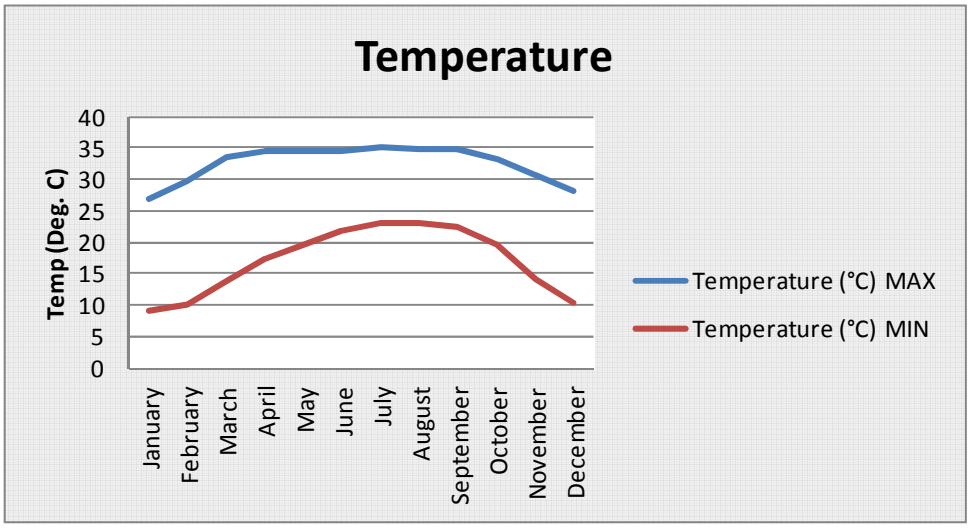
Month	Daily mean Temp. (^{0}C)		Relative Humidity (%)		Rainfall (mm)		Cloud cover (in Okta)		Mean Wind Speed (km/h)	Predominant Wind Direction	Calm (%)		Atmospheric Pressure (mb)	
	Max	Min	8:30 hrs	17:30 hrs	Monthly Total	No. of Rainy days	8:30 hrs	17:30 hrs			8:30 hrs	17:30 hrs	Max	Min
January	26.7	9	82	63	16.3	1.3	1.7	1.5	1.1	N	64	93	1014	1010
February	29.8	9.9	74	54	44.8	2.6	2	1.5	1.6	NE	51	83	1011.9	1007.6
March	33.5	13.8	69	53	140.8	6.7	2.7	2.6	1.9	E	39	66	1009.9	1005.2
April	34.4	17.3	74	64	290.6	12.4	3.9	3.8	2.5	NE	40	60	1007.4	1002.5
May	34.5	19.6	81	72	469.7	16.3	5.1	4.2	2.2	SE	44	60	1003.9	999.5
June	34.6	21.8	87	81	611.9	21.9	6.5	5.9	1.6	S	45	58	1000	996.6
July	35.1	23.2	87	81	547.9	24.2	6.6	6	1.6	N	63	54	999.8	996.5
August	34.7	22.9	87	80	454.6	21	6.4	5.6	1.4	SW	62	65	1001	997.2
September	34.7	22.4	85	80	347.4	15.3	5.7	4.9	1.2	NW	63	79	1004	999.7
October	33.1	19.4	83	79	234	8.5	4.4	3.2	0.9	SW	63	90	1008	1004.8
November	30.7	14.1	78	73	46.9	1.9	2.5	1.7	0.7	SW	69	90	1012.2	1008.4
December	28.2	10.3	82	67	8.8	0.5	1.7	1.3	0.7	N	70	96	1013.9	1010
Annual or Mean	**32.5**	**16.98**	**80.8**	**70.6**	**267.8**	**11.05**	**4.1**	**3.5**	**1.45**	**SW,NE**	**56.1**	**74.5**	**1007.2**	**1003.2**

Source: India Meteorological Department (IMD)

❑ Temperature

The monthly mean maximum temperature varied from 26.7℃ in January to 35.1℃ in July while monthly mean minimum varied from 9^0C in January to 23.2℃ in July indicating January as the coldest while July as hottest month.

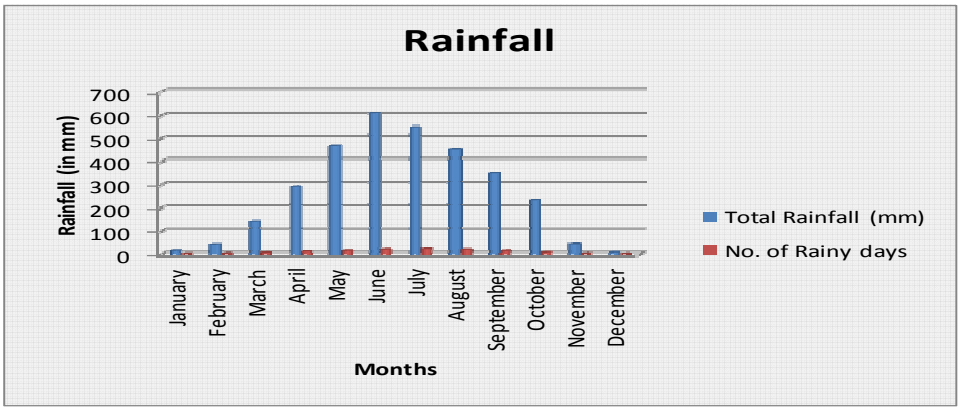
FIGURE 3.5: MONTHLY AVERAGE MAX. AND MIN. TEMPERATURE (IN ° C)



❑ Rainfall

The rainfall occurred maximum in June (611.9 mm) followed by July (547.9 mm). The total annual rainfall is 3213.7 mm. Total rainy days observed are 132.6 days. The monsoon sets in the month of June and continues till September and sometime extends up to mid October.

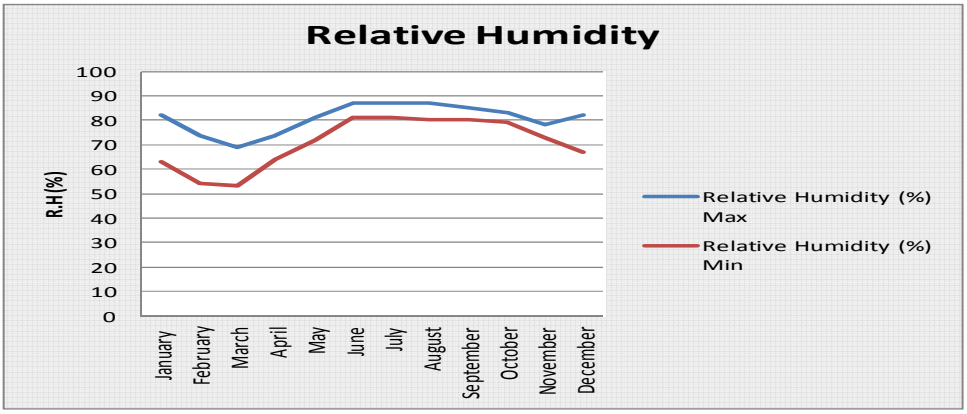
FIGURE 3.6: MONTHLY AVERAGE RAINFALL IN MM



❑ Humidity

During the month of June & July the relative humidity was highest (87%) at 08:30 Hours. The annual average Relative humidity at 08:30 Hours and 70.6% at 17:30 Hours is 80.8% and 70.6% respectively. Generally, the weather during other seasons observed is as slightly humid.

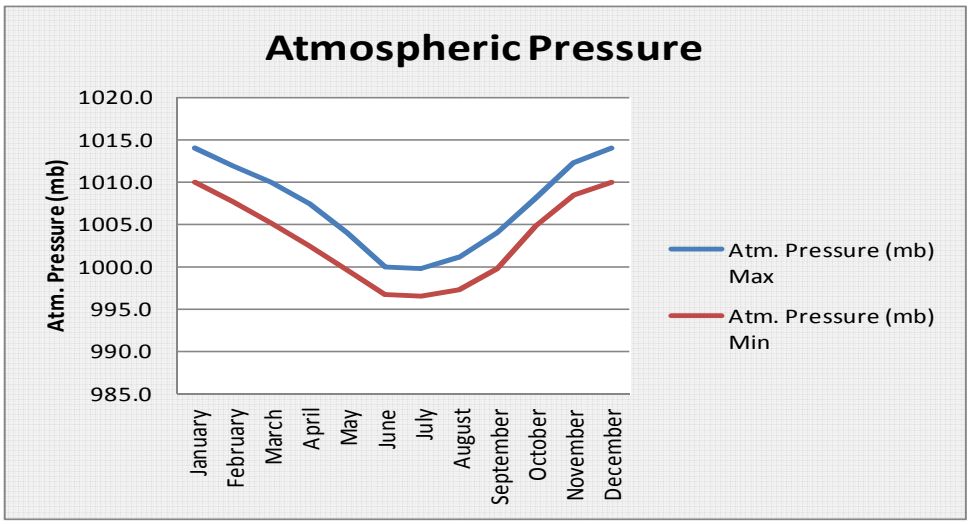
FIGURE 3.7: MONTHLY AVERAGE HUMIDITY (IN %)



- **Atmospheric Pressure**

The maximum pressure observed was 1013.9 mb occurring during the winter season, in the month of December. The minimum pressure observed was 999.8 mb occurring during the month of July in the monsoon season. It can be seen from the data that not much variations are observed in the average atmospheric pressure levels. The pressure levels are found to be fairly consistent over the region.

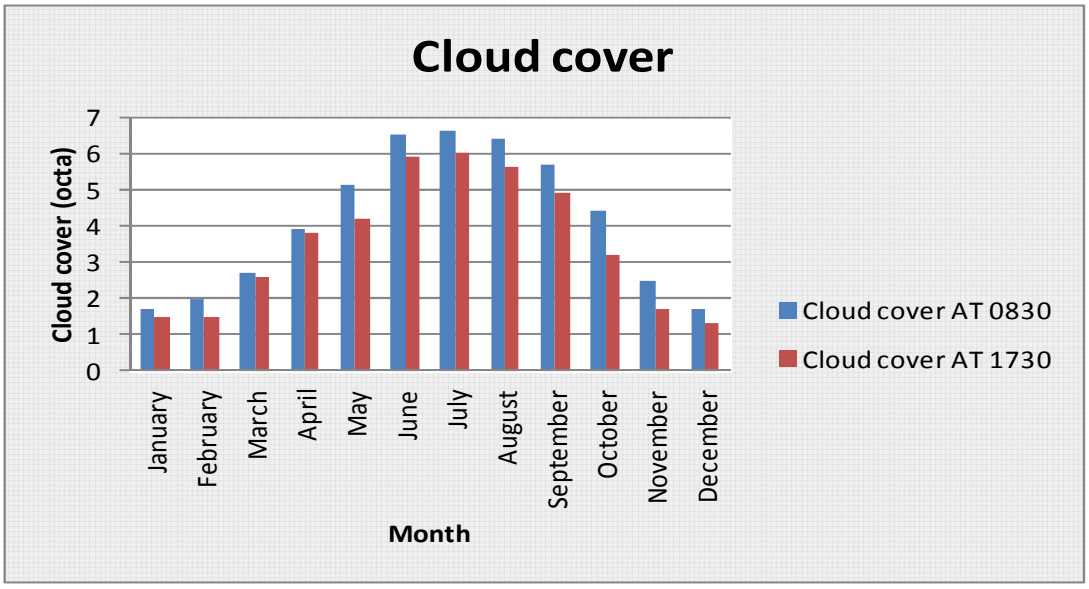
FIGURE 3.8: AVERAGE ATMOSPHERIC PRESSURE (IN MB)



- **Cloud Cover**

During the month of July the cloud cover was highest of 6.6 Octas followed by in June 6.5 Octas. The annual average cloud cover is 4.1 Octas (at 0830 Hours) and 3.5 Octas (at 1730 Hours).

FIGURE 3.9: MONTHLY AVERAGE CLOUD COVER



- **Wind speed & Direction**

The maximum wind speed observed during the month of April is 2.5 kmph and minimum wind speed observed during the month of November - December is 0.7 kmph. The annual average wind speed calculated is 1.5 kmph.

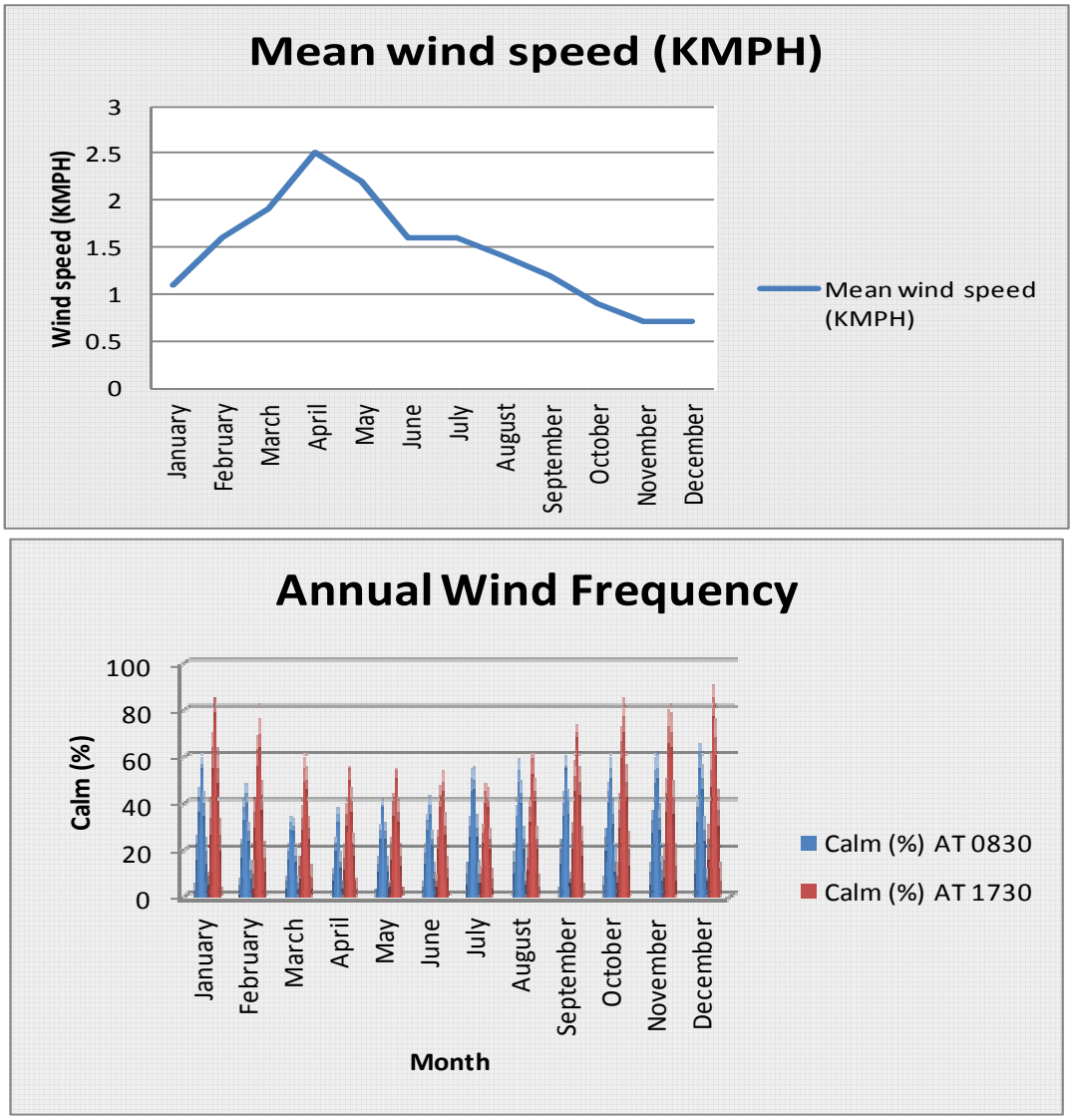
8.30 Hours:

A review of the wind rose diagram at 8.30 hours shows that predominant winds are mostly from NW and SE directions followed by NE direction. Calm conditions prevailed for 56.1% of the total time.(pl incorporate the same)

17:30 Hours:

A review of the wind rose diagram at 17.30 hours shows that predominant winds are mostly from NW and SE directions followed by NE direction. Calm conditions prevailed for 74.5% AT17:30 of the year.

FIGURE 3.10: MONTHLY AVERAGE WIND SPEED



3.6.1 SITE SPECIFIC MICRO-METEOROLOGY

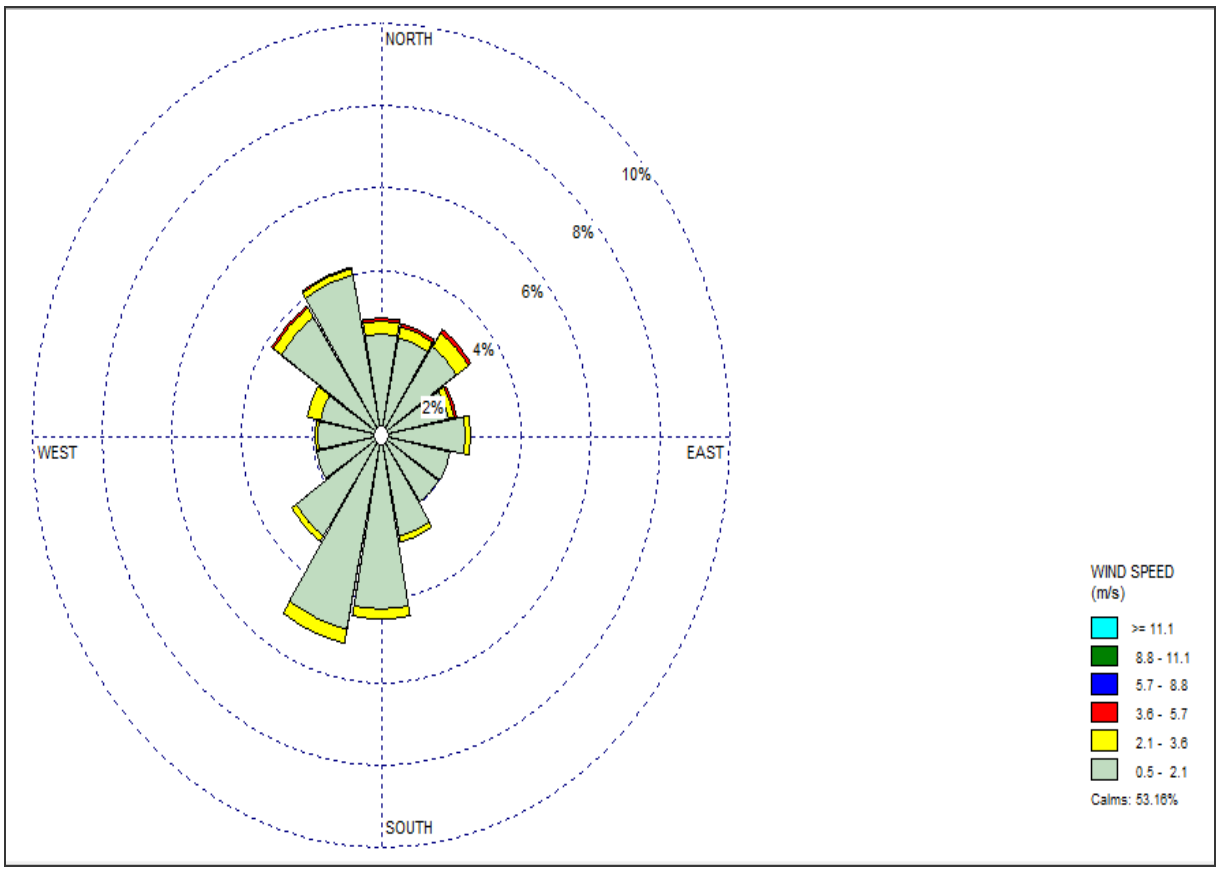
The site specific meteorological data has been monitored on hourly basis, by setting up an automatic weather monitoring station at Silchar (Latitude: 24°49'33.22"N, Longitude: 92°47'48.78"E). The data was monitored from 1st January 2015 to 30th April 2015. The parameters monitored were temperature, relative humidity, wind speed, wind direction and rainfall. The recorded data is summarized in Table 3.9 and wind rose plot shown in Figure 3.11 below.

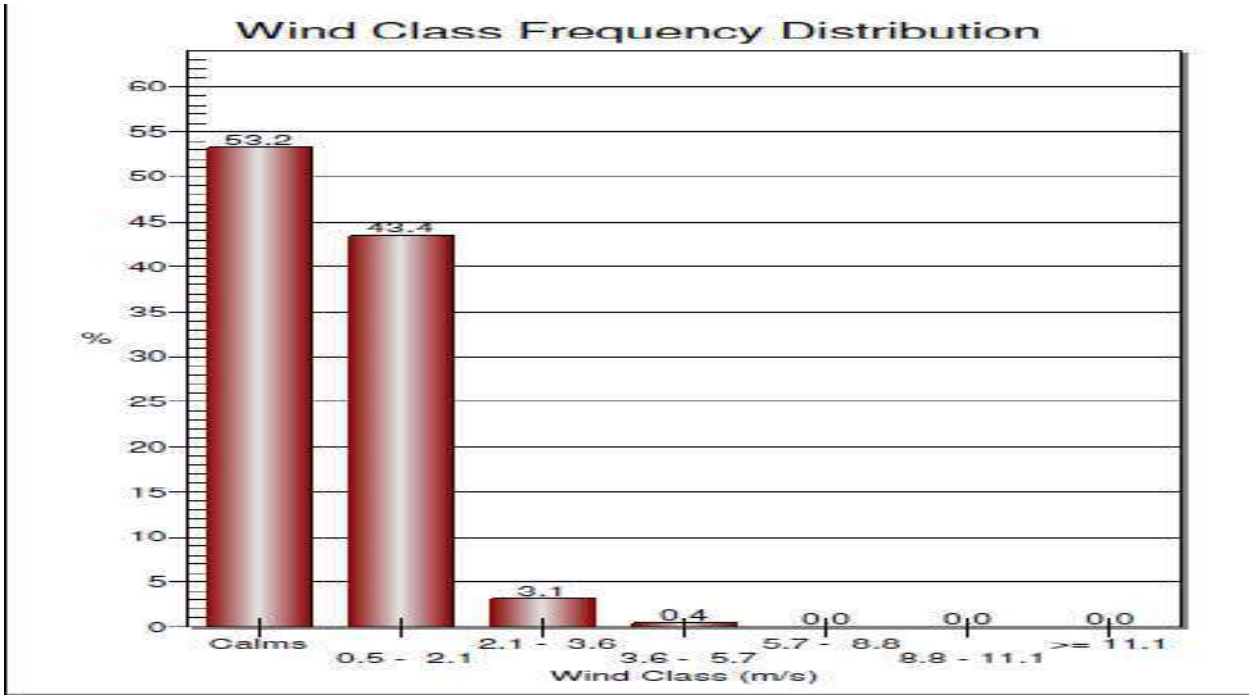
TABLE 3.9: SUMMARY OF MICRO-METEOROLOGICAL DATA (FROM 1ST JANUARY 2015 TO 30TH APRIL 2015)

Sl. No.	Parameters	Observations (7th Jan to 8th April 2015)				
		7th Jan to 31st Jan	1st Feb to 28th Feb	1st March to 31st March	1st April to 8th April	Seasonal
1	**Dry Bulb Temperature (ºC)**					
	Maximum	28.8	34.3	42.1	41.5	42.1
	Minimum	12.1	12.1	17.2	24	12.1
	Average	19.2	23.9	28.7	32.5	26.1
2	**Relative Humidity (%)**					
	Maximum	93.3	94.7	94.4	94.4	94.7
	Minimum	27.5	29.5	28.5	33.5	27.5
	Average	71.1	71.8	68.3	72.2	70.8
3	**Wind Speed (km/hr)**					
	Maximum	8.2	9.0	13.5	15.8	15.8
	Minimum	0	0	0	0	0.0
	Average	2.2	1.7	1.9	3.4	2.3
	Predominant Wind Direction (From)	N & NE	N & NE	W, NEE	W, WWN	N & NE
4	**Rainfall (in mm)**					
	Total (mm)	0.4	0.2	1.0	0.0	1.6
	No. of Rainy Days	2.0	1.0	2.0	0.0	5

The maximum and minimum temperature was observed 42.1℃ and 12.1℃, respectively during ***1st January 2015 to 30th April 2015***. The relative humidity was recorded to be varying between 27.5% - 94.7%. The winds are generally light but become forceful during letter part of the season and varied from 0 to 15.8 km/hr. Winds blow generally from the directions between North, North East during the period January 2015 to April 2015.

FIGURE 3.11: WINDROSE DIAGRAMME(BLOWING FROM)





3.5 AMBIENT AIR QUALITY

3.7.1 AMBIENT AIR SAMPLING

The ambient air monitoring has been carried out spread over the entire one season at various locations in the study area from 26th January 2015 to 17th April 2015. The frequency of monitoring has been 24 hrs twice a week at each station for 12 weeks. The parameters monitored in line with TOR are Particulate Matter PM10, Sulphur Dioxide (SO2), Nitrogen Oxides (NOx),VOC Methane or Non Methane. Concentration of pollutant parameter is compared with National Ambient Air Quality standards.

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality stations designed keeping in view the meteorological conditions of the study region and others such as major habitation, environment sensitivity etc

The details of monitoring locations are given in table 3.10 and depicted in figure 3.12. While the methods used for testing and monitoring and National Ambient Air Quality Standards are given in Table 3.11 and Table 3.12.

TABLE 3.10: AMBIENT AIR QUALITY MONITORING STATION LOCATIONS

Sl.No.	Location	Station Name	Coordinates	
			Latitude	Longitude
1	AAQ1	Dhanehari	N $24^0$45'00.9"	E $92^0$51'19.0"
2	AAQ2	Saptagram	N $24^0$34'17.0"	E $92^0$50'36.0"
3	AAQ3	Udarbondh	N $24^0$53'33.6"	E $92^0$53'22.4"
4	AAQ4	Fulertal	N 24^0 48'03.2"	E $93^0$01'16.1"
5	AAQ5	Kaligara	N $24^0$52'43.9"	E $92^0$34'54.1"
6	AAQ6	Sonakhira	N $24^0$33'40.5"	E $92^0$17'38.6"
7	AAQ7	Zerjeri	N $24^0$21'14.4"	E $92^0$18'08.7"
8	AAQ8	Gugrakona Part-II	N $24^0$45'03.6"	E $92^0$20'46.6"

TABLE 3.11: AMBIENT QUALITY STANDARDS

Sl.No.	Pollutants	Time weighted average	Concentration in ambient air		
			Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	**Sulphur Dioxide (SO2), µg/m^3**	Annual*	50	20	- Improved West & Gaeke - Ultraviolet fluorescence
		24 hours**	80	80	
2	**Nitrogen Dioxides (NO2), µg/m^3**	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
		24 hours**	80	80	
3	**Particulate Matter (size less than 10 µm) or PM$_{10}$ µg/m^3**	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24 hours**	100	100	

**Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval*

***24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.*

FIGURE 3.12: LOCATION MAP OF AMBIENT AIR QUALITY MONITORING

TABLE 3.12: PROCEDURE FOR DETERMINING VARIOUS AIR QUALITY PARAMETERS

Parameters	Technical Protocol	Minimum Detectable Limit
PM10	IS 5182 (Part-XXIII)	5 (µg/m3)
Sulphur Dioxide	IS-5182 (Part-II):2001	5 (µg/m3)
Nitrogen Dioxide	IS-5182 (Part-VI):2006	7 (µg/m3)
VOC	EPA TO-17	0.1 (ppm)
Carbon Monoxide (as CO)	IS:5182(Part-X):1999 NDIR Method)	1.14 (mg/m3)
Methane	IS-5182(Part-XVII):2006	0.1 (mg/m3)
Non-Methane	IS-5182(Part-XVII):2006	0.1 (mg/m3)

3.7.2 RESULTS OF AMBIENT AIR QUALITY

Based on detailed monitored data, the summarized ambient air quality within study area is given in Table 3.13 and summarized hereunder:

- **Particulate Matter- size less than 10 µm (PM10)**

Out of the eight (8) locations within the study area, maximum concentration for PM10 of 92.2 µg/m^3 was recorded at Kaligara village (AAQ5). The minimum concentration of 35.8 µg/m3 was recorded at Gougrakona (AAQ8). The 98th percentile value of PM10 varied between 52.1µg/m3 to 91.0 µg/m3. The PM10 is within the permissible limits at all the locations and the average value found to be highest in case of Kaligara (AAQ5) and lowest in case of Gugrakona Part-II (AAQ8).

- **Oxides of Nitrogen (NOx)**

Concentrations of Oxide of Nitrogen (NOx) varies between 19.0µg/m3 to 32.2 µg/m3, maximum concentration recorded at Kaligara (AAQ5) of 32.2 µg/m3 and minmum concentration recorded at Gugrakona Part-II (AAQ8) of 19.0 µg/m3. In all the location NOx is found to within the permissible limits. It also reported that the average value found to be highest in case of Kaligara (AAQ5) and lowest in case of (AAQ8).

- **Sulphur Dioxide (SO2)**

The concentration Sulphur Dioxide (SO2) varies between 5.0 to 11.9 µg/m3. Where AAQ5 have maximum concentration (11.9µg/m3) was recorded. At all the location resusults is within the permissible limitis. It also reported that the average value found to be highest in case of Kaligara (AAQ5) and lowest in case of Gugrakona Part-II (AAQ8).

- **Volatile Organic Compounds (VOCs)**

The VOCs (Benzene, Toluene, Ethylfenzene, p-Xylene, o-Xylene, Methane, Ethane, Propane, n-Butane, iso-Butane, Pentane) of all the location are below Detection Level.

- **Overall Baseline Ambient Air quality**

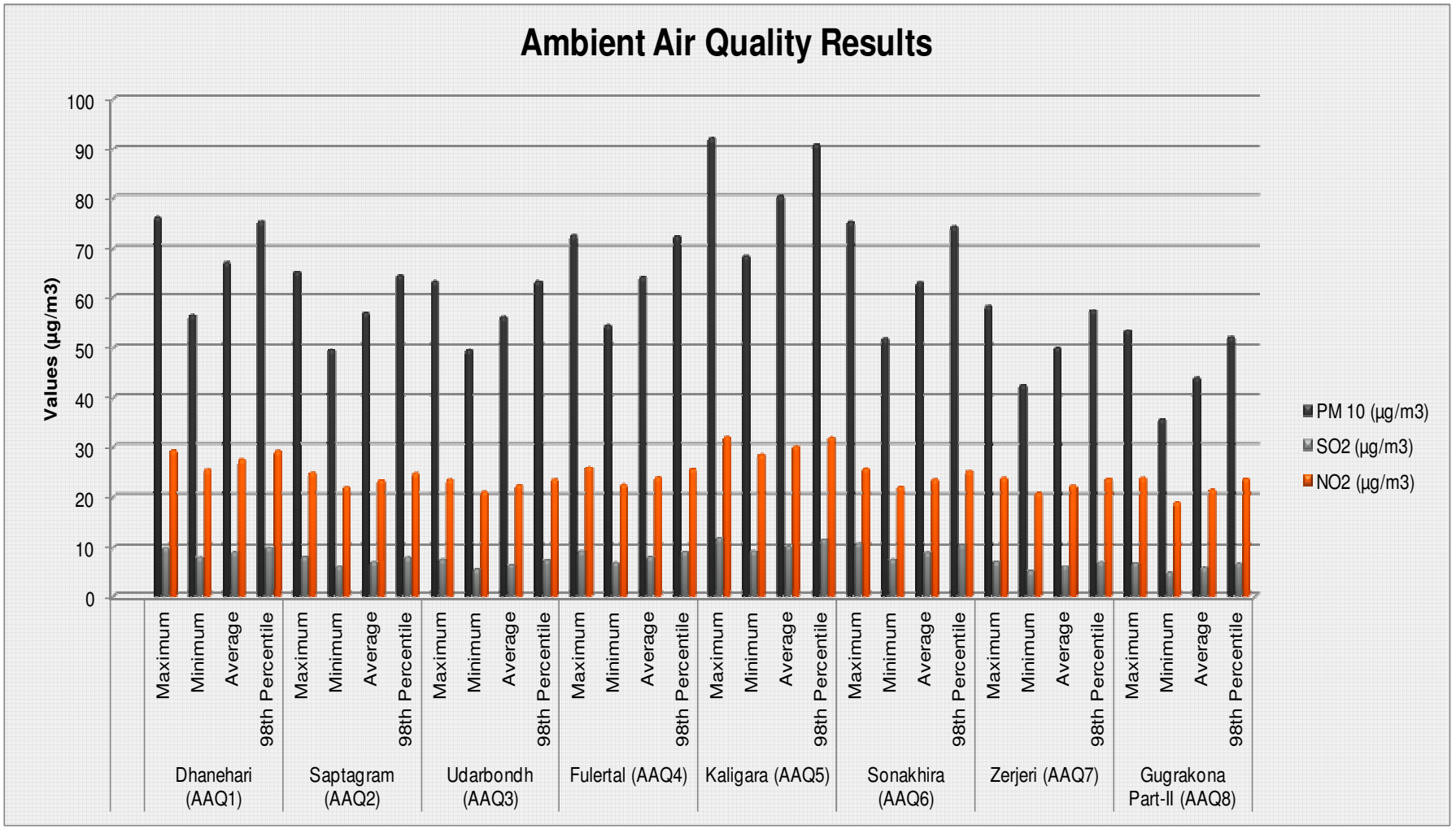
Results of the ambient air quality at all the above locations were found to be well below the standards prescribed in National Ambient Air Quality (NAAQS 2009) standards.

TABLE 3.13: AMBIENT AIR QUALITY RESULT AT SITES

Location	Statistics	PM 10 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)	VOC (µg/m3)	Hydro Carbons(HC) mg/m^3	
						Methane	Non-Methane
Dhanehari (AAQ1)	Maximum	76.2	9.9	29.2	<0.1	<0.1	<0.1
	Minimum	56.4	8	25.4	<0.1	<0.1	<0.1
	Average	67.3	9	27.5	<0.1	<0.1	<0.1
	98th Percentile	75.4	9.9	29.1	<0.1	<0.1	<0.1
Saptagram (AAQ2)	Maximum	65.3	8.1	24.8	<0.1	<0.1	<0.1
	Minimum	49.5	6.2	22	<0.1	<0.1	<0.1
	Average	56.9	7.1	23.4	<0.1	<0.1	<0.1
	98th Percentile	64.6	8	24.7	<0.1	<0.1	<0.1
Udarbondh (AAQ3)	Maximum	63.5	7.6	23.5	<0.1	<0.1	<0.1
	Minimum	49.5	5.6	21	<0.1	<0.1	<0.1
	Average	56.1	6.6	22.4	<0.1	<0.1	<0.1
	98th Percentile	63.5	7.5	23.5	<0.1	<0.1	<0.1
Fulertal (AAQ4)	Maximum	72.6	9.2	25.9	<0.1	<0.1	<0.1
	Minimum	54.5	7	22.5	<0.1	<0.1	<0.1
	Average	64.3	8.1	23.9	<0.1	<0.1	<0.1
	98th Percentile	72.4	9.1	25.5	<0.1	<0.1	<0.1
Kaligara (AAQ5)	Maximum	92.2	11.9	32.2	<0.1	<0.1	<0.1
	Minimum	68.5	9.2	28.4	<0.1	<0.1	<0.1
	Average	**80.4**	10.3	**30.1**	<0.1	<0.1	<0.1
	98th Percentile	91	11.6	32.1	<0.1	<0.1	<0.1
Sonakhira (AAQ6)	Maximum	75.3	10.8	25.6	<0.1	<0.1	<0.1
	Minimum	51.8	7.6	22.1	<0.1	<0.1	<0.1

Location	Statistics	PM 10 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)	VOC (µg/m3)	Hydro Carbons(HC) mg/m^3	
						Methane	Non-Methane
	Average	63.3	8.9	23.5	<0.1	<0.1	<0.1
	98th Percentile	74.4	10.5	25.1	<0.1	<0.1	<0.1
Zerjeri (AAQ7)	Maximum	58.3	7.2	23.8	<0.1	<0.1	<0.1
	Minimum	42.6	5.3	20.8	<0.1	<0.1	<0.1
	Average	50	6.3	22.3	<0.1	<0.1	<0.1
	98th Percentile	57.4	7.1	23.7	<0.1	<0.1	<0.1
Gugrakona Part-II (AAQ8)	Maximum	53.4	6.9	23.8	<0.1	<0.1	<0.1
	Minimum	35.8	5	19	<0.1	<0.1	<0.1
	Average	44	5.9	**21.4**	<0.1	<0.1	<0.1
	98th Percentile	52.1	6.8	23.7	<0.1	<0.1	<0.1
NAAQS (24 hours average)		**100**	**80**	**80**	**--**	**---**	**---**

FIGURE 3.13: AMBIENT AIR QUALITY RESULT AT SITES (PM10, PM2.5, SO2, NO2)



3.6 NOISE ENVIRONMENT

The main objective of noise monitoring in the study area is to establish the baseline noise levels, within study area. The noise monitoring has been conducted at 15 locations in the study area as per details given in Table 3.14.

TABLE 3.14: DETAILS OF NOISE MONITORING LOCATIONS

Sl. No.	Location	Location Code	Date of Sampling	Description	Coordinates	
					Latitude	Longitude
1	Sonabarighat	N1	23.03.2015	Near Sonai X Road	24º45'23.5" N	92º50'02.6" E
2	Masimpur	N2	24.03.2015	Near NIT X Road	24º45'29.1" N	92º47'48.7" E
3	Saptagram	N3	25.03.2015	Opp Masjid	24º34'17.0" N	92º50'36.0" E
4	Bor Jalenga Pt. III	N4	26.03.2015	Near Tea garden Road	24º40'39.7" N	92º44'08.2" E
5	Katigara	N5	27.03.2015	Near Chourangi	24º52'46.4" N	92º35'02.9" E
6	Dhanehari Pt. I	N6	28.03.2015	Near Main Road	24º44'46.8" N	92º51'02.4" E
7	Phulertal	N7	30.03.2015	Near Main Road	24º48'03.2" N	93º01'16.1" E
8	Sonakhira	N8	31.03.2015	Near Govt School	24º33'40.5" N	92º17'38.6" E
9	Udarbandh	N9	01.04.2015	Near Airport Road	24º53'33.6" N	92º53'22.4" E
10	Zerzeri	N10	02.04.2015	Near Bus Stand	24º21'14.4" N	92º18'07.3" E
11	Ghukrakona	N11	03.04.2015	Near Main Road	24º45'03.6" N	92º20'46.6" E
12	Natanpur Grant	N12	04.04.2015	Near Main Road	25º00'14.8" N	92º26'46.6" E
13	Rajyeswarpur	N13	06.04.2015	Near Main Road	24º59'20.8" N	92º29'28.8" E
14	Derby TE	N14	07.04.2015	Near Tea Garden	24º39'51.8" N	92º47'55.5" E
15	Shephinjuri TE	N15	08.04.2015	Near Tea Garden	24°32'34.72"N	92º17'47.15" E

3.8.1 METHODS OF MONITORING

- **Methodology**

Ambient Noise level was measured by using Calibrated Lutron SL - 4001 Digital Sound Level Meter on hourly basis for 24 hours. Equivalent sound pressure level of day time i.e. Leq (day) and night time Leq (night) is calculated from the hourly measured noise level and compared to Ambient Air Quality Standards with respect to Noise as per the "Noise Pollution

(Regulation and Control) Rules, 2000" stipulated for daytime and night time for residential land use. The standards are tabulated in below Table 3.15.

TABLE 3.15: AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Category of Area/ Zone	Limits in dB(A) Leq	
	Day Time (6 am to 10 pm)	Night Time (10 pm to 6 am)
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence Zone	50	40

3.8.2 OBSERVATIONS

The noise levels around the site are given in Table 3.16.

TABLE 3.16: AMBIENT NOISE LEVELS

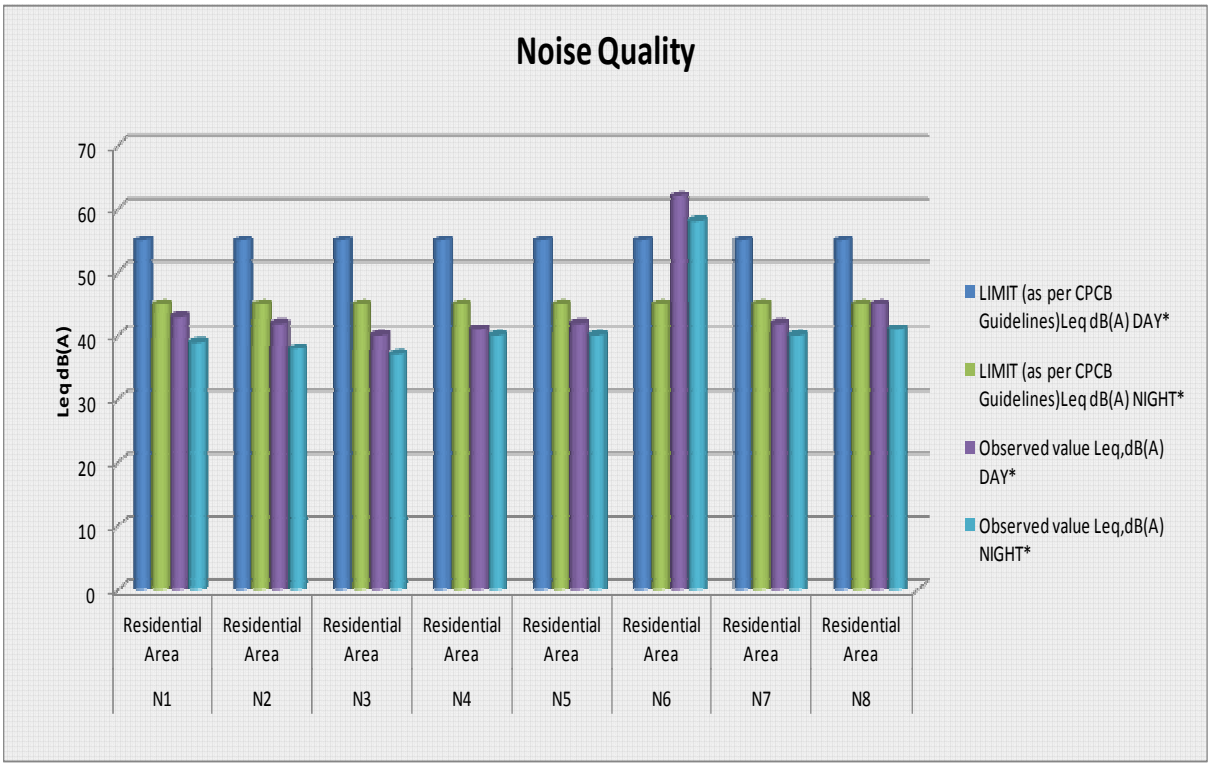
Sl.No.	Project Site	Type of area	Standard (as per CPCB Guidelines) Leq dB(A)		Observed value Leq dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	Sonabarighat	Residential Area	55	45	51.5	44.9
2	Masimpur	Residential Area	55	45	55.3	47.8
3	Saptagram	Residential Area	55	45	57.1	50.2
4	Bor Jalenga Pt. III	Residential Area	55	45	52.1	43.9
5	Katigara	Residential Area	55	45	65.2	59.3
6	Dhanehari Pt. I	Residential Area	55	45	60.1	53.6
7	Phulertal	Residential Area	55	45	51.8	41.9
8	Sonakhira	Residential Area	55	45	54.6	45.5
9	Udarbandh	Residential Area	55	45	56.8	48.7
10	Zerzeri	Residential Area	55	45	51.5	43.0
11	Ghukrakona	Residential Area	55	45	46.3	39.8
12	Natanpur Grant	Residential Area	55	45	55.2	48.3
13	Rajyeswarpur	Residential Area	55	45	52.6	44.8
14	Derby TE	Residential Area	55	45	55.6	48.6
15	Shephinjuri TE	Residential Area	55	45	51.1	43.3

Day time from 6.00 a.m to 10.00 p.m while night time from 6.00 a.m to 10.00 p.m

The monitoring results of noise levels during day and night time within the study area are shown below in **Figure 3.14.**

The highest values of noise level observed at Katigara (N5) and are higher than the standards. It is due to the vehicular traffic and other anthropogenic activities. Lowest value recorded at Ghukrakona (N11). The overall noise level found to be well below the standards value for both day time and night time.

FIGURE 3.14: AMBIENT NOISE LEVEL



3.7 WATER RESOURCE QUALITY

For assessing the baseline water quality in the study area, Water samples were collected from 10 sampling locations (via five (05) from surface water sources and five (05) from ground water resources for analysis). The sampling locations were selected based on reconnaissance survey with the following consideration:

- Location of water courses; and
- Location of residential areas representing different activities.

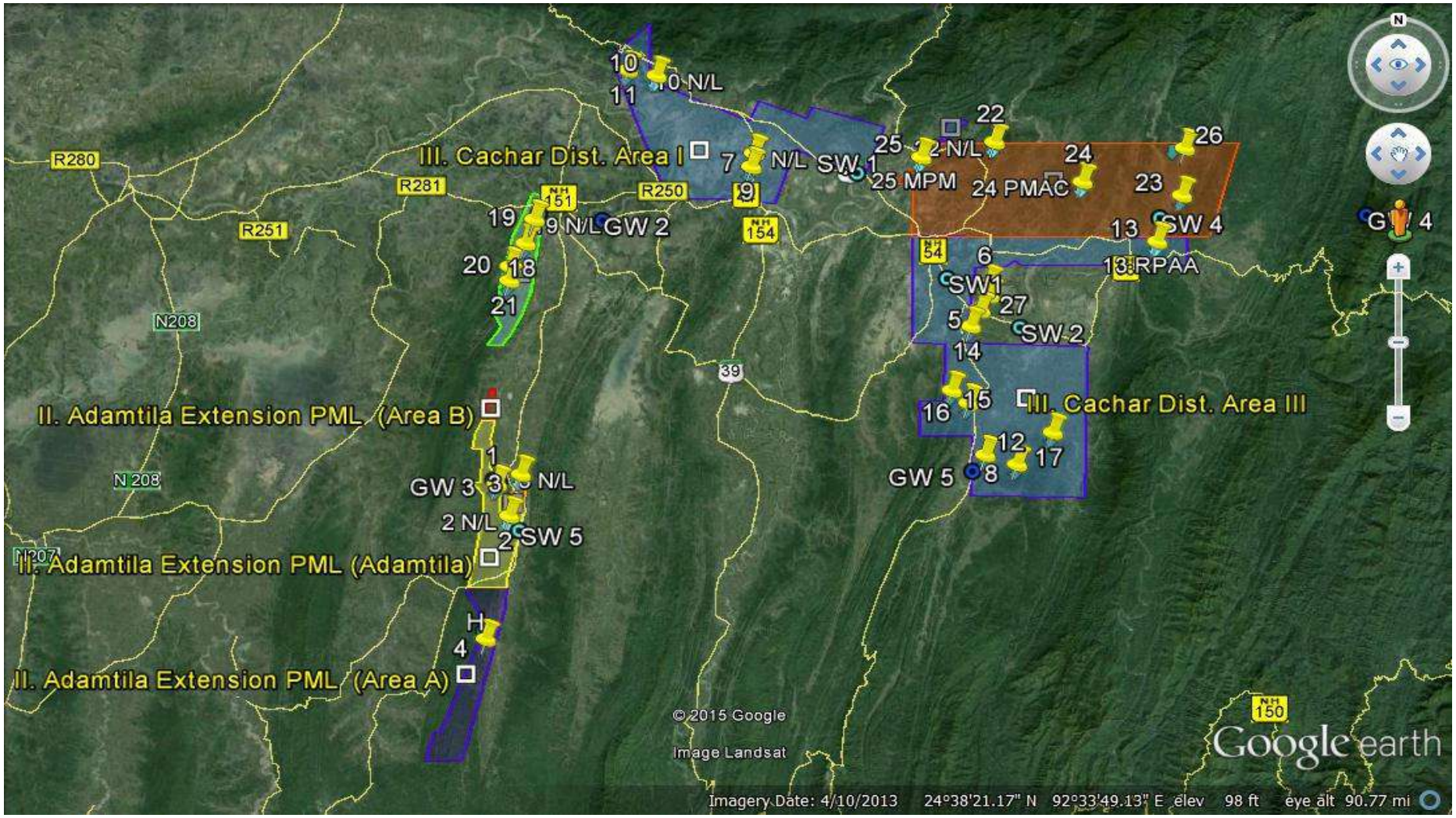
The details of water monitoring stations are shown below in Tables 3.17, Fig 3.15. The water samples were collected as grab samples and were analyzed for physical, chemical and biological characteristics.

TABLE 3.17: DETAILS OF WATER SAMPLING LOCATIONS

Sl.No	Location	Sample Code	Coordinate (Latitude/ Longitude)		Source	Sampling date
Ground Water						
1	Near Chad khira bagan railway station	GW1	24º33'33.0" N	92º18'00.2" E	Bore Well Water	31.03.2015
2	Near Chargola Railway station	GW2	24º50'54.7" N	92º25'05.4" E	Bore Well Water	31.03.2015
3	Sonakhira	GW3	24º33'40.5" N	92º17'38.6" E	Bore Well Water	31.03.2015
4	Near Kamranga railway station	GW4	24º51'10.2" N	93º03'17.6" E	Bore Well Water	01.04.2015
5	Saptagram	GW5	24º34'17.0" N	92º50'36.0" E	Bore Well Water	01.04.2015
Surface water						
1	Barak River Upstream (Near Majhigram)	SW1	24º54'04.5" N	92º42'40.2" E	River Water	31.03.2015
2	Barak River Down stream (Near Dakshin Mohanpur)	SW2	24º43'49.5" N	92º53'53.0" E	River Water	31.03.2015
3	Bonai River (Near Longai ghat)	SW3	24º51'21.5" N	92º20'41.7" E	River Water	31.03.2015
4	River near Kamranga Railway station	SW4	24º51'05.1" N	93º03'34.8" E	River Water	31.03.2015
5	River near Pecharghat	SW5	24º30'19.7" N	92º19'24.2" E	River Water	31.03.2015

The ground water samples were analysed and compared with IS 10500:2012 standards and the surface water samples where analysed and compared with class C standards.

FIGURE 3.15: SURFACE WATER SAMPLING LOCATIONS WITHIN THE STUDY AREA



- **Results & Discussions**

The baseline of physico - chemical & bacteriological charactersticts of surface & ground water is given in the Tables 3.18 & 3.19 and summarized below.

A. Ground water:

pH values varied from 5.43 to 7.4. Total dissolved solids content varied between 116 and 350 mg/l.. While total hardness varied from 50 to 110 mg/l. The hardness is generally caused by the presence of calcium and magnesium whose concentrations at different monitored locations ranged between Calcium 12 and 32 mg/l and Magnesium from 4.8 to 7.2 mg/l respectively and was observed to be maximum at GW4. Chloride values varied from 10 to 100 mg/l and Nitrate values varied from 2.6 to 5.7 mg/l. Fluoride concentrations varied between 0.4 and 0.8 mg/l. The trace metal concentrations like Arsenic, Manganese, Chromium, Lead, Mercury, Cadmium were found to be below detection limit at all locations. The Mineral Oil concentrations, phenolic compounds and cynadide at all the groundwater samples were also found to be below detection limit. From the above discussion, it is evident that the groundwater quality of the study area conforms to the IS 10500:2012 standards for Drinking Water Quality at almost all locations. However, disinfection is suggested.

B. Surface water:

The pH values varied from 6.86 to 7.62. The suspended solids content varied between 8 and 14 mg/l. while Total Dissolve Solid (TDS) varied from 68 to 120 mg/l and was found to be maximum at SW4. The parameters like BOD found to be higher in SW3 which is 12 mg/l and minimum at SW2 which is 5 mg/l. Dissolved Oxygen varied from 5.2 mg/l to 5.5 mg/l in all the samples. The trace metal concentrations like Chromium, Mercury and Lead were found to be below detection limit at all locations. The Conductivity varied between 124 and 190 mhos/cm and found to maximum for SW4. Total Coliform count varies between 1536 to 2325 cfu/100m and maximum at SW3. From the above discussion, it is evident that the surface water quality of the study area conforms to the Class E as recommended by CPCB at almost all locations.

TABLE 3.18: GROUND WATER QUALITY AT STUDY AREA

Sl. No.	Characteristics	Units	GW1	GW2	GW3	GW4	GW5	IS:10500-2012 Norms (DWS)	
								Desirable	Permissible
1	pH at 250C	-	6.68	7.4	6.76	5.43	6.84	6.5 - 8.5	NR
2	Color	Hazen	<01	<01	<01	<01	<01	5	25
3	Taste	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--	--
4	Odor	-	Unobjec-tionable	Unobjec-tionable	Unobjec-tionable	Unobjec-tionable	Unobjec-tionable	Unobjec-tionable	-
5	Conductivity at 25ºC	µmhos/cm	214	270	240	544	188	--	--
6	Turbidity	NTU	1.92	2.3	1.8	2.9	2.3	5	10
7	Total Dissolve solids	mg/L	136	170	152	350	116	500	2000
8	Total Suspended Solids	mg/L	3	2.8	1.6	1.8	2	Nil	Nil
9	Total Hardness as CaCO3	mg/L	80	90	50	110	70	300	600
10	Total Alkalinity as CaCO3	mg/L	60	90	30	70	50	200	600
11	Calcium as Ca	mg/L	20	24	12	32	20	75	200
12	Magnesium as Mg	mg/L	7.2	7.2	4.8	7.2	4.8	30	100
13	Sodium as Na	mg/L	9.2	22	29	70.3	7.8	--	--
14	Potassium as K	mg/L	1.95	2	1.5	2.8	2.8	--	--
15	Boron as B	mg/L	0.062	0.068	0.074	0.054	0.04	5	
16	Chloride as Cl	mg/L	20	15	25	100	10	250	1000
17	Sulphate as SO4	mg/L	11.3	16.2	46	78	23	200	400
18	Fluorides as F-	mg/L	0.5	0.8	0.6	0.5	0.4	1	1.5

Sl. No.	Characteristics	Units	GW1	GW2	GW3	GW4	GW5	IS:10500-2012 Norms (DWS)	
								Desirable	Permissible
19	Nitrates as NO3	mg/L	3.8	3	2.6	5.7	2.9	45	100
20	Aluminum as Al	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.03	--
21	Manganese as Mn	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.1	--
22	Phenolic Compounds	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
23	Cyanides as CN	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05	NR
24	Mineral Oil	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.03
25	Cadmium as Cd	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	NR
26	Arsenic as As	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	NR
27	Copper as Cu	mg/L	0.054	0.05	0.042	0.054	0.042	0.05	1.5
28	Lead as Pb	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05	NR
29	Iron as Fe	mg/L	0.06	0.08	0.1	0.12	0.08	0.3	NR
30	Chromium as Cr6+	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05	NR
31	Zinc as Zn	mg/L	0.042	0.048	0.03	0.044	0.036	5	15
32	Mercury as Hg	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.001	NR
33	Total Coli forms	cfu/100ml	36	24	40	28	34	10	50
34	Sodium adsorption ratio	--	35.2	26.8	22.3	46.5	38.5	--	--
35	Chemical Oxygen Demand (COD)	mg/L	<1.5	<1.5	<1.5	<1.5	<1.5	<05	--
36	BOD (3 days at 27oC)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<03	--

TABLE 3.19: SURFACE WATER QUALITY AT STUDY AREA

Sl. No.	Characteristics	Units	SW1	SW2	SW3	SW4	SW5	Class B	Class C	Class E
1	pH at 25ºC	-	6.92	6.86	6.96	7.62	6.97	6.5 to 8.5	6 to 9	-
2	Taste	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	-	-	-
3	Color	Hazen	1	2	1	1	2	-	-	-
4	Odor	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	-	-	-
5	Conductivity at 25ºC	µmhos/cm	124	156	106	190	142	-	-	2250
6	Dissolved Oxygen	mg/L	5.5	5.2	5.4	5.2	4.3	>5	>4	-
7	BOD (3 days at 27ºC)	mg/L	10	5	12	10	8	3	3	-
8	Total Dissolved Solids	mg/L	80	101	68	120	90	-	1500	-
9	Total Hardness	mg/L	40	60	30	70	40	-	-	-
10	Chloride as Cl	mg/L	10	15	10	10	10	-	-	-
11	Fluorides as F	mg/L	0.3	0.2	0.3	0.4	0.2	-	-	-
12	Sulphate as SO4	mg/L	10.5	9.5	4.7	15.3	4.4	-	-	-
13	Turbidity	NTU	2.1	2.6	2	2.4	1.8	-	-	-
14	Total Alkalinity as CaCO3	mg/L	30	40	30	60	40	-	-	-
15	Total Suspended Solids	mg/L	14	10	8	12	8	-	-	-
16	Boron as B	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	2
17	Nitrates as NO3	mg/L	2.8	3.8	1.9	2.5	2.3	-	-	-
18	Cyanides as CN	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-

Sl. No.	Characteristics	Units	SW1	SW2	SW3	SW4	SW5	Class B	Class C	Class E
19	Calcium as Ca	mg/L	12	12	8	20	12	-	-	-
20	Magnesium as Mg	mg/L	2.4	7.2	2.4	4.8	2.4	-	-	-
21	Sodium as Na	mg/L	6.4	4.6	5.2	8.7	12	-	-	-
22	Potassium as K	mg/L	2.3	1.9	1.1	1.5	1.2	-	-	-
23	Free Ammonia	mg/L	1.2	1.32	1.06	1.1	1.14	-	-	-
24	Iron as Fe	mg/L	<0.04	0.04	<0.04	0.04	<0.04	-	-	-
25	Cadmium as Cd	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
26	Lead as Pb	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
27	Copper as Cu	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
28	Arsenic as As	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
29	Chemical Oxygen Demand (COD)	mg/L	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	-
30	Zinc as Zn	mg/L	0.01	0.016	0.02	0.012	0.02	-	-	-
31	Mercury as Hg	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-
32	Manganese as Mn	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
33	Chromium(cr+6)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-
34	Mineral Oil	mg/L	0.006	0.008	0.012	0.008	0.008	-	-	-
35	Aluminum as Al	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
36	Sodium adsorption ratio	--	8.5	9.2	7.4	9	8.56	-	-	26
37	Total Coliforms	cfu/100ml	1834	2124	2325	1536	1942	500	5000	-

3.8 SOIL QUALITY

To establish the base line characteristics with respect to soil quality in the study area, analysis of soil was carried out during study period by collecting grab soil samples from Nine (09) locations. The details of soil sampling locations are as per given in Table 3.20.

TABLE 3.20: LOCATION DETAILS OF SOIL SAMPLING

Sl. No.	Location	Location Code	Coordinate (Latitude/ Longitude)		Land use
1	Sonakhira	SQ1	$24^0$45'12.7" N	$92^0$19'04.1"	Agricultural field
2	Duliakhal	SQ2	$24^0$34'17.0" N	$92^0$50'36.0"	Agricultural field
3	Dhanehari	SQ3	24^0 44'46.8" N	$92^0$51'02.4"	Agricultural field
4	Katigara	SQ4	$25^0$00'14.8" N	$92^0$26'46.6"	Agricultural field
5	Tarapur	SQ5	$24^0$51'46.6" N	$92^0$51'15.6"	Agricultural field
6	Udarbandh	SQ6	24^0 48'03.2" N	$93^0$01'16.1"	Agricultural field
7	Fulertal	SQ7	24^0 34'17.0" N	$92^0$50'36.0"	Agricultural field
8	Sonakhira	SQ8	$24^0$45'12.7" N	$92^0$19'04.1"	Agricultural field
9	Saptagram	SQ9	$24^0$34'17.0" N	$92^0$50'36.0"	Agricultural field

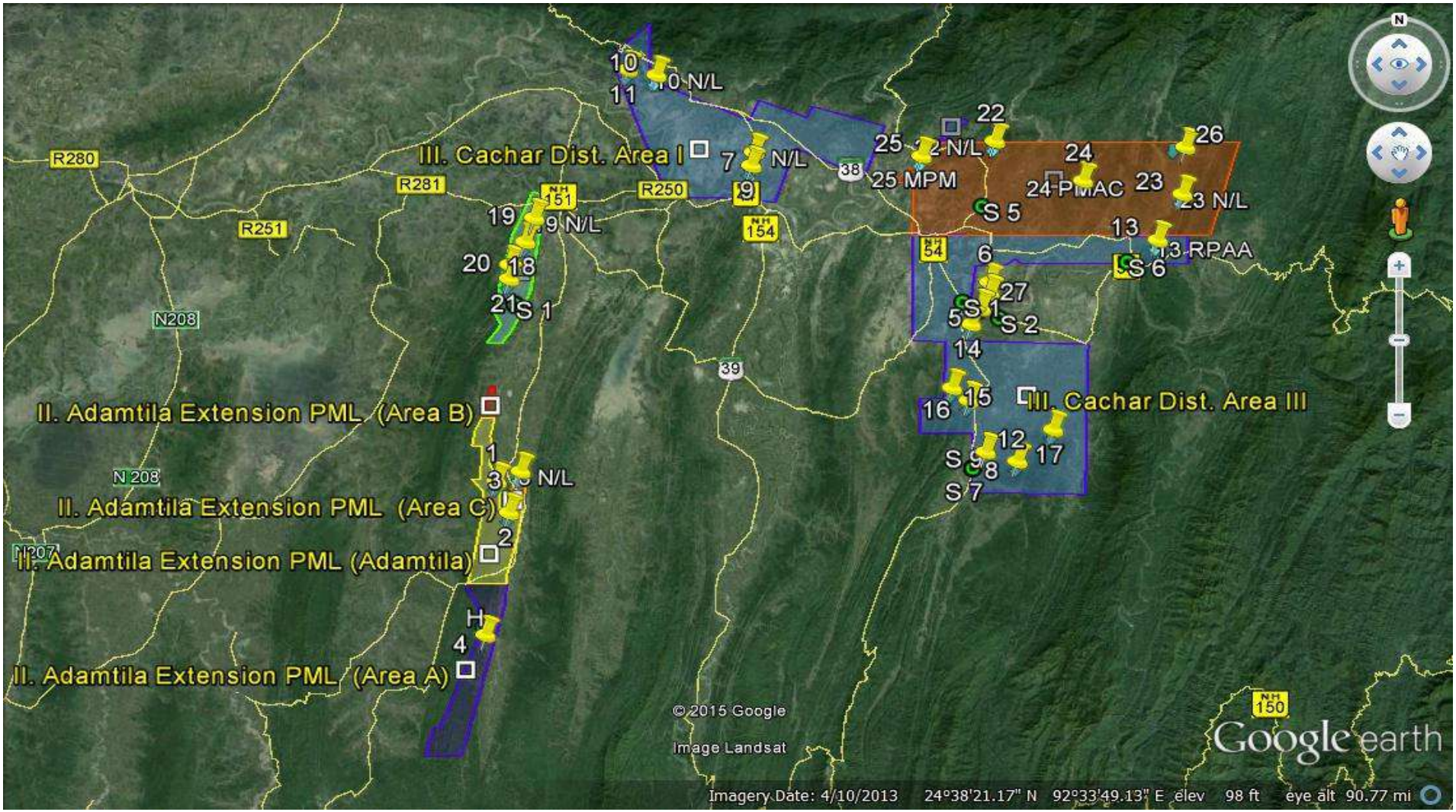
TABLE 3.21: STANDARD CLASSIFICATION OF SOIL

Sl.No.	Parameters	Classification
1	pH	<4.5 Extremely acidic 4.51- 5.00 Very strongly acidic 5.01-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline >9.01 very strongly alkaline
2	Salinity Electrical Conductivity (µS/cm) (1ppm = 640 µS/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon (%)	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (kg/Ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better

Sl.No.	Parameters	Classification
		>300 sufficient
5	Potassium (kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient
6	Phosphorus (kg/ha)	Upto 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient

Source: Hand book of Agriculture, ICAR

FIGURE 3.16: SOIL SAMPLING LOCATIONS WITHIN THE STUDY AREA



- **Results and Discussions:**

The analysis results depicting the physico-chemical characteristics of soil samples are given in Table 3.22 and described below:

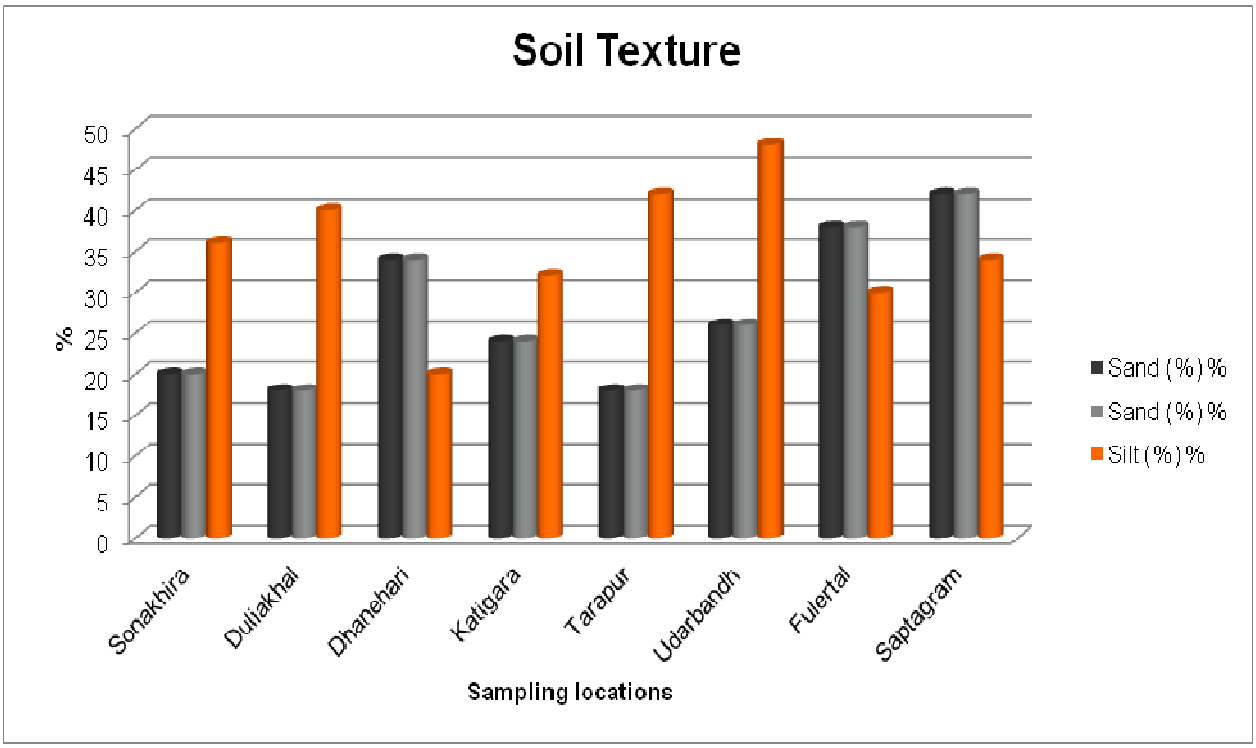
pH of the samples varied from 6.84 to 7.35 and are Neutral as per the Standard Classification of ICAR. The electrical conductivity found to be within a range from 168 µmhos/ cm to 250 µmhos/ cm. The texture of soil found to be varided from Sandy clay to clay. The Available Nitrogen content ranged from 246 kg/ha to 310 kg/ha which is considered to be better as per the Standard Classification of ICAR. The Potassium content ranged from 165 kg/ha to 215 kg/ha which is considered to be medium and Available Phosphorus ranged from 65 kg/ha to 106 kg/ha which is considered to be sufficient.

TABLE 3.22: RESULTS OF SOIL SAMPLE ANALYSIS

Sl. No	Parameter	Unit	SQ-1	SQ-2	SQ-3	SQ-4	SQ-5	SQ-6	SQ-7	SQ-8
			Sonakhira	Duliakhal	Dhanehari	Katigara	Tarapur	Udarbandh	Fulertal	Saptagram
1	Texture	-	Sandy Clay	Silty Clay	Sandy Clay	Clay	Clay	Clay	Silty Clay	Sandy Clay
	Sand (%)	%	20	18	34	24	18	26	38	42
	Silt (%)	%	36	40	20	32	42	48	30	34
	Clay (%)	%	44	42	46	44	40	26	32	26
2	Porosity (%)	%	42	34	38	32	30	38	36	24
3	Water Holding Capacity (%)	%	20.5	16.2	16.4	22.5	14.2	16.8	21.6	22.6
4	Permeability	(cm/h)	4	3.5	4.2	4.4	3.6	5.2	4.3	4
5	Moisture (%)	%	14.2	16.8	10.5	11.8	10.8	12.6	8.2	11.4
6	Cation Exchange Capacity	-	1.26	1.32	2.12	1.42	1.6	1.38	1.5	1.32
7	pH at 25^0C	-	7	7.24	6.9	7.34	6.84	7.2	7.35	7.28
8	EC	(µmhos/cm)	180	210	250	168	192	204	196	154
9	Bulk Density	(g/cc)	1.86	1.25	1.96	1.72	1.8	1.98	1.72	1.62
10	Sodium Absorption Ratio	-	2.64	3.21	2.82	2.22	2.34	2.6	2.1	2.46
11	Available Nitrogen	(kg/ha)	258	310	285	264	246	282	264	272
12	Available P as PO4 (kg/ha)	(kg/ha)	65	72	80	68	80	94	88	106

Sl. No	Parameter	Unit	SQ-1	SQ-2	SQ-3	SQ-4	SQ-5	SQ-6	SQ-7	SQ-8
			Sonakhira	Duliakhal	Dhanehari	Katigara	Tarapur	Udarbandh	Fulertal	Saptagram
13	Potassium as K	(kg/ha)	172	206	188	215	190	176	165	184
14	Exchangeable Ca	(meq/100gr)	1.96	2.2	2.38	2.92	3.25	3.32	3.16	2.92
15	Exchangeable Mg	(meq/100gr)	1.32	1.4	1.24	1.3	1.4	1.75	1.62	1.5
16	Exchangeable Na	(meq/100gr)	4.6	4.3	4.2	4	3.6	4.4	3.2	4
17	Total Organic Matter(TOC)	-	1.52	1.61	1.7	1.54	1.24	1.55	1.82	1.36
18	Zinc as Zn	mg/kg	4.18	4.28	4.34	4.2	3.36	4.2	4.48	3.62
19	Lead as Pb	mg/kg	0.08	0.06	0.08	0.06	0.05	0.06	0.09	0.06
20	Iron as Fe	mg/kg	0.6	0.56	0.92	0.74	0.48	0.4	0.52	0.64
21	Copper as Cu	mg/kg	0.06	0.08	0.05	0.08	0.03	0.08	0.05	0.08
22	Arsenic as As	mg/kg	0.02	0.06	0.04	0.05	0.06	0.09	0.08	0.09

FIGURE 3.17: PARTICLE SIZE DISTRIBUTION OF SOIL SAMPLES



3.9 ECOLOGICAL ENVIRONMENT

The study area falls under North East category as far as the Indian biogeographical zones *(Rodger, Panwar, Mathur 2000)* are concerned. Under the biogeographical provinces, the study area falls under the category of 9A- Brahmaputra Valley. The Forest map of the state is shown below in **Fig. 3.18.**

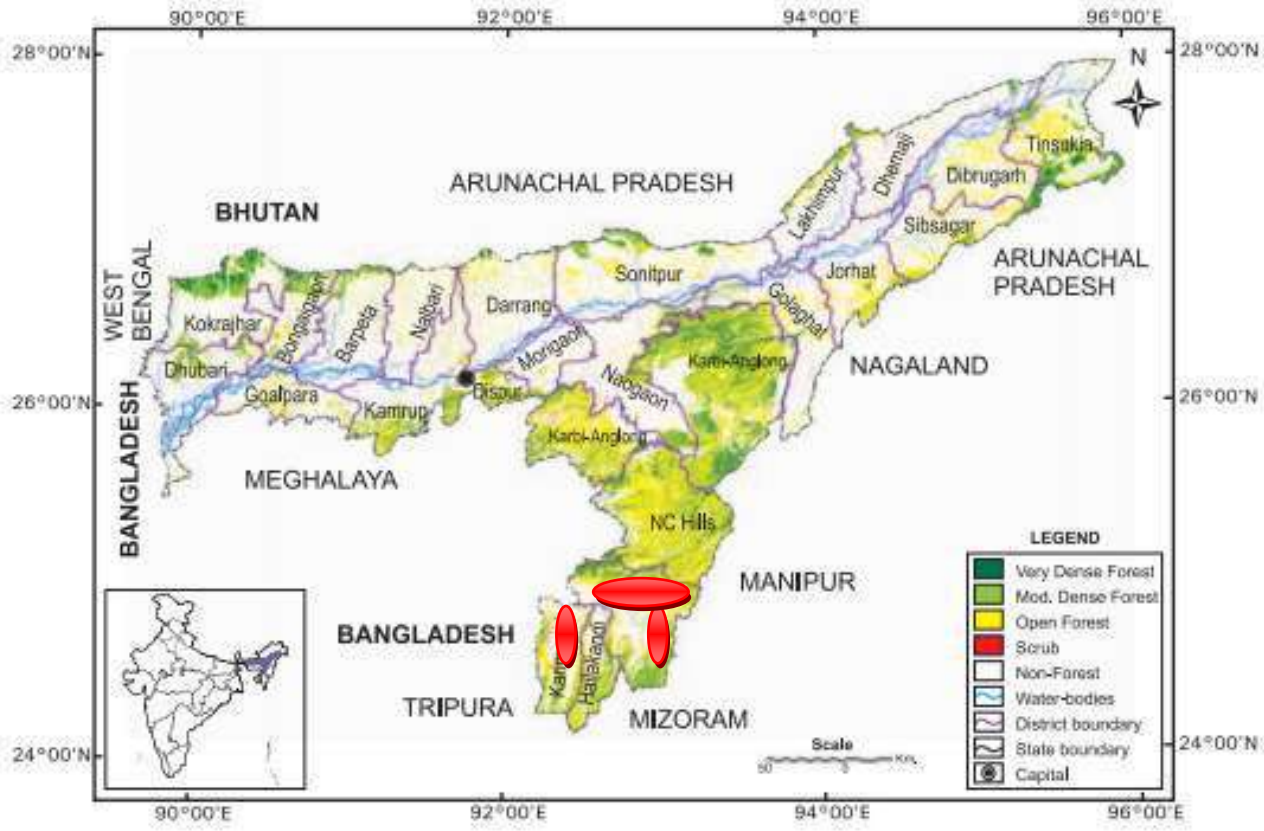


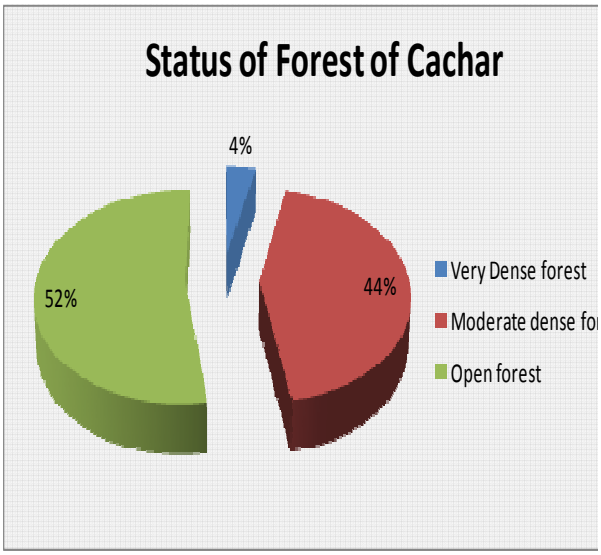
FIGURE 3:18: FOREST MAP OF ASSAM (SOURCE: FOREST SURVEY OF INDIA, 2009)

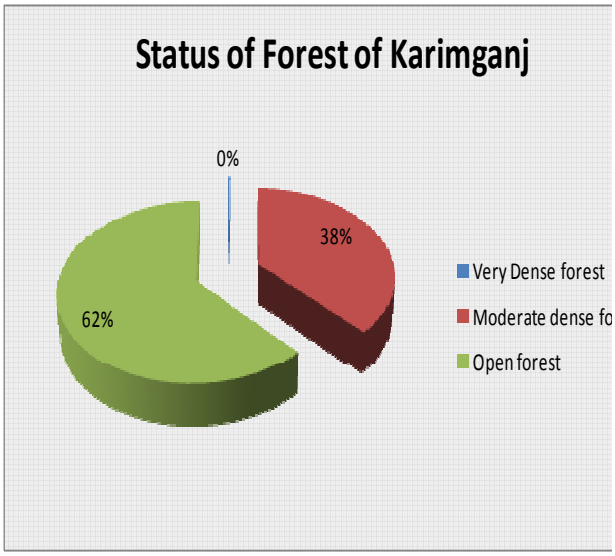
The total geographical area and forest area of the Cachar and Karimganj district under study as depicted below:

TABLE 3.23: DISTRICT WISE GEOGRAPHICAL AND FOREST AREA OF CACHAR & KARIMGANJ, ASSAM

S.No.	District	Geographical area	Very Dense forest	Moderate dense forest	Open forest	Total	% GA	Scrub
1	Cachar	3786	82	976	1173	2231	58.93	16
2	Karimganj	1809	3	320	533	856	47.32	48
	Total State	78438	1461	11558	14673	27692	35.3	179

Source: FSI 2009-10





Based on secondary information collected, blockwise ecological status has been discussed in details in this chapter.

Onsite Ecological investigations were carried out within 1 km radius of each well (26 No.s) within PML blocks area to meet the following objectives:

- To establish the present status of ecological conditions surrounding all the well locations
- To study the existing anthropogenic stresses on the prevailing ecosystem.
- To identify and predict the likely impacts on the local ecosystem from the proposed activities;
- To list out floral species, terrestrial vertebrate and aquatic flora and fauna present within the study area, and significance status under The Wildlife (Protection) Act, 1972;
- To define ecological/conservation status of each species as per IUCN categories (Red Data List).
- To list out the species used as medician.
- To formulate mitigatory measures and a sustainable Environmental Management Plan (EMP) basing upon the likely impacts.

During survey, following aspects were considered for study:

- Assessment of present status of flora and fauna;
- Identification of rare and endangered species of plants and animals (if any);
- Identification of ecologically sensitive areas within the study area;
- Assessment of migratory route of wildlife (if any); and
- Assessment of Aquatic Ecology with specific reference to aquatic birds and fishery resources

3.9.1 METHODOLOGY

This study has been carried out during the during April 2015 for the purpose of providing an independent and comprehensive baseline assessment of the flora and terrestrial vertebrate and aquatic fauna and associated habitat values within study area.

Terrestrial investigations for flora and fauna records were collected by random field survey around each identified exploratory well and a checklist was prepared. During field survey, discussions with the local people were made for getting the information related to local biodiversity in and around the villages. The ecological status of the study area has been assessed based on the following methodology:

- Primary field surveys to establish primary baseline of the study area;
- Compilation of secondary information available in published literatures/working plan was referred from State Forest Department and other sources from 5 PML blocks.

A. Floral Study

The assessment of the flora of the study area is done by an extensive field survey of the area.

- Plants are identified based on their specific diagonistic characters of Family, Genus and Species using available floral, other related literature and herbarium Botanical Survey of India.
- Besides the identification of plant species, information is collected on the vernacular names and uses of plants made by local inhabitants.
- Qualitative analysis of vegetation is made by two different methods such as floristic (by simple studying various genera and species of various plant groups i.e. herbs, shrubs, trees etc).

B. Faunal Study

- **Terrestrial Fauna**

Ground surveys are carried out by trekking the study area for identification of important animal groups such as birds, mammals and reptiles for sampling of animals through the following methods.

- For sampling birds/ avifauna ‘point sampling’ along the fixed transects (foot trails) were done to record all the species of birds with the help of binoculars; field guides and photography for more than 1 hour on each transect (n=4).

- For sampling mammals, 'direct count on open width (20 m) transect' were used on the same transects. Besides, information on recent sightings/records of mammals by the locals are also collected from the study areas.
- 'Reptiles' mainly lizards were sampled by 'direct count on open width transects'.
- Secondary information collected from local villagers, published government data etc.

- **List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972**

Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN. Various methods used for study animals are as follows:

A. **Point Survey Method:** Observations were made at each site for 15-20 min duration.
B. **Road Side Counts:** The observer travelled by motor vehicles from site to site and all sightings were recorded.

3.9.2 ECOLOGICAL STATUS OF BLOCKS

The forests in Cachar district can be classified into 2 types as per available record:

1B/C3 – Cachar tropical evergreen

2B/C2 – Cachar tropical semi evergreen

These types of forests do not occur in compact blocks over extensive areas. These forests are largely composed of evergreen species. The upper storey is comprised of Cham (*Artocarpus chapiasha*), Bon am (*Mangifera spp.*), Sutrong (*Lophopetolum fibriatum*), Morica sundi (*Alscodophene owdenii*). The middle storey is represented by Jam (Eugenia fruticosa), Kurta (*Calophylum polyanthum*), Karol (*Kayea floribunda*), Dhuna (*Canarium resinifrum*) etc. In the lower storey Agar (*Aquilaria agolocha*), Chalmugra (*Synocardia ordorata*) are important. Bamboos are found in abundance at many places within Cachar block, Sector VC PML, Banskandi PML block area.

Cachar Dist. PML block area consists about 47% of agricultural land, Open mixed jungle of about 11% and reserved forest area of about 15%. Sonai reserved forest situated near Cachar dist. PML block. Several tea estates also situated wihin this PML block like Badarpur TE, Jalalpur TE, Palai TE, Maniarkhal TE etc. Some important tree species are *Alistonia scholaris, Anthrocephalus sinensis, Azadirchta indica, Acacia auriculoformis, Artocarpus heterophyllus, Delonix regia, Phyllanthus embilica, Ficus religiosa, Mangifera indica, Lagerstroemia speciosa, Dalberjia sisso, Terminalia arjuna, Salix tetrasperma,*

Terminalia belerica, Ficus cunia, Azadirachta indica, Acacia nilotica, Anthocephalus kadamba, Saraca indica, Tamarindus indica

Sector VC PML block area consists about 22% of agricultural land, Open mixed jungle of about 18% and dense forest area of 32%. Hatichhare TE, Barasingha TE, Chandighat TE, Baiddhan TE, Udarband TE, Dayapur TE, Kharil TE are situated within this block. . Some important tree species are *Alistonia scholaris, Anthrocephalus sinensis, Azadirchta indica, Acacia auriculoformis, Artocarpus heterophyllus, Delonix regia, Phyllanthus embilica, Ficus religiosa, Mangifera indica, Lagerstroemia speciosa, Dalberjia sisso, Terminalia arjuna.*

Banskandi PML block shows that majority of the land (57.63%) within the Block is used for agriculture purpose followed by homestead plantation/vegetation about 21.92%. Several bamboo patches were found and principal species of Bamboos are *Dendrocalamus hamiltonii* (Kako) and *Bambusa tulda* (Jati). However, other bamboo species are also found. In places where the soil is wet over a long period and is in ill drained clay, rich in humus, various species of canes are found. They form an impenetrable thorny thicket sometimes with a few trees standing over them. Vegetations are also recorded in the non-forest are of the block. Tree species in these sites are mostly planted and few are natural. Some important tree species are *Mangifera indica, Aegle mermelos, Salmalia malabarica, Delonix regia, Dalberjia sisso, Ficus religiosa, Ficus bengalensis, Alstonia scholaris, Areca catechu.*

Forest of the Karimganj block area is categorized under 3C/C1 type “North Indian Tropical Moist Deciduous Sal Bearing Forest” as per Champion & Seth forest type classification.

Adamtila Ext PML block shows majority of the land is forest land (47.1%) followed by agriculture land (16.5%). Open mixed jungle & scrub cover an area of 15.4% of the total Block area. Reserve forest also falls within this blocks are mainly of Churaibari Reserve Forest (North West) and Tilbhum Hills RF (South). Several tea estates also situiated within this block which are mainly Lalkhim TE, Shephinjuri TE, Sonakhira TE Baithakal TE, Hatikhira TE, Isabeel TE. Major plant species are *Mangifera indica, Aegle mermelos, Salmalia malabarica, Delonix regia, Dalberjia sisso, Ficus religiosa, Anthocephalus sinensis, Alistonia scholaris, Bombax ceiba, Terminalia arjuna, Salmalia malabarica etc.*

North Patharia PML block shows that majority of the land (29.2%) within the Block is used for agriculture purpose with paddy as the primary produce followed by forest land about 22.9%. Open mixed jungle and open scrub cover an area of 11.1% and the homestead land

plantation associated with settlements cover 22.5% of the total Block area. Some tea estate also situated within this block which are Jalalnagar TE, Ayalabari TE, Madanpur TE, Promodnagar TE. Major plant species are *Mangifera indica, Aegle mermelos, Salmalia malabarica, Delonix regia, Dalberjia sisso, Ficus religiosa, Anthocephalus sinensis, Alistonia scholaris, Bombax ceiba, Terminalia arjuna, Salmalia malabarica*

3.9.3 FLORISTIC COMPOSITION AT WELL SITES

The survey was conducted within the 1 km radius of each identified location of well within 5 blocks. It is observed that human settlements present near each well and many of villages have moderate ranges of plantations. Most of the wells are in agricultural fields and some wells are found to be near tea garden and hilly area.

During site assessment several floral species encountered within the 5 blocks. The Wildlife (Protection) Act 1972 prohibits picking, uprooting, damaging, destroying, acquiring or collecting six species of plants from forest land and any area specified, by notification, by the Central Government [Clause 17A of Chapter IIIA (Protection of Specified Plants), page 346 of Handbook Vol. 1]. The six species are: Beddome's cycad (*Cycas beddomei*), Blue Vanda (*Vanda coerulea*), Kuth (*Sassurea lappa*), Ladies slipper orchids (*Paphiopedilum sp.*), Pitcher plant (*Nepenthes khasiana*), Red Vanda (*Rananthera imshootiana*). None of these species is recorded in the forests of the study area. The Following species were enlisted from the well locations during the field visits as given in Table 3.24.

TABLE 3.24: FLORISTIC DIVERSITY IN THE STUDY AREA

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
Tree				
1	*Terminalia arjuna*	Arjun	Combretaceae	Not yet Assessed
2	*Salix tetrasperma*	Indian Willow	Salicaceae	Not yet Assessed
3	*Terminalia belerica*	Baera	Combretaceae	Not yet Assessed
4	*Ficus benghalensis*	Bot	Moraceae	Not yet Assessed
5	*Dillenia indica*	Chalta	Dilleniaceae	Not yet Assessed
6	*Podocarpus neriifolius*	Brown Pine	Podocarpaceae	Least Concern
7	*Grewia glabra*	Dhamon	Tiliaceae	Not yet Assessed
8	*Syzygium cumini*	Jaman	Myrtaceae	Not yet Assessed
9	*Ficus cunia*	Dumur	Moraceae	Not yet Assessed
10	*Anthocephalus kadamba*	Kadam	Rubiaceae	Not yet Assessed
11	*Diospyros melanoxylon*	Kendu	Ebenaceae	Not yet Assessed
12	*Aegle marmelos*	Bel	Rutaceae	Not yet Assessed
13	*Azadirachta indica*	Neem	Meliaceae	Not yet Assessed
14	*Acacia nilotica*	Babla	Mimosaceae	Not yet Assessed

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
15	*Annona squamosa*	Ata	Annonaceae	Not yet Assessed
16	*Borassus flabellifer*	Taal	Arecaceae	Endangered
17	*Albizia lebbeck*	Sirish	Fabaceae	Not yet Assessed
18	*Bursera serrata*	Nour	Burseraceae	Not yet Assessed
19	*Psidium guajava*	Guava	Myrtaceae	Not yet Assessed
20	*Saraca indica*	Asoka	Leguminosae	Not yet Assessed
21	*Tamarindus indica*	Tetul	Leguminosae	Not yet Assessed
22	*Ficus mysorensis*	Dhopabar	Moraceae	Not yet Assessed
23	*Premna bengalensis*	Gohora	Lamiaceae	Not yet Assessed
24	*Adina cordifolia*	Haldu	Rubiaceae	Not yet Assessed
25	*Elaeocarpus robustus*	Helok	Elaeocarpaceae	Not yet Assessed
26	*Terminalia chebula*	Harida	Combretaceae	Not yet Assessed
27	*Randia fasciculata*	Harumoin	Rubiaceae	Not yet Assessed
28	*Aquilaria agallocha*	Agar	Thymeleaceae	Not yet Assessed
29	*Amoora wallichii*	Atari	Meliaceae	Not yet Assessed
30	*Alstonia scholaris*	Chatim	Apocynaceae	Least Concern
31	*Areca catechu*	Supari	Piperaceae	Not yet Assessed
32	*Artocarpus heterophyllus*	Kanthal	Moraceae	Not yet Assessed
33	*Salmalia malabarica*	Simul	Malvaceae	Not yet Assessed
34	*Shorea robusta*	Sal	Dipterocarpaceae	Least Concern
35	*Ficus religiosa*	Pipal	Moraceae	Not yet Assessed
36	*Sapindus detergens*	Ritha	Sapindaceae	Not yet Assessed
37	*Stereospermum chelonoides*	Missi	Bignoniaceae	Not yet Assessed
38	*Sterculia villosa*	Udal	Sterculiaceae	Not yet Assessed
39	*Sterculia foetida*	Jangli Badam	Malvaceae	Not yet Assessed
40	*Schima wallichii*	Usoi	Theaceae	Not yet Assessed
41	*Pongamia glabra*	Karach	Fabaceae	Least Concern
42	*Toona ciliata*	Poma	Meliaceae	Least Concern
43	*Talauma phellocarpa*	Khariasopa	Magnoliaceae	Not yet Assessed
44	*Trema orientalis*	Chikum	Cannabaceae	Not yet Assessed
45	*Ziziphus jujuba*	Boroc	Rhamnaceae	Least Concern
46	*Eucalyptus sp.*	Eucalyptus	Myrtaceae	Not yet Assessed
47	*Ficus rumphii*	Heibong	Moraceae	Not yet Assessed
48	*Garcinia lancifolia*	Dephal	Clusiaceae	Not yet Assessed
49	*Grevillea robusta*	Silver Oak	Proteaceae	Not yet Assessed
50	*Grewia microcos*	Heitup	Tiliaceae	Not yet Assessed
51	*Holiadrana longfolia*	Kherai	Annonaceae	Not yet Assessed
52	*Kydia calycina*	Khabi	Malvaceae	Not yet Assessed
53	*Lagerstroemia flosreginae*	Jarul	Lythraceae	Not yet Assessed
54	*Lannea grandis*	Akaman	Anacardiaceae	Not yet Assessed
55	*Leucaena leucocephala*	Subabul	Fabaceae	Not yet Assessed
56	*Machilus villosa*	Uingthou manbi	Lauraceae	Not yet Assessed

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
57	*Mangifera indica*	Aam	Anacardiaceae	Not yet Assessed
58	*Terminalia catappa*	Badam	Combretaceae	Not yet Assessed
59	*Castanopsis hystrix*	Thangji	Fagaceae	Not yet Assessed
60	*Cassia siamea*	Bandar Lathi	Fabaceae	Not yet Assessed
61	*Caryota urens*	Bara flawar	Arecaceae	Least Concern
62	*Ceiba pentandra*	Swet Simul	Malvaceae	Not yet Assessed
63	*Cinnamomum tamala*	Tejpata	Lauraceae	Not yet Assessed
64	*Crataeva religiosa*	Barun	Capparaceae	Not yet Assessed
65	*Citrus maxima*	Batabi Lebu	Rutaceae	Not yet Assessed
66	*Delonix regia*	Krishnachura	Fabaceae	Least Concern
67	*Diospyros kaki*	Gulal	Ebenaceae	Not yet Assessed
68	*Dillenia indica*	Heigri	Dilleniaceae	Not yet Assessed
69	*Callicarpa arborea*	Banmala	Verbenaceae	Not yet Assessed
70	*Melanorrhoea usitata*	Kheu	Anacardiaceae	Not yet Assessed
71	*Butea monosperma*	Palash	Fabaceae	Not yet Assessed
72	*Careya arborea*	Kumbhi	Lecythidaceae	Not yet Assessed
73	*Artocarpus Chaplasha*	Lathar	Moraceae	Not yet Assessed
74	*Baccaurea sapida*	Kusum	Phyllanthaceae	Not yet Assessed
75	*Tectona grandis*	Teak	Lamiaceae	Not yet Assessed
76	*Dalbergia sissoo*	Sissu	Fabaceae	Not yet Assessed
77	*Albizia procera*	Kala Siris	Mimosaceae	Not yet Assessed
78	*Eriobotrya bengalensis*	Maya	Rosaceae	Not yet Assessed
Shrub				
1	*Bambusa balcooa*	Boro bans	Poaceae	Not yet Assessed
2	*Bambusa rutans*	Malka bans	Poaceae	Not yet Assessed
3	*Bambusa tulda*	Jati Bans	Poaceae	Not yet Assessed
4	*Bambusa arundinacea*	Kata bans	Poaceae	Not yet Assessed
5	*Lantana camara*	Wild Sage	Verbenaceae	Not yet Assessed
6	*Asparagus racemosus*	Satamul	Asparagaceae	Not yet Assessed
7	*Acalypha indica*	Bishohory	Euphorbiaceae	Not yet Assessed
8	*Calamus gracilis*	Chuli beth	Poaceae	Not yet Assessed
9	*Calamus erectus*	Beth	Poaceae	Not yet Assessed
10	*Plectiomia assamica*	Cane	Poaceae	Not yet Assessed
11	*Bambusa pallida*	Makal	Poaceae	Not yet Assessed
12	*Jatropha curcas*	Bongali Ara	Euphorbiaceae	Not yet Assessed
13	*Ipomoea fistulosa*	Morning Glory	Convolvulaceae	Not yet Assessed
14	*Dendrocalamus hamiltonii*	Kako bans	Poaceae	Not yet Assessed
15	*Hymenodictyon excelsum*	Ban kadam	Rubiaceae	Not yet Assessed
16	*Hyptis suaveolens*	Buno tulsi	Lamiaceae	Not yet Assessed
17	*Calotropis procera*	Aakanda	Asclepiadaceae	Not yet Assessed
18	*Adhatoda vasica*	Basuti	Acanthaceae	Not yet Assessed
19	*Musa paradisiaca*	Kela	Musaceae	Not yet Assessed

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
20	*Xanthium stromarium*	Gokru	Tiliaceae	Not yet Assessed
21	*Hibiscus rosa-sinensis*	Jaba Phool	Malvaceae	Not yet Assessed
22	*Camellia chinensis*	Tea	Theaceae	Not yet Assessed
23	*Similax macrophylla*	Chopchini	Smilacaceae	Not yet Assessed
24	*Zizyphus rugosa*	Barai	Rhamnaceae	Not yet Assessed
25	*Abutilon indicum*	Petari	Malvaceae	Not yet Assessed
26	*Caesalpinia crista*	Lataguti	Caesalpiniaceae	Not yet Assessed
27	*Calotropis gigantea*	Akanda	Apocynaceae	Not yet Assessed
28	*Ervatamia coronaria*	Tagar	Apocynaceae	Not yet Assessed
29	*Euphorbia neriifolia*	Monasa	Euphorbiaceae	Not yet Assessed
30	*Glycosmis arborea*	Bon nimbu	Rutaceae	Not yet Assessed
31	*Hibiscus rosa-sinensis*	Jaba	Malvaceae	Not yet Assessed
32	*Ixora coccinea*	Rangan	Rubiaceae	Not yet Assessed
33	*Justicia gendarussa*	Jagat Madan	Acanthaceae	Not yet Assessed
34	*Ricinus communis*	Rehri	Euphorbiaceae	Not yet Assessed
35	*Vitex negundo*	Nishinda	Lamiaceae	Not yet Assessed
36	*Thevetia peruviana*	Kolkey	Apocynaceae	Not yet Assessed
37	*Musa sapientum*	Kala	Musaceae	Not yet Assessed
38	*Eupatorium odoratum*	Assamlota	Asteraceae	Not yet Assessed
39	*Clerodendrum viscosum*	Bhant	Verbenaceae	Not yet Assessed
40	*Bridelia stipularis*	Gayo lahara	Phyllanthaceae	Not yet Assessed
41	*Rauwolfia serpentina*	Sarpagandha	Apocynaceae	Not yet Assessed
42	*Cissus repanda*	Pani lahara	Vitaceae	Not yet Assessed
43	*Bauhinia anguina*	Nagbacli	Caesalpiniaceae	Not yet Assessed
44	*Mucuna prurita*	Kowchu	Fabaceae	Not yet Assessed
45	*Morinda citrifolia*	Hardikanth	Rubiaceae	Not yet Assessed
46	*Tinospora cordifolia*	Gurjo	Menispermaceae	Not yet Assessed
47	*Malvaviscus sp.*	Lanka-jaba	Malvaceae	Not yet Assessed
	Herb			
1	*Bacopa monnieri*	Brahmi	Scrophulariaceae	Least Concern
2	*Acacia catechu*	Khair	Mimosaceae	Not yet Assessed
3	*Cannabis sativa*	Bhang	Cannabinaceae	Not yet Assessed
4	*Crotalaria albida*	Ban-methi	Fabaccae	Least Concern
5	*Croton caudatus*	Lata-mahudi	Euphorbiaceae	Not yet Assessed
6	*Microlepia speluncae*	Lace Fern	Dennstaedtiaceae	Not yet Assessed
7	*Datura metal*	Dhutra	Solanaceae	Not yet Assessed
8	*Michelia champaca*	Golden Champa	Magnoliaceae	Least Concern
9	*Amaranthus spinosus*	Khutura	Amaranthaceae	Not yet Assessed
10	*Mimosa pudica*	Lajjabati	Fabaceae	Least Concern
11	*Curcuma spp*	Sunti	Scitamineae	Not yet Assessed
12	*Datura fastuosa*	Dhatura	Solanaceae	Not yet Assessed
13	*Saccharum spontaneum*	Khagra	Coramineae	Least Concern

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
14	*Andropegon squarrrous*	Binna	Coramineae	Not yet Assessed
15	*Dioscorea bulbifera*	Kathalu	Dioscoreaceae	Not yet Assessed
16	*Gmelina arborea*	Gomari	Verbenaceae	Not yet Assessed
17	*Elsholtzia blanda*	Bon-tulasi	Lamiaceae	Not yet Assessed
18	*Tridax procumbens*	Tridax Daisy	Asteraceae	Not yet Assessed
19	*Sesamum indicum*	Til	Pedaliaceae	Not yet Assessed
20	*Catharanthus roseus*	Nayantara	Apocynaceae	Not yet Assessed
21	*Cynodon dactylon*	Bermuda grass	Poaceae	Not yet Assessed
22	*Imperate arundinacea*	Chhan	Coramineae	Not yet Assessed
23	*Alysicarpus vaginalis*	Alyce Clover	Fabaceae	Not yet Assessed
24	*Desmodium triflorum*	Creeping Tickfoil	Fabaceae	Least Concern
25	*Acalypha indica*	Muktajhuri	Euphorbiaceae	Not yet Assessed
26	*Amaranthus viridis*	Notey	Amaranthaceae	Not yet Assessed
27	*Achyranthes aspera*	Ubtisath	Amaranthaceae	Not yet Assessed
28	*Cassia tora*	Chakunda	Fabaceae	Not yet Assessed
29	*Blumea lacera*	Kukursunga	Asteraceae	Not yet Assessed
30	*Clerodendrum indicum*	Bamunhati	Verbenaceae	Not yet Assessed
31	*Centella asiatica*	Thankuni	Apiaceae	Least Concern
32	*Commelina benghalensis*	Kanshira	Commelinaceae	Least Concern
33	*Heliotropium indicum*	Hatisur	Boraginaceae	Not yet Assessed
34	*Euphorbia hirta*	Bara Dudhi	Euphorbiaceae	Not yet Assessed
35	*Curcuma amada*	Aamada	Zingiberaceae	Not yet Assessed
36	*Solanum nigrum*	Kakmachi	Solanaceae	Not yet Assessed
37	*Croton bonplandianum*	Bantulsi	Euphorbiaceae	Not yet Assessed
38	*Urena lobata*	Bon-okra	Malvaceae	Not yet Assessed
39	*Vernonia cinerea*	Kukshim	Asteraceae	Not yet Assessed
40	*Phyllanthus urinaria*	Hazarmani	Phyllanthaceae	Not yet Assessed
41	*Curcuma zedoaria*	Sati	Zingiberaceae	Not yet Assessed
42	*Oxalis corniculata*	Amrool	Oxalidaceae	Not yet Assessed
43	*Leucas aspera*	Choto halkusa	Lamiaceae	Not yet Assessed
44	*Leonurus sibiricus*	Rakto Drone	Lamiaceae	Not yet Assessed
45	*Pedilanthus tithymaloides*	Rangchita	Euphorbiaceae	Not yet Assessed
46	*Andropogon aciculatus*	Bon-guti	Poaceae	Not yet Assessed
47	*Cardiospermum halicacabum*	Kapal phota	Sapindaceae	Not yet Assessed
48	*Bryonopsis laciniosa*	Mala	Cucurbitaceae	Not yet Assessed
49	*Vitis adnata*	Bhatia Lata	Vitaceae	Not yet Assessed
50	*Smilax ovalifolia*	Kumari Lata	Smilacaceae	Not yet Assessed
51	*Coccinia cordifolia*	Telakucha	Cucurbitaceae	Not yet Assessed
52	*Saccharum spontaneum*	Khagra	Poaceae	Least Concern
53	*Phragmites karka*	Nal-khagra	Poaceae	Least Concern
54	*Mikania scandens*	Tara Lata	Asteraceae	Not yet Assessed
55	*Luffa cylindrica*	Dhundul	Cucurbitaceae	Not yet Assessed

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
56	*Ipomea pes tigridis*	Langali Lata	Convolvulaceae	Not yet Assessed

- ***Economically important Flora of the study area***
- **Agricultural crops:** Paddy (Khariff, Rabi, Jait) is the main crop. Also Pulses (Lathyrus, Blackgram, Greengram), Oilseeds are other important crops. Different fruits like Banana, papaya, mangoes and vegetables like Potatoe, chili, brinjal, cauliflower and capcicum also grown by the local people. Most of the cultivable land remains fallow in winter due to lack of irrigation facilities. The consultation with local people reveals that the farmers are cultivating the improved varieties in the field.
- **Medicinal plant species:** The nearby area is also endowed with the several medicinal plants which are commonly available in the shrub forest and waste lands. The common medicinal plants of the region are *Asparagus racemosus, Aegle marmelos* (Bel), *Azadirachta indica* (Neem), *Alstonia scholaris* (Chhatim) etc.
- **Rare and endangered floral species:** During the survey in the study area any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines has not been observed.

3.9.4 FAUNAL COMMUNITIES

The Cachar PML Block falls in Lower Jiri Reserve Forest (R.F.), Sonai Reserve Forest and Adamtila Ext PML block is very close to Tilbhum Hills RF & Churaibari RF. The well locations within Banaskandi PML are mainly on agricultural land. Several well locations of Cachar PML block falls within tea estates. While most of the wells within Sector VC PML blocks fall within open scrub and Bamboo forest and some within tea estates. Both direct (sighting) and indirect (evidences) observation methods were used to survey the faunal species around the study area. Additionally reference of relevant literatures (published/ unpublished) and dialogues with local villagers were also carried out to consolidate the presence of faunal distribution in the area *(Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988).*

Mammals: No wild mammalian species was directly sighted during the field survey. Dialogue with local villagers located around the study area also could not confirm presence of any wild animal in that area. Common Langur, Mongoose, Indian Mole Rat, Palm Squirrel were observed during primary survey.

Avifauna: Since birds are considered to be the indicators for monitoring and understanding human impacts on ecological systems *(Lawton, 1996)* attempt was made to gather quantitative data on the avifauna by walk through survey within the entire block area and surrounding area. From the primary survey, a total of 80 species of avifauna were identified and recorded from the 5 block area. The diversity of avifauna from this region was found to be quite high and encouraging.

List of fauna species found in the study area are mentioned in Table 3.25 to 3.26. The tree lizard and common garden lizards are also seen. Variety of butterflies (like common grass yellow, plain tiger) and insects (such as beetles, spiders, red ants, and flies) are spotted in abundance in the study zone.

TABLE 3.25: FAUNA RECORDED FROM THE PRIMARY SURVEY IN THE STUDY AREA AND THEIR CONSERVATION STATUS

Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
Mammals					
1	*Bandicota bengalensis*	Common Indian Rat	V	Not assessed	NS
2	*Muntiacus muntjak*	Barking deer	III	Least Concern	DS
3	*Cervus unicolor*	Sambar deer	III	Vulnerable	NS
4	*Axis porcinus*	Hog Deer	III	Endangered	NS
5	*Funambulus pennanti*	Common five Stripped Squirrel	IV	Not assessed	NS
6	*Hystra indica*	Porcupine	II	Least Concern	NS
7	*Axis axis*	Cheetal	III	Least Concern	NS
8	*Panthera pardus*	Leopard	I	Near Threatened	NS
9	*Mus musculus*	Common mouse	V	Least Concern	DS
10	*Nycticebus coucang*	Slow loris	I	Not assessed	NS
11	*Viverricula indica*	Small Indian Civet	I	Least Concern	NS
12	*Macaca assamensis*	Assamese Macaque	II	Near Threatened	NS
13	*Prionailurus viverrinus*	Fishing Cat	I	Not assessed	NS
14	*Leporidae sp.*	Rabbit	IV	Not assessed	DS
15	*Tamiops mcclellandii*	Himalayan Stripped Squirrel	IV	Not assessed	DS
16	*Bos sp.*	Cow	-	Not assessed	DS
17	*Felis silvestris*	Wild cat	II	Vulnerable	NS
18	*Felis chaus*	Jungle cat	II	Least Concern	NS
19	*Felis bengalensis*	Leopard cat	I	Not assessed	NS
20	*Macaca mulatta*	Rhesus Monkey	II	Least Concern	DS
21	*Crocidura caerulea*	Grey musk shrew	-	Not assessed	DS
22	*Presbytis pileatus*	Langur	I	Not assessed	NS
23	*Bubalus arnee*	Wild Buffalow	I	Endangered	NS

Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
24	*Sus scrofa*	Wild pig	III	Not assessed	NS
25	*Bos gaurus*	Gaur	I	Not assessed	NS
26	*Herpestes edwardsii*	Common Indian Mongoose	II	Least Concern	DS
27	*Lutra lutra*	Common otter	II	Near Threatened	NS
28	*Canis bengalensis*	Indian fox	-	Not assessed	NS
29	*Mus rattus*	Indian rat	V	Not assessed	DS
23	*Gazella gazelle*	Indian Gazelle	I	Not assessed	NS
24	*Lepus nigricollis*	Indian Hare	IV	Least Concern	DS
25	*Boselaphus tragocamelus*	Blue Bull	-	Least Concern	NS
26	*Nycticebus coueang*	Slow Loris	I	Not assessed	NS
27	*Petinomys fuscocapillus*	Flying Squirrel	I	Near Threatened	NS
		Birds			
1	*Corvus splendens*	House crow	V	Least Concern	DS
2	*Acridotheres tristis*	Common Maina	IV	Not assessed	DS
3	*Turdoides caudatus*	Common Babbler	IV	Least Concern	DS
4	*Pycnonotus cafer*	Red vented Bulbul	IV	Least Concern	DS
5	*Corvus macrorhynchos*	Jungle crow	-	Least Concern	DS
6	*Merops orientalis*	Common bee eaters	IV	Least Concern	DS
7	*Passer domesticus*	Indian house sparrow	V	Least Concern	DS
8	*Dicrurus macrocercus*	Black Drongo	IV	Least Concern	DS
9	*Dicrurus leucophaeus*	Ashy Drngo	IV	Least Concern	DS
10	*Columba livia*	Pigeon	-	Least Concern	DS
11	*Alcedo atthis*	Common kingfisher	IV	Least Concern	DS
12	*Halcyon smyrnensis*	White breasted king fisher	IV	Not assessed	DS
13	*Buceros bicornis*	Hornbill	I	Near Threatened	DS
14	*Harpadon nehereus*	Duck	IV	Not assessed	DS
15	*Zenaida macroura*	Dove	IV	Not assessed	DS
16	*Milvus migrans*	Common kite	IV	Least Concern	DS
17	*Grus grus*	Common crane	IV	Least Concern	DS
18	*Eudynamys scolopacea*	Koel	IV	Not assessed	DS
19	*Nicticorax nycticorax*	Night Heron	IV	Not assessed	DS
20	*Bubulcus ibis*	Cattle egret	IV	Least Concern	NS
21	*Psittacula krameri*	Rose ringed parakeet	IV	Least Concern	DS
22	*Psittacula alexandri*	Indian Red breasted Parakeet	IV	Near Threatened	NS
23	*Cuculus varius*	Cuckoo	IV	Least Concern	DS
24	*Chloropsis aurifrons*	Green Bulbul	IV	Not assessed	NS
25	*Ardeola grayii*	Pond heron	IV	Not assessed	DS
26	*Anas clypeata*	Northern shoveler	-	Least Concern	NS
27	*Gallus varius*	Jungle fowl	-	Least Concern	DS

Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
28	*Houbaropsis bengalensis*	Bengal Floricans	I	Critically Endangered	NS
29	*Orthotomus sutorius*	Tailor bird	IV	Least Concern	NS
30	*Motacilla cinerea*	Gray wagtail	IV	Least Concern	DS
31	*Dendrocitta vagabunda*	Indian Tree pie	IV	Least Concern	DS
32	*Turdus ruficollis*	Drak throated thrush	IV	Least Concern	DS
33	*Dicrurus paradiseus*	Racket tailed Drongo	IV	Least Concern	DS
34	*Picus canus*	Grey headed wood peacker	IV	Least Concern	DS
35	*Dendrocopos mahrattensis*	Yellow wood pecker	IV	Not assessed	DS
36	*Acrocephalus agricola*	Paddy field warbler	-	Least Concern	DS
37	*Cisticola juncidis*	Streaked fantail warbler	IV	Least Concern	NS
38	*Lonchura punctulata*	Spotted Munia	IV	Least Concern	NS
39	*Accipiter nisus*	Sparrowhawk	-	Least Concern	NS
40	*Acridotheres fuscus*	Jungle myna	IV	Least Concern	DS
41	*Alanda gulgula*	Small skylark	IV	Not assessed	DS
42	*Aegithina tiphia*	Common Iora	IV	Least Concern	DS
43	*Anthus rufulus*	Paddyfield Pipit	IV	Least Concern	DS
44	*Apus affinis*	House swift	IV	Least Concern	DS
45	*Centropus sinensis*	Crow Pheasant	IV	Least Concern	DS
46	*Columba punicea*	Pale-capped Pigeon	IV	Vulnerable	DS
47	*Apus apus*	Common swift	IV	Least Concern	DS
48	*Copsychus saularis*	Magpie-Robin	IV	Least Concern	DS
49	*Dendrocitta vagabunda*	Tree Pie	IV	Least Concern	DS
50	*Estrilda amandava*	Red munia	IV	Not assessed	DS
51	*Fulica atra*	Common coot	IV	Least Concern	DS
52	*Gallinago gallinago*	Common snipe	IV	Least Concern	DS
53	*Gallus gallus*	Red jungle fowl	IV	Least Concern	DS
54	*Gracula religiosa*	Hill myna	IV	Least Concern	DS
55	*Heliaetur Indus*	Brahminey kite	IV	Not assessed	DS
56	*Lanius schach*	Long-tailed Shrike	IV	Least Concern	DS
57	*Leptopilos dubius*	Adjutant stork	IV	Not assessed	DS
58	*Liconia episcoptous*	White neck stork	IV	Not assessed	DS
59	*Magalaima asiatica*	Blue Throated Barbet	IV	Not assessed	DS
60	*Pericrocotus flammeus*	Scarlet Minivet	IV	Least Concern	DS
61	*Aethopyga siparaja*	Indian Yellow backed sunbird	IV	Least Concern	NS
62	*Oriolus oriolus*	Golden oriole	IV	Least Concern	DS
63	*Parus major*	Great Tit	IV	Least Concern	DS
64	*Egretta garzetta*	Little Egret	IV	Least Concern	DS
65	*Phalacrocorax niger*	Little Cormorant	IV	Least Concern	DS

Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
66	*Ardea alba*	Large Egret	IV	Least Concern	DS
67	*Egretta intermedia*	Intermediate Egret	IV	Not assessed	DS
68	*Phalacrocorax carbo*	Large Cormorant	IV	Least Concern	DS
69	*Sturnus contra*	Pied myna	IV	Least Concern	DS
70	*Nectarinia asiatica*	Purple sunbird	IV	Least Concern	DS
71	*Streptopelia chinensis*	Indian Spotted Dove	IV	Not assessed	DS
72	*Tachybaptus ruficollis*	Little Grebe	-	Least Concern	DS
73	*Pericrocotus cinnamomeus*	Small minivet	IV	Not assessed	DS
74	*Coracias benghalensis*	Indian Roller	IV	Not assessed	DS
75	*Vanellus indicus*	Red Wattled lapwing	-	Least Concern	DS
76	*Centropus bengalensis*	Lesser coucal	-	Least Concern	DS
77	*Cypsiurus balasiensis*	Asian palm swift	IV	Least Concern	DS
78	*Anas creaca*	Common Teal	IV	Not assessed	DS
79	*Motacilla alba*	White Wagtail	-	Least Concern	DS
		Reptiles			
1	*Bungarus caeruleus*	Common Krait	IV	Not assessed	NS
2	*Ahaetulla nasuta*	Green vine snake	-	Not assessed	NS
3	*Elaphe radiata*	Copperhead Ratsnake	-	Not assessed	NS
4	*Varanus bengalensis*	Bengal monitor	IV	Least Concern	NS
5	*Naja naja*	Cobra	I	Least Concern	NS
6	*Ptyas mucosus*	Oriental rat snake	-	Not assessed	NS
7	*Gecko gecko*	Common house gecko	-	Not assessed	DS
8	*Calotes microlepis*	Burmese False Bloodsucker	-	Not assessed	DS
9	*Calotes versicolor*	Common Garden Lizard	-	Not assessed	DS
10	*Varanus varanus*	Tree lizard	II	Not assessed	DS
11	*Vipera russelli*	Russell's viper	IV	Not assessed	NS
12	*Ptyas mucosus*	Yellow rat snake	II	Not assessed	NS
		Amphibians			
1	*Rana tigrina*	Common yellow frog	IV	Least Concern	NS
2	*Bufo melanostictus*	Toad	IV	Least Concern	NS
3	*Hoplobatrachus tigerinus*	Indian bull frog	-	Least Concern	DS
		Butterfly			
1	*Eurema hecabe*	Common Grass Yellow	IV	Not assessed	DS
2	*Junonia hierta*	Yellow pansy	IV	Least Concern	DS
3	*Danaus chrysippus*	plain tiger	IV	Not assessed	DS
4	*Junonia atlites*	Grey pansy	IV	Not assessed	DS
5	*Neptis hylas*	Common Sailer	IV	Not assessed	DS
6	*Precis iphita*	Chocolate Pansy	IV	Not assessed	DS

N.B: NS= Not sighted but included as per the information provided by villagers, DS = Direct Sighting

	
Intermediate Egret (*Egretta intermedia*)	***Ardeola grayii* (Pond heron)**
	
Lanius schach (Long-tailed Shrike)	***Dicrurus macrocercus* (Black drongo)**
	
Streptopelia chinensis (Indian Spotted Dove)	***Lepus nigricollis* (Indian Hare)**

Livestock like cattle, buffalo, goat sheep, duck, and pig are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry farms are mostly common in this area; however, some commercial poultry farms are also recorded in the district.

TABLE 3.26: LIST OF OTHER FAUNA RECORDED WITHIN THE STUDY AREA

Sl.No.	Scientific name	English Name
Mammals		
1	*Canis familiaris*	Dog (Street dog)
2	*Felis catus*	Billi (Domestic cat)
3	*Sus scrofa*	Suar (Domestic pig)
4	*Capra hircus*	Domestic goat
5	*Bubalus bubalis*	Domestic buffalo
6	*Bos indicus*	Cow
Birds		
1	*Anas platyrhyncha*	Duck
2	*Columbia livia*	Pigeon
3	*Gallus domesticus*	Domestic chicken
Fishes		
1	*Labeo rohita*	Rahu
2	*Catla catla*	Katla
3	*Cirrhinus mirgala*	Mirgala
4	*Clarius batrachus*	Magur
5	*Macrobrachium rosenbeigie*	Chingri
6	*Channa punetatus*	Lata
7	*Puntius Sp.*	Puthi
8	*Liza tade*	Bhangar
9	*Chana striatus*	Sole
10	*Anabas tesludineus*	Koi

The study area is marked with moderate population of flora and fauna. With reference to the Wildlife Protection Act 1972 total number of wildlife tabulated in this study can be characterized as given in the Table 3.27.

TABLE 3.27: CHARACTERIZATION OF FAUNA IN THE STUDY AREA (AS PER W.P ACT, 1972)

Sl.No.	*Schedule of Wildlife Protection Act 1972*	*No. of species*
1	*Schedule I*	*14*
2	*Schedule II*	*9*
3	*Schedule III*	*5*
4	*Schedule IV*	*81*
5	*Schedule V*	*5*
6	*Schedule VI*	*0*

3.9.5 AQUATIC ECOSYSTEM

There are several rivers and cannals present within all the 5 blocks. The major rivers are Barak, Sonai, Jiri, Chiri, Langai, Larsing and Rukni. All these rivers and nalas form the aquatic ecosystem. Riparian vegetation was also recorded from the banks of these rivers.

The most dominant macrophytes are *Phragmites karka*, *Arundo donax, Alternantha sessilis, Cyperus iria, Hydrilla verticillata* and *Nymphoides cristrat*. A total of 21 species of aquatic macrophytes were recorded from these aquatic ecosystems. Several Fish species generally found within the study area.

TABLE 3.28: LIST OF MACROPHYTES RECORDED WITHIN THE STUDY AREA

Sl.No	Scientific name	Common Name	Local Status
1	*Polygonum barbatum*	Panimarich	Common
2	*Cyperus iria*	Jal Mutha	Common
3	*Exacum tetragonum*	Kuchri	Common
4	*Hydrilla verticillata*	Jhangi	Common
5	*Alternantha sessilis*	Haycha	Common
6	*Eclipta alba*	Kesut	Common
7	*Canna indica*	Parijat	Common
8	*Arundo donax*	Gaha nal	Common
9	*Phragmites karka*	Nal	Common
10	*Lemna perpusilla*	Khudi Pana	Common
11	*Ipomea aquatica*	Kalmi	Common
12	*Ceratophyllum demersum*	Jhanji	Common
13	*Nymphaea lotus*	Shalook	Common
14	*Monochoria vaginles*	Kachar	Common
15	*Nelumbo nucifera*	Padma	Common
16	*Wolffia arrhiza*	Sujipana	Common
17	*Pistia stratiotes*	Toka Pana	Common
18	*Nymphaea rubra*	Lal Shalook	Common
19	*Neptunia oleracea*	Pani Lajuk	Common
20	*Vallisneria spiralis*	Baicha	Common
21	*Salvinia cucullata*	Watermoss	Common

Fish is widely available in the still (Bills / Ponds) and flowing water bodies (Rivers/Nalas) of the study area. Freshwater fish species within the study area (5 block area) have been identified. Major fish fauna of fresh water bodies include catla, rohu, mrigala, bata, punti, titpunti, maurala, chela, boal, lata, shole, kholse, pancal, baan, tangra, etc. A total of 26 species of fishes were recorded from these aquatic ecosystems.

TABLE 3.29: LIST OF FISH SPECIES RECORDED WITHIN THE STUDY AREA

Sl.No	Scientific name	English Name	Local Status
1	*Catla catla*	Katla	Common
2	*Labeo rohita*	Rohu	Common
3	*Wallgo attu*	Boal	Common
4	*Puntius sarana*	Punti	Common
5	*Mystus vittatus*	Tengra	Common

Sl.No	Scientific name	English Name	Local Status
6	*Notoptenus notopterus*	Kangla	Rare
7	*Tor tor*	Pakhiranga	Rare
8	*Silonia silondia*	Banspati	Common
9	*Oxygaster bacails*	Chella	Common
10	*Labeo bata*	Bata	Common
11	*Cirrhinus reba*	Reba	Common
12	*Labeo calbasu*	Calbasu	Common
13	*Ctenopharyngodon idellus*	Grass carp	Common
14	*Cyprinus carpio*	Common carp	Common
15	*Puntius javanicus*	Java Puti	Common
16	*Oreochromis mossambica*	Tilapia	Common
17	*Rhinomugil corsula*	Corsula mullet	Common
18	*Hypophthalmichthys molitrix*	Silver carp	Common
19	*Clarias gariepinus*	African giant magur	Common
20	*Heteropneustes fossilis*	Singi	Common
21	*Hypophthalmichthys nobilis*	Big head	Rare
22	*Labeo gonius*	Goania	Common
23	*Cirrhinus mrigala*	Mrigal	Common
24	*Pangasins sutchi*	Pungas	Common
25	*Clarias batrachus*	Magur	Common
26	*Anabas testitudineus*	Koi	Rare

3.10 SOCIO ECONOMIC ENVIRONMENT

The present section analyzes the existing socio-economic conditions of the study area. It also identifies the potential issues prevailing in the study area and expectation of locals.

3.10.1 THE BLOCK AREA

The proposed 26 exploratory wells are planned in the five blocks comprises Adamtila PML and N. Patharia PML of Karimganj district and Cachar dist.PML, Banaskandi PML and Sector VC PML of Cachar district of Assam State. These five blocks include 231 rural villages and eight (08) census town from fourteen (14) community development blocks (CD block) of Cachar district and 96 rural villages from four (04) community development blocks (CD block) of Karimganj district.

3.10.2 DEMOGRAPHIC PROFILE OF BLOCK AREA

The village-wise demographic profile viz. number of households, population, male-female breakup, scheduled caste, scheduled tribes and literates within five blockis given in Annexure 1 and the demographic profile at a glance is depicted below in Table 3.30.

TABLE 3.30: DEMOGRAPHIC PROFILE OF BLOCK AREA AT A GLANCE

Demographic Parameters	Population		
	Study Area Block	Cachar District	Karimganj District
Number of CD Blocks	18	14	04
Number of Villages	335	231	96
Number of Census Town (CT)	08	08	-
Total Households	126280	102143	24137
Total Population	594376	473627	120749
Male Population	303882	242471	61411
Female Population	290494	231156	59338
Scheduled Caste	79394	66060	13334
Scheduled Tribes	3748	3580	168
Total Literates	395446	323858	71588
Population (0-6yrs)	93044	71673	21371
Sex Ratio (No. of females per 1000 males)	956	953	966
Scheduled Caste (%)	13.3	13.9	11.0
Scheduled Tribes (%)	0.6	0.7	0.1
Total Literacy (%)	79.0	80.6	72.0

Source: Primary Census Abstract CD (2011) of Assam State; Cachar and Karimganj District

The salient observations are summarized below:

- The Study area block includes total 18 CD Block comprising fourteen (14) i.e. Katigorah, Salchapra, Borkhola, Kalain, Silchar, Udarbond, Sonai, Barjalenga, Narsingpur, Palonghat, Baskandi, Binnakandi, Rajabazar and Lakhimpur of Cachar district and four (04) i.e. North Karimganj, South Karimganj, Patharkandi and Lowairpoa of Karimganj district.
- Total population within five block is 594376; out of which about 473627 people (from 102143 households) exist within fourteen CD block of Cachar district while 120749 people (from 24137 households) resides within four CD block of Karimganj district.
- The scheduled caste population in the study area block is 13.3%. The scheduled tribe population was found to be insignificant i.e. 0.6%
- Sex ratio in the study area is 956 females per 1000 male which is below sex ration of Cachar and Karimganj district i.e.958 and 961 respectively.
- The literacy rate in study area block is 79% which is similar with average literacy rate of Cachar district i.e. 80.4% and Karimganj district i.e., 79.3%.

3.10.3 ECONOMIC RESOURCE BASE

3.10.3.1 AGRICULTURE AND HORTICULTURE OF CACHAR DISTRICT

The farming system of Cachar district is mainly agriculture and agri-based allied activities. Rice is the main cereal crop of the district. Rice is grown as a double crop, rice in sequence

with vegetables/mustard/oilseeds. Rape and mustard is the important oilseed crop, though sesamum and linseed are also grown to a limited extent. Rajmah, black gram and pea are the main pulse crops. Different vegetables are grown particularly on riverine tracts. Homestead garden is common farming system of the district.

Pineapple, arecanut, coconut, banana, jackfruit and citrus are the important horticultural crops. Pineapple is specialty of zone for its sweetness and is grown on a commercial scale in tillah land of certain regions of Cachar district. The major areas of pineapple cultivation in Cachar district are Lakhipur, Rajabazar and Udharbond block.

In case of livestock, local cow and buffalo are the main enterprises. Fishery is found in some places as commercial enterprise.

The silk and weaving industry of Assam is one of the traditional handicraft activities which has generated employment and provided livelihood opportunities to people in the district.

3.10.3.2 AGRICULTURE AND HORTICULTURE OF KARIMGANJ DISTRICT

Economy of Karimganj district is agrarian in character with majority of workforce engaged in agriculture and its allied activities like Farming, Livestock, Fishery, and Forestry etc. Rice is the main farm product of the district. Other field crops cultivated in the district include pigeon pea, mustard, black gram, sugarcane and potato etc.

Horticultural crops (Fruits) viz. Pineapple, Assam lemon, Litchi, Guava, Banana, Papaya, Jackfruit, Citrus and Plantation crops (Coconut and Areca nut) are also grown in the district.
Livestock and Poultry occupy an important place in the rural economy and also act as household assets. Cattle, buffalo, goat, sheep etc are the most common livestock animals.
Fishery: Karimganj District has huge potential for fishery, being endowed with a large number of rivers, swamps, ponds and other natural water bodies. There are 49 registered beels covering a total area of 4,420 Hectares and about 23,535 smaller ponds and lakes covering another 3,545 Hectares. Besides, there are 7 river based fisheries in operation.
Forestry: Timber, Bamboo, Cane, Stone, Sand are the major forest products of the district. The forests are rich in various costly timbers like teak, sundi, gamari etc.

3.10.4 WORKFORCE DISTRIBUTION WITHIN BLOCK AREA

The workers participation of the block area block shows that the majority (64.6%) of main workers are engaged as others workers (which include all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport banking, mining, construction, political or social work, priests, entertainment artists, etc.) followed by cultivators (24.2%), agriculture labourers (8.8%) and

household labourers (2.4%). The marginal workers include majority (55.5%) other workers followed by agriculture labourers (22.5%), cultivators (12.4%) and household labours (9.6%).The percentage of non-workers is higher i.e. 63.5%. Village wise employment pattern in block area is given in Annexure 2.

The workers participation of the block area at a glance is given below in Table 3.31.

TABLE 3.31: WORKERS PARTICIPATION IN THE STUDY AREA

Particulars	Study Area	Cachar District	Karimganj District
Total Population	594376	473627	120749
Main Workers (%)	151920 (25.5)	122043 (25.8)	29877 (24.7)
Marginal workers (%)	47954 (8.1)	35793 (7.5)	12161(10.1)
Non Workers (%)	394502 (66.4)	315791 (66.7)	78711 (65.2)

Source: *District Census Handbook; Cachar and Karimganj District (2011)*

3.10.5 CULTURAL AND AESTHETIC ATTRIBUTES

A. Cachar District

Silchar, located on the banks of River Barak attracts tourists in great numbers to its natural beauty, rich and diversified culture and better infrastructure. The places of tourist importance are given below:

- **Khaspur**: 20 km from silchar town stands the ruin of a great Dimasa kingdom, capital of historical time. It was the capital of the Dimasa Kachari Kings and its construction was completed in 1690 AD. The main attractions are the Lion Gate, the Sun Gate and age-old kings temple. The original palace is non-existent, but its subsidiaries, the main entrance gate, the Suryadwar, Debalaya are intact. The entrances are of elephant-patterns.
- **Kachari Fort** is situated at Khaspur, which was the capital of Kachari Empire. The fort is a famous historic monument that stands proof of the rich cultural heritage of the bygone era. The ruins reflect the influence of non-Aryan culture.

- **Kancha Kanti Kali Temple** is situated 15 km from Silchar on the way to the Kumbhirgram ariport which is a union of goddess Durga and goddess Kali. The original temple was built in 1806 AD by the Kachari king. Human sacrifices were offered to the Goddess till 1818 AD. The old temple is ruined now and has been replaced by new temple which was built in 1978.
- **Palace of Kachari Kings** is situated at a distance of about 10km from Silchar. The Kachari Dynasty was a mighty and powerful dynasty, belonging to the Bodo-Kachari ethnic group.

B. Karimganj District

- Badarpurghat is a historical fort, which is located 25 km from Karimganj and nearest from N Patharia Block. The fort lies on the banks of Barak River and it was constructed by the British.

C. Festival Celebrated in Block Area

- **Bihu**: The Bihus are the national festivals which have been celebrated in all districts of Assam from ancient times. It is the Assamese New Year celebrated in the month of April every year. Bihu is a series of three prominent festivals. In the months of Bohaag (Baisakh, the middle of April), Maagh (the middle of January), and Kaati (Kartik, the middle of October). Each Bihu coincides with a distinctive phase in the farming calendar. The Bohaag Bihu marks the New Year at the advent of seeding time, the Kaati Bihu marks the completion of sowing and transplanting of paddies, and the Maagh Bihu marks the end of the harvesting period.
- Durga Puja is another festival celebrated with great enthusiasm. Muslims celebrate two Eids (Eid ul-Fitr and Eid al-Adha) with much eagerness
- **Karam Puja** is the most important festivals of tea tribes communities of Assam with a view to propagate “Mother of Earth” – the goddesses of creation. It is celebrated in the night of “Bhado Ekadasi” which is generally in the mid of August. It is basically an agriculture related festival. It is believe that by the blessing of god “Karam” they will get bumper crops and their family will be saved from evil.

3.10.6 THE STUDY AREA SPECIFIC DETAILS

The study areas have been designated based on the radial distance of 1 km from the centre of each (26 no.) proposed well within PML blocks for studying socio-economic profile. The study area villages fall under nine (09) CD blocks of Cachar district and four (04) CD blocks of Karimganj district. The summary of villages within study area at a glance and details of study area villages is given below in Table 3.32 and Table 3.33.

TABLE 3.32: SUMMARY OF STUDY AREA VILLAGES AT A GLANCE

District	Sub-division	CD Block	Village
Cachar	Silchar	Katogorah	04
		Borkhola	03
		Kalain	09
		Udarbond	02
		Sonai	02
		Narsingpur	05
		Palonghat	01

		Rajabazar	04
	Lakhipur	Lakhipur	01
Total A			**31**
Karimganj	Karimganj	North Karimganj	08
		South Karimganj	10
		Patharkandi	03
		Lowairpoa	05
Total (B)			**26**
Total (A+B)			**57**

The above Table 3.31 reveals that a total of 57 (fifty seven) villages includes 31 from eight (08) CD blocks of Cachar district and 26 villages from four (04) CD blocks of Karimganj district. There are no villages lie within 1km distance from the centre of proposed two well locations i.e. 15 NL and 17 NL.

TABLE 3.33: DETAILS OF WELL LOCATION AND STUDY AREA SPECIFIC VILLAGES

Sl. No.	Name of Well Location	Villages located within 1km radius from centre of proposed well location	CD Block	District
1	TIAA	Pachim Salgoi	Lowairpoa	Karimganj
2	NL	Hatikhira T.E.	Lowairpoa	Karimganj
3	NL	Baithakhal Basti	Lowairpoa	Karimganj
		Ankapai Punjee	Lowairpoa	Karimganj
4	NL	North Maguna F.V.	Lowairpoa	Karimganj
5	BK3	Dhanipur	Narsingpur	Cachar
		Dhanehari Pt III	Sonai	Cachar
6	BKAC	Dhanehari Pt I	Sonai	Cachar
7	NL	Niz Katigorah Pt II	Katigorah	Cachar
		Siddeswar Pt I	Katogorah	Cachar
8	TNAA	Tupidahar Pt II	Katogorah	Cachar
9	HRAB	Siddeswar Pt II	Palonghat	Cachar
		Sidhipur	Katigorah	Cachar
10	NL	Talkar Beel	Kalain	Cachar
		Rajyeswarpur Pt II	Kalain	Cachar
		Rajyeswarpur Pt I	Kalain	Cachar
11	NTAB	Karaballe Grant	Kalain	Cachar
		Biswambarpur	Kalain	Cachar
		Gumra Grant	Kalain	Cachar
		Tarapur	Kalain	Cachar
		Digor Mahadevpur	Kalain	Cachar
		Kushierkul (Kushiyarkul)	Kalain	Cachar
12	NL	Debipur	Narsingpur	Cachar
		Gajalghat	Narsingpur	Cachar
13	RPAA	Chalitartol	Lakhipur	Cachar
14	BKAD	Kajidahar Pt III	Narsingpur	Cachar
15	NL	N.A.	-	-
16	NL	Barjalenga Pt IV	Narsingpur	Cachar

17	NL	N.A.	-	-
18	PTAC	Kulcherra Pt I	South Karimganj	Karimganj
		Kulcherra Pt II	South Karimganj	Karimganj
		Ranibari	South Karimganj	Karimganj
		Krishnanagar Pt II	South Karimganj	Karimganj
19	NL	Bargool	North Karimganj	Karimganj
		Chandpur	Patharkandi	Karimganj
		Panchas	South Karimganj	Karimganj
20	NL	Nayagram Pt II	North Karimganj	Karimganj
		Madanpur T.E.	North Karimganj	Karimganj
		Hizimangura Pt I	North Karimganj	Karimganj
		Chandkhani	North Karimganj	Karimganj
		Nandibari	North Karimganj	Karimganj
		Chandkhani Chak	North Karimganj	Karimganj
21	PTAB	Promodnagar T.E.	North Karimganj	Karimganj
		Ghugrakona Pt I	South Karimganj	Karimganj
		Ghugrakona Pt II	South Karimganj	Karimganj
		Ghugrakona Pt IV	South Karimganj	Karimganj
		Maizbagargool Pt III	South Karimganj	Karimganj
		Gangpar	Patharkandi	Karimganj
		Saidpur	South Karimganj	Karimganj
		Baraituk	Patharkandi	Karimganj
22	NL	Larsingpar Grant	Udarbond	Cachar
		Jhapirbond Pt II	Udarbond	Cachar
23	NL	Dikcha Grant	Rajabazar	Cachar
		Budhan Nagar	Rajabazar	Cachar
24	PMAC	Narainpur Grant Pt II	Rajabazar	Cachar
25	MPM	Masimpur Pt II	Borkhola	Cachar
		Ardvallik	Borkhola	Cachar
		Dudhpatil Pt II	Borkhola	Cachar
26	TKAD	Kanakpur Pt II	Rajabazar	Cachar

Source: District Census Handbook; Cachar and Karimganj District (2011).

3.10.7 METHODOLOGY

The methodology adopted in the assessment of socio-economic condition in the study area specific is as given below:

- The primary data on socioeconomic profile was collected through site observation, interviews with the key-informants and group discussions in the selected villages. Presidents of Gaon Panchayat, respondent (male-female) and school principal/teacher were chosen for the collection of socio-economic baseline information during the site visit by SGS team. The secondary data includes demographic profile, and employment pattern have been sourced from Primary Census Abstract-2011 compact disk (CD) of Assam obtained from Office of Registrar General India, New Delhi and Infrastructure resource base has been extracted from District Census Handbook; Census of India,2011 (http://www.censusindia.gov.in/2011census/dchb/DCHB.html)

- The socio-economic survey pertaining to the subjective analysis of the socio-economic indicators was carried in nine Gaon Panchayats viz. Sonabarighat, Saidpur, Larsing, Siddeshwar, Bodarpur-Masimpur, Dalu, Panibhora, Dholai and North Karimganj for understanding the perception of the inhabitants regarding the proposed drilling activities. Details of primary survey are depicted below.

3.10.8 BASELINE SOCIO-ECONOMIC STATUS OF STUDY AREA

3.10.8.1 DEMOGRAPHIC PROFILE

The village-wise demographic profile viz. number of households, population, male-female breakup, scheduled caste, scheduled tribes and literates is given in Annexure 3. The demographic pattern of the study area (within 1km from centre of each proposed well) at a glance is depicted below in Table 3.34.

TABLE 3.34: DEMOGRAPHIC PROFILE OF THE STUDY AREA AT A GLANCE

Demographic Parameters	Study Area	Cachar District	Karimganj District
Number of CD Blocks	13	09	04
Number of Villages	57	31	26
Total Households	14120	9322	4798
Total Population	66761	42966	23975
Male Population	34328	22200	12128
Female Population	32433	20766	11667
Scheduled Caste	14227	9292	4435
Scheduled Tribes	303	300	03
Total Literates	43491	29289	14202
Male Literates	24047	16107	7940
Female Literates	19444	13182	6262
Population (0-6yrs)	10705	6509	4196
Male Population (0-6yrs)	5482	3373	2109
Female Population(0-6yrs)	5223	3136	2087
Sex Ratio (No. of females per 1000 males)	945	935	962
Scheduled Caste (%)	21.3	21.6	18.5
Scheduled Tribes (%)	0.4	0.7	0.0
Total Literacy (%)	77.6	80.3	71.8
Male Literacy (%)	83.4	85.5	79.2
Female Literacy (%)	71.4	74.8	65.4

Source: *District Census Handbook; Cachar and Karimganj District (2011)*

The salient observations are summarized below

- Total population in the study area is 66761 comprise 42966 people (from 9322 households) of Cachar district and 23795 people (from 4798 households) of Karimganj district
- The scheduled caste population exist in the study area is 21.3% .The scheduled tribe population was found to be insignificant in Cachar and Karimganj district.

- Sex ratio in the study area is 945 females per 1000 male, which is below sex ratio of Cachar and Karimganj district (Rural) as well as Assam state (Rural) i.e. 955, 961 and 960 females per thousand males and nearly similar with national average (940) as per the latest reports of Census Directorate 2011.
- The literacy rate in the study area is 77.6% which is similar with average literacy rate of Cachar and Karimganj district (rural) i.e. 77.1% and 76.1% and higher in comparison with Assam state (rural) i.e., 69.3%.

3.10.8.2 INFRASTRUCTURE RESOURCE BASE

The availability of community facility as education, health, potable water, electricity, communication and transport facilities are important indicators of the well being and Quality of Life (QoL) of villagers. The data for the infrastructure facilities has been extracted from village directory of Cachar and Karimganj district from Census of India (2011) and village wise facilities available in the study area are given in Annexure 4.

The extracted details are as follows:

- The fifty four villages in the study area have primary school (1st to 5th standard). However, three villages are availing this facility within a distance of 5kms. Middle school facility exists in twenty six villages and remaining twenty seven and five villages are availing this facility within a distance of 5kms and 5-10kms, respectively.
- Govt. senior secondary school is available in four villages viz. Kajidahar Pt III, Tarapur, Kushierkul (Kushiyarkul) and Gumra Grant. Out of remaining (53 villages), eighteen are availing this facility within 5kms, twenty five (5-10kms) and ten villages (above 10km) distance.
- Degree education (Arts, Science and Commerce) is not available in none of the villages. Only three villages of have an access to this facility within a distance of 5kms whereas twenty eight and twenty six villages are availing this facility within a distance of 5-10km and more than 10kms distance. People in the study area visit Badarpur, Katigorah, silchar and Lakhipur and Karimganj town to avail higher educatin viz. polytechnic, engineering and medical degree.
- Primary Health Centre (PHC) exists in two villages of Cachar district i.e. Tarapur and Kanakur Pt III and one village of Karimganj district i.e. Hatikhirs T.E. whereas Primary Health Sub-centres (PHS) exist in only Chandur village of Karimganj district. Out of remaining (56) villages, nineteen, twenty eight and eleven are availing this facility within 5kms, 5-10kms and more than 10kms distance from their village. None of the village has medical facility of Allopathy. Hospital with surgical facilities is available in Silchar and Karimganj town.

- Medicine shop is available in thirty nine villages. However, rest eighteen villages are availing this facility with 5-10kms distance.
- Supply of Tap water is exists in twenty eight villages. No source of drinking water is available in three villages viz. North Maguna F.V., Budhan Nagar and Dudhpatil Pt II. However, remaining twenty six villages have other sources like hand pumps, open wells and tube wells.
- Power supply facility is available in fifty two villages for domestic use. However, only two villages have facility of water for irrigation purposes.
- The state transport bus service is available in thirty five villages and remaining twenty two villages are availing this facility within 5-10 kms distance.
- Railway station facility available in three villages viz. Niz Katigorah Pt II, Siddeswar Pt I and Gumra Grant. Residents of twenty six and twenty eight villages have to travel (above 10kms) and (5-10kms) distance to avail this facility.
- Postal office is available in two villages i.e Sidhipur and Debipur. Out of remaining (55 villages), sixteen are availing this facility within 5kms, twenty villages (5-10kms) and twenty one villages (above 10km) distance.
- Only thirteen villages are connected with pucca road network.
- Rice, wheat, sugar and kerosene are being distributed to those families who are having valid ration cards under public distribution system (PDS) run by the government which is available in thirty two villages.
- Weekly Haat (market) exists in thirty one villages however twenty six villages visit market within 5-10 kms distance.
- Sports club/recreation centre is available in nine villages. However forty eight villages are availing this facility within within 5-10kms distance.

3.10.8.3 ECONOMIC RESOURCE BASE

3.10.8.3.1 WORKFORCE DISTRIBUTION IN THE STUDY AREA

The workers participation of the study area shows that the majority (62.5%) of main workers are engaged as others workers (which include all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport banking, mining, construction, political or social work, priests, entertainment artists, etc.) followed by cultivators (25.3%), agriculture labourers (10.7%) and household labourers (1.5%). Similarly, majority (61.7%) of marginal workers are also engaged as other workers followed by agriculture labourers (23%), cultivatots (10.1%) and household labours (5.2%). The percentage of non-workers in the study area is higher i.e. 64.2%. Village wise employment pattern in the study area is given in Annexure 5.

The workers participation of the study area of 1km radius from centre of each proposed well location at a glance is given below in Table 3.35.

TABLE 3.35: WORKERS PARTICIPATION IN THE STUDY AREA

Particulars	Study Area	Cachar District	Karimganj District
Total Population	66761	42966	23795
Main Workers (%)	18345 (27.5)	12011 (27.9)	6334 (26.7)
Marginal workers (%)	5551(8.3)	3305 (7.7)	2246 (9.4)
Non Workers (%)	42865 (64.2)	27650(64.4)	15215 (63.9)

Source: *District Census Handbook; Cachar and Karimganj District (2011)*

3.10.8.3.2 LIVELIHOOD IN THE SURVEYED VILLAGES

During survey, focus group discussion was conducted in eight Grampanchayats with GP presidents and local people. During discussion, it was revealed that majority of households are involved in agriculture and its allied activities as a source of livelihood. These households are mooundinstly depending upon rain water to carry out agriculture activities. The main crop is rice. Green vegetables and fruits are also grown in Homestead gardens. These gardens are characterized by high density haphazard planting without maintaining proper spacing. The villagers sell these products in weekly haat and main market of Silchar, Badarpur, Lakhipur and Karimganj town. Apart from this, people are also engaged as government servants, teachers, plantation workers, small business, construction labors etc. A small proportion of households are engaged as permanent and casual tea garden working labours in the surrounding tea gardens. Households of scheduled caste and scheduled tribes population in the villages of Cachar district are mainly dependent on forest based livelihood.

3.10.8.4 CULTURAL AND AESTHETIC ATTRIBUTES

Study area include 1km radial distance from centre of each proposed well location does not involve any major place with religious, archaeological and historical importance

Festival Celebrated in the Study Area

- **Bihu**: The Bihus are the national festivals which have been celebrated in the study area from ancient times. It is the Assamese New Year celebrated in the month of April every year.
- **Durga Puja and Deul Mahotshav (Holi)** is widely celebrated in the study area. Muslims celebrate two Eids (Eid ul-Fitr and Eid al-Adha) with much eagerness.
- **Karam Puja** is the most important festivals of tea tribe's communities with a view to propagating "Mother of Earth" – the goddesses of creation.

3.10.8.5 MEDICAL & PUBLIC HEALTH FACILITIES

During consultation, it was revealed that the existing health infrastructure and services in the study area comprises of Primary Health Centre (PHC) and Health Clinics run by Private Practitioners. PHC exists in two villages of Cachar district i.e. Tarapur and Kanakur Pt III and one village of Karimganj district i.e. Hatikhirs T.E. All PHCs is staffed with a medical officer supported by a pharmacist, a senior clerk and an aya (midwife) and caters to a population of only nearby villages. However, Maternity and Child Welfare (MCW) Centre, Allopathic Hospital and Dispensary are not available in any of the village. Hospital with surgical facilities is available in Silchar and Karimganj town. It was also informed that doctors and staff of PHCs organizes general health check-up and awareness programme on maternal and child care, eye care and immunization camps in the surrounding villages.

- **Existing Health Conditions and Concerns**

During discussion, except routine cough, cold and fever, diarrhoea was reported common amongst villagers in the study area which is due to open excreta and flies all around. Presidents of Gaon panchayat stated that due to lack of health infrastructure ,equipments as well as poor coverage of the existing health services, the people have to travel long distance which is time consuming and expensive also. The analysis of secondary data based on census 2011 also revealed that people from 95% villages in the study area are availing health facility within 5kms, 5-10kms and more than 10kms distance from their village.

During interaction with (Mr. Partha Sarathi Chanda), president of Panibhora Gaon Panchayat and (Ms. Zarina Akhtar Lashkar), president of Sonabarighat Gaon Panchayat and other members opined that increase in number of tuberculosis patients in the area may be possibly due to excess of tobacco chewing and smoking.

There is a good awareness about pulse polio and vaccination among people in the area. The private hospitals in Silchar, Katigora, Udarbond and Karimganj town are equipped with better facilities than the PHCs in the study area. These private clinics mostly cater to the affluent class residents i.e., mostly belonging to middle income group in the area and hence people are expecting health infrastructure with adequate staff shall be provided by project authorities under welfare scheme/CSR plan on priority basis.

3.10.9 OUTCOME OF SOCIO-ECONOMIC SURVEY

The salient observations arising out of survey are:

- The average family size in the study area is 5 per family. However, joint families are ranging from 5-10 members per household.

- A household belongs to both Hindu and Muslim religion with caste-hierarchy OBC, General, Schedule caste and Scheduled tribes etc.
- Study area have mostly single dwelling unit. The houses are made largely using wood based materials. Wooden plank flooring is adopted in stilted houses and mud plaster flooring in rural area. Roofing is made of weed, leaves with boundary wall of Ikara reed. Other common type of flooring include cement flooring have also seen in few houses belongs to middle class family in the area. Pitched/corrugated/galvanized iron sheet roofing is the most common form of roofing system used in modern buildings. Open space in front (chotal) and back side (bari) of the house is common in majority of households in the area.

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- Among surveyed villages, primary education facility (1st to 5th standard) is available. Students travel 5-10kms distance to avail middle, secondary and senior secondary education. For higher education like degree, diploma, polytechnic and engineering, students travel Silchar, Lakhipur and Karimganj town.
- Source of potable water in the surveyed villages comprises of hand pump and open well. Tap water supply through Public Health Engineering Department (PHED) exists in few very households. People informed during survey that due to erratic power supply, people don't get sufficient water for domestic purpose.

- President of surveyed gaonpanchayays stated that, only 25% households in the villages falling under respective GPs have individual toilet facility in the form of soak pit. Toilets are constructed away from the main house near the periphery of the plot. Unhygienic kachha toilet and open defecation is common in the study area which leads to diarrhoea and other related ailments.
- Power supply facility is available for domestic use in all the villages but few households in each surveyed village does not have electric connection which may be due to very low economic status. Wood remains the primary source of fuel for lower income groups whereas very few economically better off families have shifted to LPG for cooking purposes.
- During survey, it was informed by local people that Primary Health Center (PHC) is available in Tarapur and Kanakur Pt III. But people are not satisfied with existing inadequate health facilities and long distance travel to avail the same. Further, in case of emergency, people have to travel Govt hospital at Silchar, Lakhipur and Karimganj town which is time consuming (due to poor condition of internal road network) and expensive also. Inhabitants also added that only people from lower income group visit PHC whereas people who can afford consult private practitioners nearby town. Therefore, people are expecting a Health clinic with adequate staff and all infrastructure facilities to be provided by proponent in nearby area under welfare activity.
- The predominant crop cultivated in the area is paddy. Black gram and pea are the main pulse crops. Horticultural crops (Fruits) viz. Guava, Banana, Papaya, Jackfruit is also grown in the study area. Few households grow green vegetables potato, brinjal, pumpkin and cauliflower which are sold in weekly haat in the surrounding villages or in main market of nearby town.

- Homestead garden is common farming system in the study area. In few households it was found that presence of small pond is common meant for drinking, washing and fishing etc.




- Tea plantation occupies an important place in the study area. As a source of livelihood, small population from each surveyed village is engaged as seasonal and permanent workers in the surrounding tea gardens. Majority of the workers are leaf pluckers in the tea garden and they are mostly female.

- The traditional handicraft activity (weaving) is also one of the earning sources of few households in the study area.
- Bamboo has played an important part in the lives of the people of Assam It grows in natural forests, and is cultivated in homesteads and on private plantations. It is utilized in many ways, for housing, fencing, functional articles, agricultural implements, basketry and even as a fuel.

- The approach road and internal road network in all surveyed villages are katchha and in bad condition. State transport bus service up to the village is not available. Besides, people use two wheeler and auto rickshaw for their routine household chores. The nearest railway station is Silchar.

- Rice, wheat, sugar and kerosene are being distributed to those families who are having valid ration cards under public distribution system (PDS) run by the government.
- The communication facility is unsatisfactory in terms of post office but majority of villages are privilege with coverage of mobile phones.
- Recreational facilities like television and radio are available in households having good economic status.

3.10.10 AWARENESS AND OPINION OF PEOPLE ABOUT THE PROJECT

An attempt has been made to know the awareness and opinion of the people about proposed project activities. Project awareness amongst the public is low in the surveyed villages. The respondents expect employment and improvement in basic infrastructure of the surrounding villages. They informed SGS team about their expectation of improvement in road condition and health facilities and drinking water supply which is of prime concern to them.

In general, the people in the study area are happy with their existing social environment and lifestyle. Some of the concerning issues as identified by SGS team during the socio-economic survey refer to:

- People expect that all social welfare activities should be planned considering the basic problems of the villages and the villagers should be consulted while deciding the welfare programmes by project proponent.
- The people are in favour of the setting up of various types of industries in the area as this will surely result into improvement in quality of life provided it is equipped with adequate measures for environmental pollution control and preference should be given to local people in job opportunities on the basis of their qualification, experience and skill.

3.10.11 COMMUNITY CONSULTATION

It will be of profound importance to study the perception as well as reaction of the community people towards the proposed project activity. In-depth interview with president of selected Gram panchayat and school teacher was done to gather the existing baseline socio-economic information on a various parameters of Quality of Life.

The group discussions were held with local residents, adult (men and women). During discussion, issues related to employment generation, information flow, health and safety, social welfare activity, temporary and permanent land requirement etc. were discussed.

Head-Master (Mr. Akhil Chandra Deka) of Jhapirbond Assamese Medium School (Jhapirband village falls under Larsing Gaon Panchayat of Udarbond development block)stated that long distance and financial constraints are making it difficult for the children of poor financial conditions to avail of higher educational facilities in nearby towns. There is however a desire among the local youth for technical training to enhance their opportunities for employment in the nearby industries.

People are expecting financial help to provide school uniform and books to poor children and monitory help to complete higher education to meritorious students.

Discussion with (Mr. Dilip Singh Chatri) President of Dalu Gaon Panchayat of Borkhola development block and (Ms. Seema Rani Das) resident of Dholai Gaon Panchayat of Narsinghpur development block at village Chenijan.

Ms. Zarina Akhtar Lashkar, President of Sonabarighat Gaon Panchayat of Sonai Development Block expressed her concern over the issue of unemployment in the area. Due to lack of higher/technical education, both men and women are mostly engaged in agriculture and as tea garden labourers.

Local people are expecting that project proponent shall spread awareness about proposed project activity amongst local people and proper compensation shall be given to land owners improvement in road and health infrastructure on priority basis.

Mr. Ali Hussain Barbhuiya from village Dhaneri pt I and residents of village Dhaneri pt II and Sonabarighat pt I and II complained that land was acquired by ONGE in 2011 for drilling/exploration activity but people were not aware about acquisition of land for proposed drilling operation and proposal made to government for the same. People came to know about same when actual acquisition was taking place. It was also informed that compensation for cutting trees has been paid but land restoration cost is still pending. People also opined that damages were done to houses of few residents sonabarighat Pt I and II due to blasting done by ONGC in year 2012 but none of them received compensation for the same.

During discussion, Sulsana Khaton Bhrbhuya, President of South Saidpur Gaon Panchayat of Sonai Development Block opined that preference should be given to local people for employment opportunities in various activities during construction phase.

Further, people have to travel long distance to avail health facilities at Silchar and Lakhipur town, which is time consuming and expensive. Therefore, people are expecting a mobile medical facility with testing and diagnostic facilities to be provided by proponent in nearby area under welfare activity.

Discussion with (**Ms. Bobita Pal**) President of Siddheshwar Gaon Panchayat of Katigora Development Block and (**Ms. Samarendra Kumar Das**), Retd. Principal of Dalu Higher Secondary School from Badarpur-masimpur Gaon Panchayat were done regarding awareness about proposed project activity and existing socio-economic condition of the local people in the study area.

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

CHAPTER 4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 PREAMBLE

Generally, the environmental and social impacts can be categorized as either primary or secondary. Primary impacts are those, which are attributed directly by the project and secondary impacts are those, which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the proposed actions. The details of criteria opted for impacts assessment are as per described hereunder:

Actual and foreseeable events, including operational and typical events are discussed in this chapter. Processes that may create risk to the environment are considered and are analyzed in terms of key potential environmental impacts.

The environmental impacts may include all those that are beneficial or adverse, short or long term (acute or chronic), temporary or permanent, direct or indirect and local or regional. The adverse impacts may include all those leading to harm to living resources, damage to human health, hindrance to other activities, impairment of quality for use, reduction of amenities, damage to cultural and heritage resources, and damage to physical structures. For each identified potential environmental impact, the associated environmental risk is assessed based on its likelihood and significance. For the proposed proposal, the impacts assessment is being performed in three steps:

- *Step 1 : Identification of interactions between activities and environmental receptors*
- *Step 2 : Identification of potentially significant environmental impacts*
- *Step 3 : Evaluation of all significant environmental impacts*

In **Step 1**, based on the description of activity proposed to be undertaken and environmental baseline description, a detailed matrix of activities and environmental receptors is prepared. Then based on the legal framework and baseline environment data, it is determined whether an interaction exists between an activity and a receptor.

In **Step 2,** based on the interactions identified in Step 1, potentially significant impacts due to the proposed changes are identified. The impacts may be beneficial/adverse, direct/indirect, reversible/irreversible and short-term/long-term as per criteria given below in **Table 4.1.**

TABLE 4.1: IMPACT RATING ASSESSMENT

Impact		Criteria
Nature of impact	Beneficial	Positive
	Adverse	Negative
Duration of impact	Short term	Impacts shall be confined to a stipulated time
	Long term	Impacts shall be continued till the end of life of proposal
Impacted Area	Localized	Impacts shall be confined within study area
	Regional	Impacts shall be continued beyond study area

In **Step 3,** all the potentially significant impacts are evaluated and a qualitative evaluation is made. An impact level is rated as "low", "medium" or "high". The impact rating is based on two parameters i.e. the "severity of impact" and the "likelihood of occurrence of impact".

- ***Severity of Impact:*** The severity of an impact is a function of a range of considerations including impact magnitude, impact duration, impact extent, compliance of prescribed legal framework and the characteristics of the receptors/ resources; and
- ***Likelihood of Occurrence:*** How likely is the impact

The significance of each impact is determined by assessing the impact severity against the likelihood of the impact occurring as summarized in the impact significance assessment matrix provided below in **Table 4.2.**

TABLE 4.2: IMPACT RATING ASSESSMENT MATRIX

Impact Severity	Impact Likelihood			
	Unlikely (e.g. Not expected to occur during project lifetime)	**Low Likelihood (e.g. may occur once or twice during project lifetime)**	**Medium Likelihood (e.g. may occur every few year)**	**High Likelihood (e.g. Routine, happens several times a year)**
Slight	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
Low	Negligible Impact	Negligible Impact	Negligible to Minor Impact	Minor Impact
Medium	Negligible Impact	Minor Impact	Minor–Moderate Impact	Moderate Impact
High	Minor Impact	Moderate Impact	Major Impact	Major Impact

Notes:
Negligible Impact : Defined as magnitude of change comparable to natural variation
Minor Impact : Defined as detectable but not significant
Moderate Impact : Defined as insignificant; amenable to mitigation; should be mitigated where practicable
Major Impact : Defined as significant; amenable to mitigation; must be mitigated

ONGC's primary purpose and need for the proposed activities is firstly to establish the availability of commercial quantity of the hydrocarbons by exploratory drilling of 26 wells within 5 blocks.

The key potential environmental aspects associated with proposed exploration drilling of 26 wells include the following:

- Transportation of equipment;
- Fuel and HAZCHEM (explosives etc.) handling;
- Discharges of drilling cutting, slurries and wastewater;
- Atmospheric emissions from diesel engines and test flaring, if any (on discovery of petroleum products) ;
- Loss of crops and flora due to acquisition of land on temporary basis;
- Interface on the terrestrial environment viz. landuse, soil quality flora and fauna;
- Acoustic disturbance;
- Timing of activities (in areas of temporal significance);
- Interface to the surrounding villages communities, having bearing on socio-economic status of the human population, their health and amenities; and
- Rehabilitation of the well site areas in case commercial reserves of hydrocarbon is confirmed.

4.2 IMPACTS/RISKS DURING EXPLORATORY DRILLING OF WELLS

The drilling sites will contain all equipment, storage, workshops, etc. using distances between various rig components in line with existing rules and regulations for the area of operation and the hazardous area drawing of the drilling/ work over rig.

Drilling operation basically involves two steps; first – drilling of wells and second – testing of well. Drilling process is associated with various hazards such as well active situation (kicks), blowouts, H_2S situation (if any) etc., in addition to discharges of air emissions, waste water and solid wastes. ***ONGC*** is committed to minimise the impacts by using standard practice of operation. Impacts on various aspects are described below:

4.2.1 COMPONENTS CREATING RISKS/IMPACTING TO NATURAL ENVIRONMENT

The components of drilling operation that could result in environmental impacts include the following as shown below in **Table 4.3.**

TABLE 4.3: ENVIRONMENTAL IMPACTS FROM EXPLORATORY DRILLING OPERATION

Source	Potential impact	Component affected	Comments
Roads	Access	H/At/B/Aq/T	Vegetation cleared, possible erosion and changes in surface hydrology; emissions, vibration and (onshore) noise from earth moving equipment; disturbance to local population. Secondary impacts related to influx and settlement through new access routes. Mainly short-term, transient impacts. Potential long-term impacts from access construction.
Site preparation	Footprint	H/At/B/Aq/T	Requirement for proper site selection to minimize possible impact. Removal of vegetation and topsoil; possible erosion and changes in surface hydrology; drainage and soil contamination; land use conflict; loss of habitat; construction noise, vibration and emissions from vehicles; disturbance to local population, aesthetic visual intrusion. Short term provided adequate decommissioning and rehabilitation.
Camp and operations	Discharges, Emissions, Waste Socio-economic Cultural	H/At/B/Aq/T H	Water supply requirements; noise, vibration and emissions from plant equipment and transport; extraneous light; liquid discharges—muds and cuttings; wash water; drainage; soil contamination—mud pits, spillages, leakages; solid waste disposal; sanitary waste disposal, sewage, camp grey water; emissions and discharges from well test operations; additional noise and light from burning/flare. Nature: Short-term, transient. Land-use conflicts, disturbance and interference to local population, special considerations required for native and indigenous population; interactions between workforce and local population; immigration; potential effects on local infrastructure—employment, education, roads, services; hunting, fishing, poaching. Nature: Short-term, transient.
Decommissioning and aftercare	Footprint	H/B/Aq/T	Proper controls during construction and operations and careful decommissioning and aftercare should effectively remove risk of long term impacts. Improper controls can result in soil and water contamination; erosion and changes in surface hydrology; wildlife disturbance; loss of habitat; impacts to biodiversity; human and cultural disturbance; secondary impacts to socio-economic infrastructure, immigration, changes in land and resource use.
H- Human, socio-economic , culture; Aq-Aquatic; B- Biosphere; T- Terrestrial; At- Atmospheric			

4.2.2 RISKS/IMPACTS TO NATURAL ENVIRONMENT

4.2.2.1 LAND USE PATTERN

Approximately 2.5 Acre of land in total would be impacted for each exploration drilling of 26 wells. An approach road (with a width of 2.5 m) would need to be made from the road head to the drilling site. Total number of wells proposed to be drilled is Twenty Six (26) and drilling

of each exploratory well is proposed to a maximum up to 3000 m depth. Total estimated time required for drilling and testing of one well will be about 60 Days and 30 days respectively.

The land acquired for drilling site & road would not be available for anu use for a period of about one year, in case the exploration drilling is unsuccessful and would be restored in its original condition. Otherwise, land shall be acquired for development of well for production.

As per land use pattern details, about 30% of study area is agricultural followed by forest lands (29%), Open mixed jungle (13%), Water bodies (10%), settlements (7%).

Hence, the impact on the land use pattern of the study area is as per given below.

Impact Rating	Land Use pattern
Significance and Nature of impact	Negligible and Adverse
Duration of impact *	Short term/long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

* Long term for drilling site*in case petroleum reserves is confirmed*

4.2.2.2 ECOLOGY

Impact on the ecology will be mainly confined to drilling site and will vary with the proximity from the drilling locations. Beyond the drilling site, impacts may be during flaring to be carried out for testing. However, with the proper measures as defined in Chapter-2, the impact shall be mininmized.

However, the impacts are of temporary nature, which will last only for few months at each drill location during the exploratory drilling activities and will thus allow subsequent recovery after the activities stops. Considering the above aspects the chance of irreversible ecological impact at the exploration stage is minor. During the site preparation activities vegetation clearance would be nominal or minor. Efforts will be made to avoid areas of comparatively dense vegetation cover, unless absolutely essential.

No land having ecological sensitivity shall be considerd. The land acquired for drilling site & road would not be available for agriculture or any use for a period of about one year. The land, in case the exploration drilling is unsuccessful, would be restored in its original condition. Otherwise, land shall be acquired for development of well for production.

Hence, the impact on the ecology of the study area is as per given below.

Impact Rating	Ecology
Significance and Nature of impact	Negligible and Adverse
Duration of impact *	Short term/long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

* Long term for drilling site in *case petroleum reserves is confirmed.*

4.2.2.3 WATER RESOURCES

Typically, the water consumption for each well will be 20-25 kilolitres per day (KLD) for 75-90 days per well. The camp will normally operate with around 25 personnel in two shifts (total 50 personnel) and will consume water @ 5 KLD for domestic purpose only. However, the drilling and domestic water requirement would depend on the time required to drill the well, which is primarily dependent on the proposed depth. However, the drilling and domestic water requirement would depend on the time required to drill the well, which is primarily dependent on the proposed depth. The water requirement will be met from the local sources through water tankers. Suitable water transport arrangement will be made to transfer water for both drilling and domestic purposes. Therefore considering the water availability and abundant sources, there would be insignificant impacts on water resources due to usage in the project.

Hence, the impact on the water resources of the study area is as per given below.

Impact Rating	Water Resources
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.2.2.4 Water Quality

The study area is having small tributaries river system. Within the Cachar Dist. PML block the major river and its tributeries are Barak River, Puni Khal, Surma River, Rukni River, Mathura Khal, within Banaskandi PML block area the major rivers are Sonai River, Barak River, within Adamtila Ext PML block major rivers are Phuri Ganga, Langai river, within North Patharia PML block major river is Langai River and within Sector VC PML block the major rivers are Larsing River, Diksa river, Bali gang, Barak river, Diglang Nadi.

- Potential wastewater discharges may arise from the following sources:
  - ✓ *Spent drilling muds, cuttings and completion fluids disposal;*
  - ✓ *Treated domestic effluent (sewage and kitchen waste);*

- ✓ *Any produced water and liquid hydrocarbon fractions collected in the test separator during well testing.*
- ✓ *Potential contaminated storm water drainage from the derrick floor and other systems;*

Approximately 5 m3/day of wastewater would be generated from the drilling operation including minor quantities from washing and cleaning of rig floor and other equipments. The primary pollutants in the wastewater would thus be suspended solids, dissolved solids and traces of floating oil from washing of rig floor and other equipments. Wastewater will be collected in lined pits and clarified wastewater will be treated in mobile ETP located at the well sites and the treated effluent is collected in a treated water collection tank, from which it is re-circulated for drilling equipment washing, plantation and dust suppression purposes.

It is estimated that approximately 5 m3/day of sewage will be generated from each well site. The sewage will be disposed through soak pit/septic tank arrangement. No impacts are thus envisaged from sewage disposal from site.

Hence, the impact on the water quality of the study area is as per given below.

Impact Rating	Water Quality
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.2.2.5 SOIL QUALITY & CONTAMINATION

The chances of soil contamination shall be from the storage practices of chemicals and fuels surface runoff carrying contaminated substances. The drilling mud and the cuttings shall be inert in nature but could also add to the sub surface contamination if not handled appropriately. The extent of impact on surrounding soils from unconfined liquid chemical or fuel spills will depend upon the season and the nature of the spillage.

At the conclusion of well testing at each drilling site, solar drying will dewater the waste pits. All residual solids and liner will be covered with thick column of native soil. The cutting mud is inert and with appropriate lining of the pit in place it does not pose any scope of environmental hazard. Grading will be done to ensure natural run-off. Any remaining topsoil that has been stocked during the site clearance will be re-spread over appropriate portions of the site. Plantation of saplings will be commenced during the next rainy seasons to restore the site and conduct afforestation in and around the site.

ONGC has incorporated all these aspects in the well sites design and also has an elaborate waste management plan to ensure safe disposal practices and minimum chances of soil or sub surface contamination.

Hence, the impact on the soil quality of the study area is as per given below.

Impact Rating	Soil Quality & Contamination
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.2.2.6 AIR ENVIRONMENT

The potential sources of air emissions during the drilling operation would be as follows:

- DG sets;
- Test flaring; and
- Vehicles movement.

There will be four (04) DG sets of capacity 1430 KVA each and one (01) DG set of capacity 250 KVA installed at the rig while one (01) DG Set of 100 KVA at campsite. At a time, during drilling, maximum three (03) 1430 KVA DG sets shall be in operation except during test flaring and one DG set shall be kept as stand by. During test flaring, only DG set of 250 KVA shall be in operation to meet the power requirement. Emissions from DG Set will be continuous throughout the drilling operations.

The test flaring will be done for short period for six hour/day and for 1 to 4 days (maximum) in case it is required. The quantities involved in test flaring may be highly variable due to geological un-certainties and reservoir potential. However, the maximum quantity expected in such wells are 2500 m^3/hour (15000 m^3/day) (max.) of gas. Temporary flaring will be carried out at ground with elevated stack of 5 m high.

The test flaring will result in temporary emissions of CO_2, water vapours, NO_x and other trace gases. It is assumed that the occurrence of SO_2 in the flare gas would be in traces or negligible as gas shall not have H_2S. The pollutants of concerns from DG Sets are NO_x, SO_2, CO, CO_2, particulate, and un-burnt hydrocarbons. However pollutants such as PM, SO2 and NOx have been considered for dispersion modeling.

Movement of traffic shall be very minimum as same shall be used only for mobilization of manpower and consumable materials on continuous basis.

- Prediction of the Ground level concentration (GLC) of emissions are made using software of Industrial Sources Complex Short Term model version 3 (ISCST3) approved by Environment Protection Agency (EPA) USA. ISCST3 which is a Gaussian Plume based model and is executed using stability classes developed by Pasquill and Gifford. Following are the assumptions made while using the model:
    - No dry and wet depletion of pollutants; and
    - Receptors are on flat terrain with no flagpole.

GLCs are calculated by using meteorological data collected from the meteorological station at site during the monitoring period i.e. from 26th January 2015 to 26th April 2015.

The emission characteristics and other details from DG Set and flaring assumed for the modeling are summarized below in **Table 4.4**.

TABLE 4.4: SOURCE AND EMISSION CHARACTERISTICS FOR DISPERSION MODELING

Sr. No.	Particulars	Unit	Flare stack*	DG set (1430 KVA)	DG set (250 KVA)	DG set (100 KVA)
1	Number of Stack	-	1	4	1	1
2	Fuel feed rate	m^3/hr	2500 (natural gas)	0.2700 (HSD)	0.075 (HSD)	0.023 (HSD)
3	Stack Diameter	m	0.21	0.42	0.28	0.12
4	Stack Height	m	5	16	6	4.7
5	Stack Exit Temperature	°K	1273	815	524	510
6	Stack Exit Velocity	m/s	20	25	23	21
7	Actual Flow Rate	m^3/s	0.69	3.5	1.32	0.26
8	Normal Flow Rate**	Nm^3/s	0.15	1.5	0.42	0.1
9	Emission					
	PM	g/s	-	0.04	0.01	0.005
	SO_2	g/s	-	0.53	0.05	0.01
	NOx	g/s	1.06	1.07	0.34	0.16

**Emission for flare is calculated using Emission Factors as described in US EPA AP42, fifth edition, January 1995.*

Ground Level Concentrations (GLCs) for pollutants as mentioned above have been calculated for following:

- An area of 5 km x 5 km with 200m x 200m grids;
- Scenarios as per given hereunder:

a) Scenario 1 – Continuous operation of 3 numbers 1430 KVA DG sets during drilling operation.
b) Scenario 2 –Test Flaring and operation of 250 KVA DG set, and
c) Scenario 3 – Continuous operation of 100 KVA DG Set.

❑ **Findings**

- Isopleths for 24 hourly average increases in GLCs are depicted in ***Figure 4.1*** to ***4.9*** for all three scenarios.
- ***Figure 4.1*** describes the GLC increase isopleths of PM for Scenario 1, which are drawn at an interval of 0.02 µg/m^3.

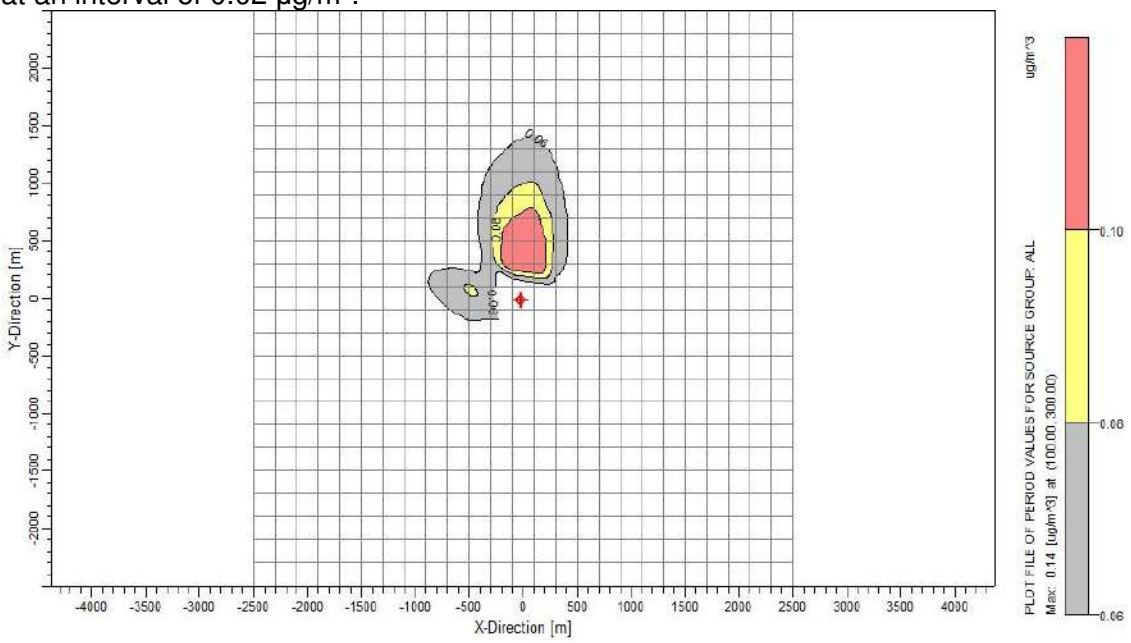


FIGURE 4.1: MAXIMUM GLC INCREASE OF PM FOR SCENARIO 1 (DG SET 3X1430 KVA)

- GLC increase contours at an interval of 0.3 µg/m^3 of SO_2 for Scenario 1 are depicted in ***Figure 4.2*** below.

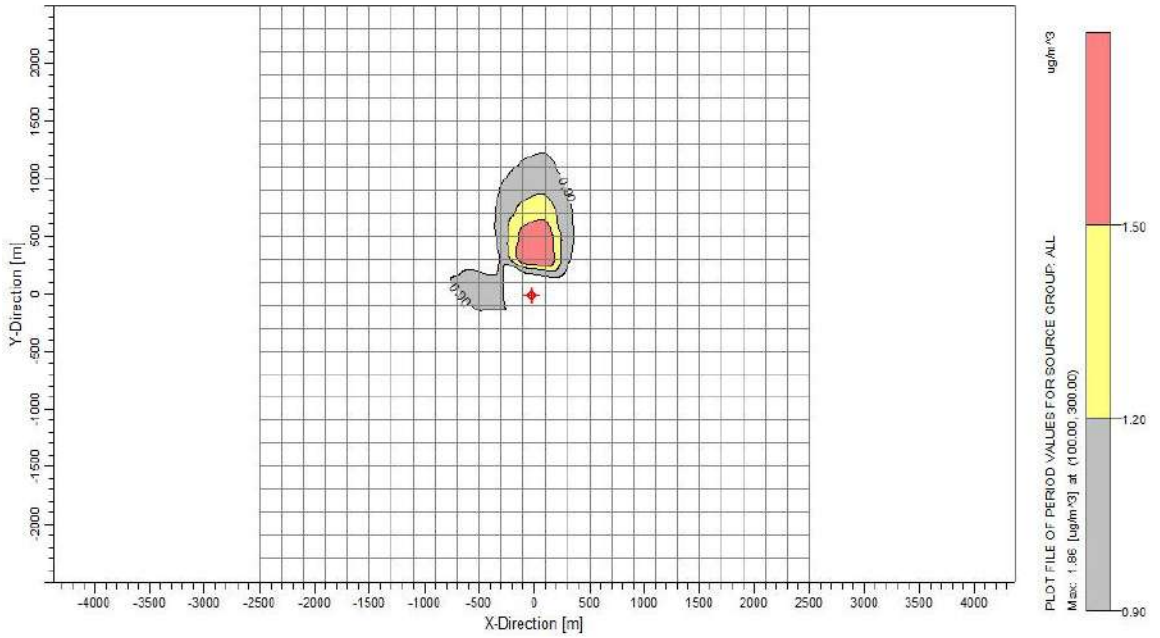


FIGURE 4.2: MAXIMUM GLC INCREASE OF SO_2 FOR SCENARIO 1 (DG SET 3X1430 KVA)

- In ***Figure 4.3*** GLC increase isopleths at an interval of 0.5 µg/m^3 of NO_x for Scenario 1 are given.

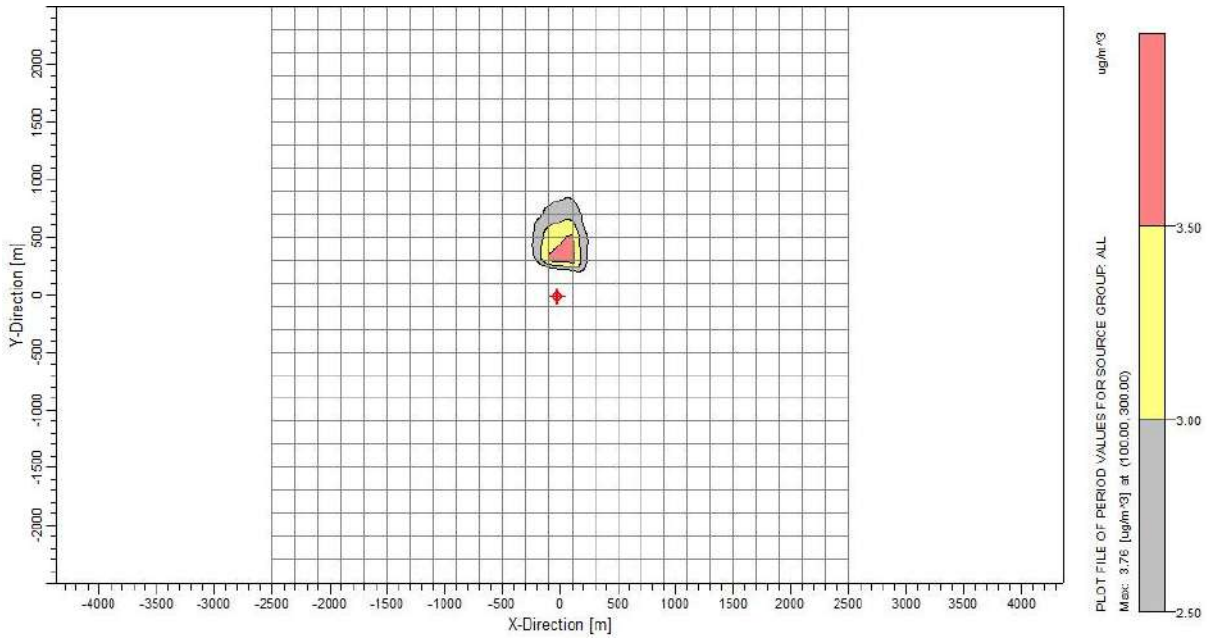


FIGURE 4.3: MAXIMUM GLC INCREASE OF NO_x FOR SCENARIO 1 (DG SET 3X1430 KVA)

- GLC increase contours at an interval of 0.02 µg/m^3 of PM for Scenario 2 are depicted in ***Figure 4.4***.

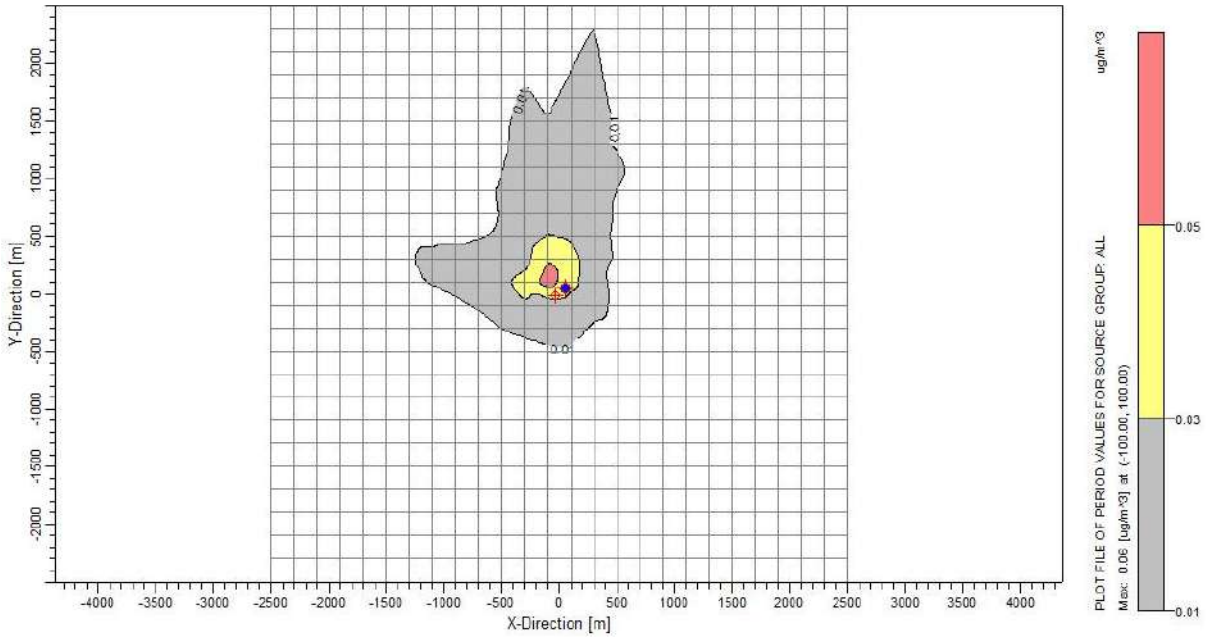


FIGURE 4.4: GLC INCREASE OF PM FOR SCENARIO 2 (DG SET 1X250 KVA + FLARING)

- ***Figure 4.5*** explains the GLC increase isopleths of SO_2 for Scenario 2, drawn at 0.1 µg/m^3 interval.

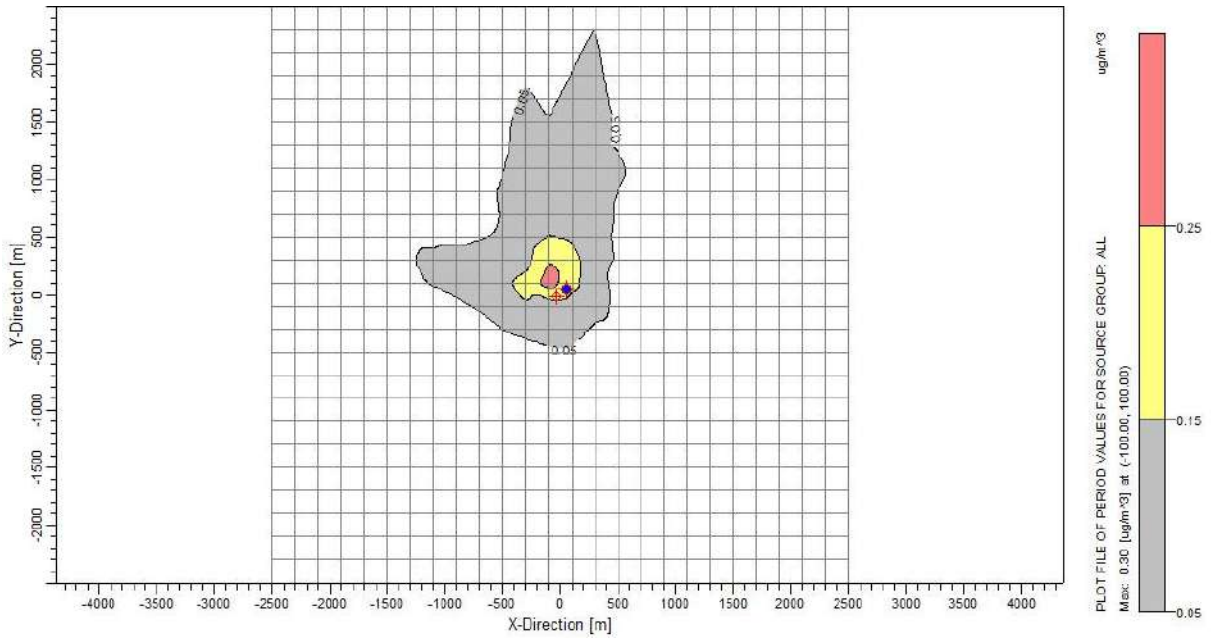


FIGURE 4.5: GLC INCREASE OF SO_2 FOR SCENARIO 2 (DG SET 1X250 KVA + FLARING)

In ***Figure 4.6*** GLC increase isopleths at an interval of 2.0 µg/m^3 of NO_x for Scenario 2 are shown.

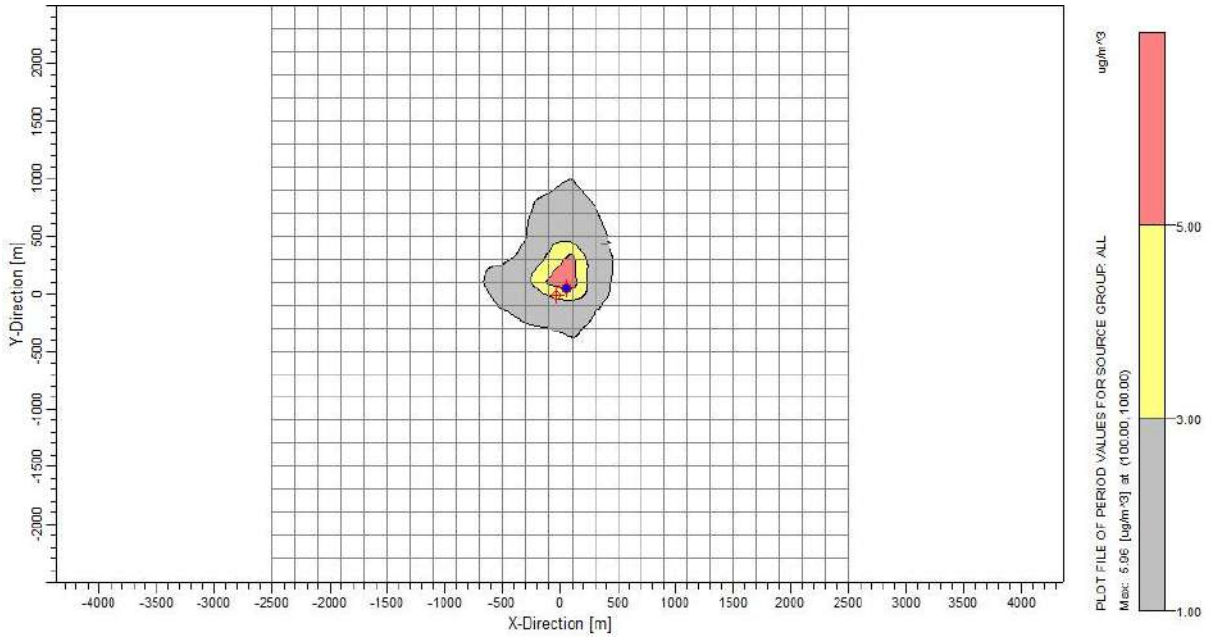


FIGURE 4.6: GLC INCREASE OF NO_x FOR SCENARIO 2 (DG SET 1X250 KVA + FLARING)

- GLC increase contours at an interval of 0.03 µg/m^3 of PM for Scenario 3 are depicted in ***Figure 4.7***.

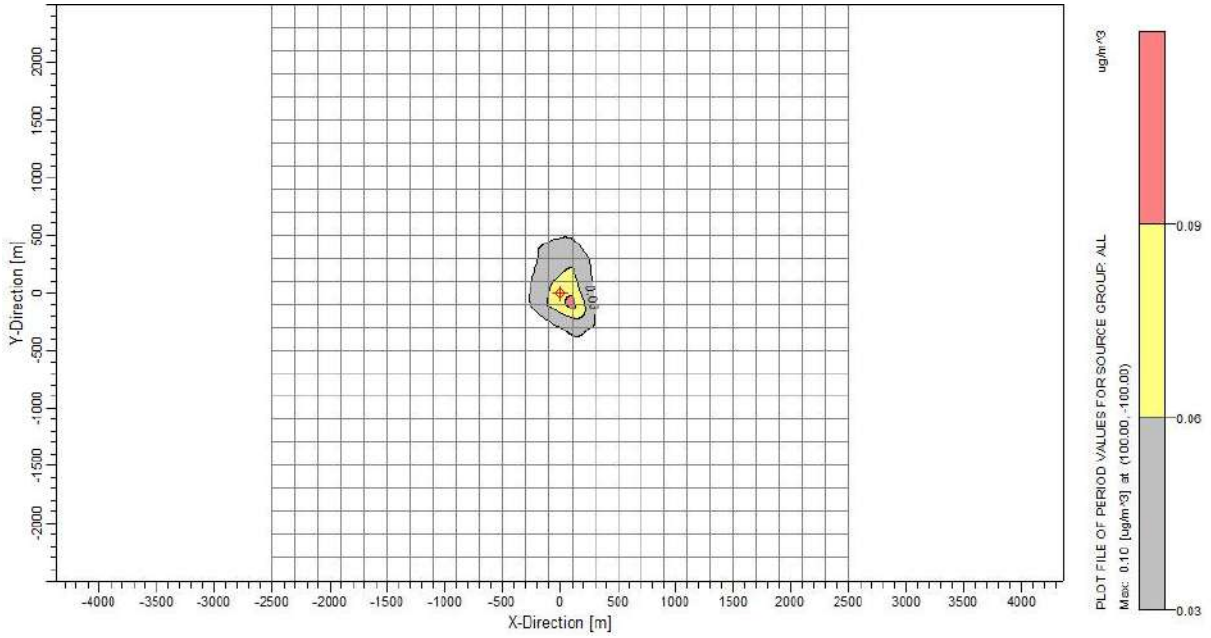


FIGURE 4.7: GLC INCREASE OF PM FOR SCENARIO 3 (DG SET 1X100 KVA)

- In ***Figure 4.8*** GLC increase isopleths at an interval of 0.03 µg/m^3 of SO_2 for Scenario 3 are given.

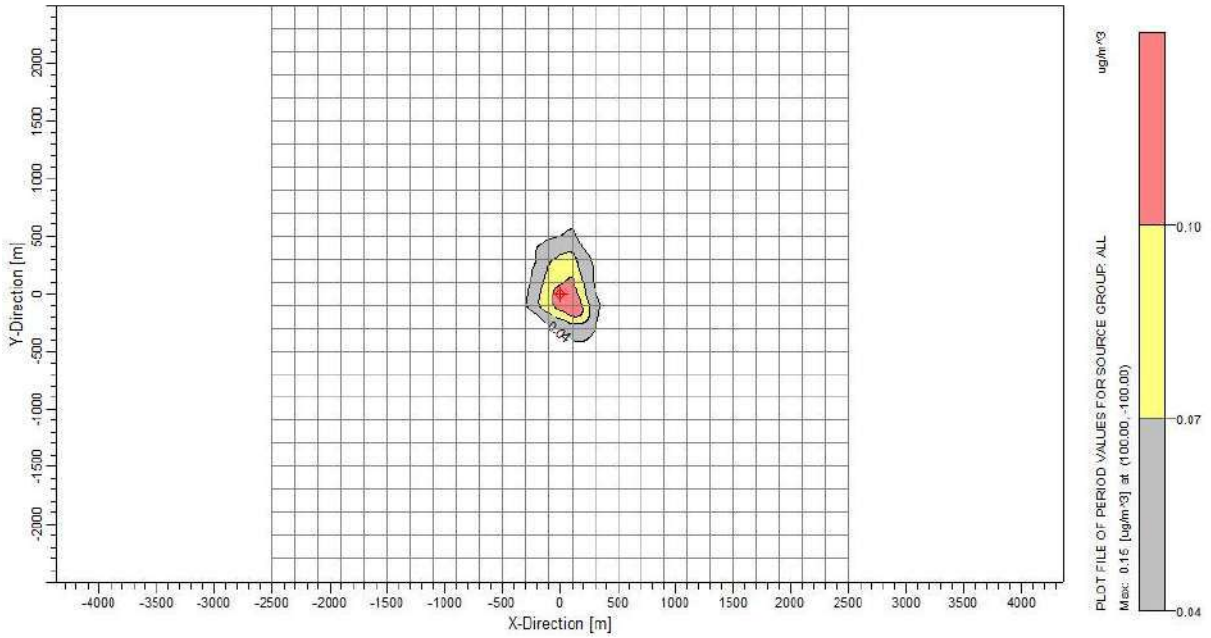


FIGURE 4.8: GLC INCREASE OF SO_2 FOR SCENARIO 3 (DG SET 1X100 KVA)

- ***Figure 4.9*** explains the GLC increase isopleths of NO_x for Scenario 3, drawn at 0.5 µg/m^3 interval.

FIGURE 4.9: GLC INCREASE OF NO_x FOR SCENARIO 3 (DG SET 1X100 KVA)

- Overall impact on existing ambient air quality shall be as per given hereunder in ***Table 4.5.***

TABLE 4.5: OVERALL IMPACT ON EXISTING AMBIENT AIR QUALITY

Particulars	Predicted 24-Hour Average Maximum Concentration (µg/m^3)		
	PM	SO_2	NO_x
Scenario 1 Maximum GLCs	0.14	1.86	3.76
Scenario 2 Maximum GLCs	0.06	0.30	5.96
Scenario 3 Maximum GLCs	0.10	0.15	3.30
Maximum Predicted GLCs	0.14	1.86	5.96
Maximum Concentration Recorded in Ambient Air as Baseline	92.2	11.9	32.2
Maximum Projected Concentration in Ambient Air	92.34	13.76	38.16

- Activities considered shall be for limited period (test flaring for maximum four days & six hours per day and DG set of 1430 KVA and 100 KVA for two months for each well).

Hence impact on ambient air quality is rated as shown below:

Impact Rating	Ambient Air
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.2.2.7 NOISE ENVIRONMENT

For the prediction of noise level, equipment/machinery, identified as important sources that may have adverse impact on the existing noise level within the block are: drilling machines, compressor pumps, DG set etc. General noise levels generated from them are as per given below in Table 4.6:

TABLE 4.6: GENERAL NOISE LEVELS OF SOURCES

Source of Noise/Equipment	Noise Level (dBA)
Mechanical Drilling Rig	105
DG Set (@1430 KVA	75
Compressor Pumps	105

Source: Hale hall Exploration site (Spectrum Acoustic)

The resultant noise level from above sources is 108 dB (A).

The general noise level due to other activities during exploratory drilling of well such as preparation of site, commissioning of rig, cementing, surface test flaring, well logging etc may sometimes go upto 90 dB(A) at the work sites during day time.

For an approximate estimation of dispersion of noise in the ambient from the source point, a standard mathematical model for sound wave propagation is used. For the modeling purposes, flat terrain is considered and environmental attenuation factors are not considered.

Based on the model, calculations are made assuming maximum noise level to be generated during drilling phase as 108 dB (A) and the predicted attenuated noise levels from the drilling at different distances are as per given hereunder Table 4.7:

TABLE 4.7 PREDICTED ATTENUATED NOISE LEVELS WITH DISTANCE

Attenuated Noise Level (dB(A))	Distance from source (m)
70	30
55	175
45	550

The above results show that the elevated noise levels will be limited to a short distance from source. The noise level so generated from the drilling operations will be mingled with the ambient noise level within short distance from the site as per details given below in Table 4.8.

TABLE 4.8: BACKGROUND AMBIENT NOISE LEVELS WITH DISTANCE

Background Ambient Noise Level (dB(A))	Distance from source (m)
70	200
55	1000
45	3000

However, monitored noise level reveals that:

- In residential areas, the daytime equivalent Noise level (Leqday) varied between 47.7 and 55.5 dB (A) while equivalent noise level during night (Leqnight) varied from 37.9 to 47.4 dB (A);
- In residential areas designated as commercial area, the daytime equivalent noise level (Leqday) varied between 52.1 and 55.5 dB (A) and equivalent noise level during night (Leqnight) varied from 41.9 to 47.4 dB (A) during study season; and
- At highways, the daytime equivalent noise level (Leqday) varied between 62.8 and 73.6 dBA during during study season. The equivalent noise level during night (Leqnight) varied from 49.8 to 63.7 dBA.

The above noise levels worked out are without mitigation measures. With the Mitigation measures, the noise levels will be further restricted within very short distance from the sources. The operators/personnel working near the noise sources within drilling site will be provided with earmuffs and earplugs.

Also, out of total period of 64 days of exploratory drilling at one location, drilling days shall be limited (approximately maximum for one month).

For activities other than drilling, the workers in general are likely to be exposed to an equivalent noise level of 80-90 dB (A) in 8 hour shift for which all statutory precautions as per the law will be implemented. Use of proper Personal Protective Equipment (PPE) will further mitigate adverse impact of noise on the workers, if any. The impacts can be further minimized and made insignificant by using standard practice of exploratory drilling of well.

Hence the impact on the noise level during drilling is rated as per given below:

Impact Rating	Noise Level
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.2.3 COMPONENTS CREATING RISKS TO SOCIO-ECONOMIC ENVIRONMENT

The components of the exploratory drilling/testing of wells that could result in effects on the socio-economic environment include the following:

- **Property Management**
  - **Partial Loss of the Land and Productivity of Land/crops**

Approximately 1.69 hect and 1.5 -2.5 hect land in total would be impacted for each exploratory drilling of well and camp site respectively. An approach road may need to be made from the road head to the drilling site. The width of the road is estimated to be around 2.5 m. It is likely that ploughing and sowing activities in and around drilling site and road may be affected during cultivation season. The land acquired for drilling site & road would not be available for agriculture for a period of about one year. The land, in case the exploration drilling is unsuccessful, would be restored in its original condition.

The landowners would be adequately compensated for loss of standing crop as well as for inability to cultivate the land for that particular period. In case the crop has already been sown, the landowners would be compensated for loss of income from that crop. The loss of

crop production for that particular cropping season as well as partial loss of productivity of the soil in affected areas will be adequately compensated.

During the test flaring loss of any standing crops in the vicinity will be adequately compensated based on the loss of income from the crop.

In case, extraction of petroleum products shall be economic viable then land as mentioned above shall be acquired and compensation shall be paid as per the existing regulations.

- **Loss of Physical Assets/ Common Property Rights**

In the event that some dug wells, tube wells, private trees, cattle sheds and tool sheds etc are to be removed for the exploration drilling, ***ONGC*** will either shift these assets or compensate for the losses at the prevailing market price.

No forest or settlement land shall be acquired for propsosal.

Hence, the impact on the property management is as per given below.

Impact Rating	Noise & Vibration
Significance and Nature of impact	Negligible and Beneficial
Duration of impact *	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

*Long term for drilling site*in case petroleum reserves is confirmed*

- **Employment**

The labour strength engaged during exploratory drilling will depend upon activities, since many activities are labour intensive. Most of the unskilled labour will be by and large available from the nearby villages and towns. Thus, impact on the physical and aesthetic resources will be minimal.

In addition to direct employment, several opportunities for locals will be available in terms of supply of construction materials & machinery, vehicles and other essential commodities.

Hence, overall impact is rated as shown below:

Impact Rating	Employment
Significance and Nature of impact	Negligible and Beneficial
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Low

❑ **Disturbance to Community Resources and Safety**

a) Buildings and other infrastructure

Buildings, if any could be affected by proximity to the drilling site. ***ONGC*** would adhere to safe working practices, ensuring safe working distances for drilling operation.

b) Road crossings and traffic

There are safety risks related to crossing public roads near the drilling site and there may be a requirement to cordon off the road. Close consultation with local Police prior to placing any signage is intended.

Hence overall impact is rated as shown below:

Impact Rating	Disturbance to Community Resources and Safety
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Low

4.3 RISK/ IMPACT MITIGATION TECHNIQUES

In order to minimize environmental impacts, the following section conveniently classified the mitigation measures (in continuation to suggested DMP and EMP in chapters 6 & 8 respectively) based on the various activities performed during the operation:

❑ **Mobilization of Drilling Equipment**

- Existing road network shall be utilized up to maximum extent;
- Regular maintenance and check-up record shall be maintained of all vehicles used for the transportation of the men and machinery to the site; and
- Close consultation with the local police prior to transportation any equipment to the site.

❑ **Drilling Site Preparation**

- Selection of drilling site in non- flooding zone as indentified for each river present within block;
- Minimize cleared area and size of site/maximize perimeter to area ratio to aid natural re-vegetation;
- Use hand cutting to clear vegetation initially—where necessary be selective in using machinery;
- Not removing top humus soil by stripping to a depth of 0.35 m;
- Conserve root stock and topsoil, store for later rehabilitation;

- Limit leveling activity;
- Do not burn brush and uprooted materials;
- Natural drainage patterns of the area should be considered in the location of equipment, pads, and pits so that storm water runoff does not create an environmental hazard by erosion of base material, which could lead to equipment instability, or by flooding of pits, which could cause a discharge of oil or other fluids into the local surface waters;
- Construction designs should include installation of erosion and sedimentation control systems;
- Each site (except for the locations of the waste containment area and freshwater storage facility) will be covered with up to 100 mm (4 inches) of suitable base. This would help to provide sufficient load-bearing capacity to enable all construction and drilling operations to be executed safely and with minimum impact on the environment;
- Incorporate drainage and minimize disturbance to natural drainage patterns. Engineer slopes and drainage to minimize erosion. Design for storm conditions/ensure offsite natural runoff does not wash over site/use perimeter drainage ditches;
- Seal bund and ensure proper drainage of machinery areas, fuel and chemical storage, and mud mixing areas;
- Provide base material compatible with local ground conditions. Hard core should be laid on geotextile membrane. Avoid concreting sites;
- Protect water courses from contamination and siltation;
- Protect groundwater from drill stem penetration and shallow aquifers from possible site contamination;
- Where water courses and aquifers are deemed sensitive, consider a fully sealed site, avoid use of mud pits, preferentially use steel tanks, but if used must be lined. Pits if used must be lined;
- Mud and burn pits, if used, must have adequate contingency capacity to account for rainfall, and must be fully lined and bunded.
- To prevent erosion of the soil on slopes, check banks and spur drains would be constructed;
- Earth moving equipment, typically a bulldozer with a grader blade and ripper type and a bucket type bulldozer for excavation work, will be used;
- As the site is graded and leveled, site berms, culverts, drains and drainage treatment facilities will be provided to control run-off and enable the site to be operational throughout the dry season; and

Following types of erosion control should be provided: (whichever is feasible)

- ✓ *Rip Raps*
- ✓ *Stone walls*
- ✓ *Rock berms*
- ✓ *Gabions*

❑ **Drilling Operation**

The approximate area of one well site would be about 1.69hectares. As per the standard practice of operation, in practice, waste minimization and safety will be achieved through a number of measures:

- Employing industry standard technologies and practices;
- Extremities of flare lines will be located at least 90 m from roads, public works, processing units or tanks. They will be at least 50 m from a well, gas/oil separator, site drainage or other possible source of ignitable vapours. The flaring would be elevated type with a height of 5m;
- Loading & unloading of fuel and various materials should be properly handled and controlled;
- Maintain good housekeeping to avoid any accidental spill;
- Bulk storage of lubricants and fuels will be permitted only within the designated places and fuel tanks must be properly marked by content and chemicals;
- Drip trays will be required to contain any leaks under stationary vehicles, items of plant and large vehicles carrying such fuels;
- Provide spill kit near oil storage area i.e. sand bags, absorbing pad, shovels etc;
- Any soil contaminated at the site will be removed and disposed off at the landfill, burn pit, as appropriate;
- Carefully designing the fluid handling system so as to maximize recycling of fluids and treatment of cuttings;
- Provision of treatment facilities so as to maximize recycling of fluids and minimizing quantities of effluents;
- Contracting and procurement of appropriate equipment so as to minimize breakdowns;
- Residue disposal ; after drilling completion, solids from de-watered drilling fluids (solids) and cuttings will be filled in solar drying beds and covered with soil;
- Non-contaminated run-off from the majority of the drilling site will be routed, possibly via a silt trap, through a discharge pipeline to a suitable off-site location;
- Potentially contaminated surface run-off from the drill pad will be routed via an oil trap system where oils will be skimmed off and put in drums for removal from site;

- Equipment maintained in good working order. Workers near noise source provided with noise protection equipment (ear muffs);
- Acoustic mufflers in large engines (where practicable);
- Duration of well testing shall be minimized by careful planning;
- High combustion efficiency, smokeless/burner will be used;
- Any dry, dusty materials (chemicals, muds etc.) shall be sealed in containers;
- Adequate and properly maintained firefighting equipment would be present at the site and all fires and ignition sources to be controlled to prevent fire; etc.

❑ **Demobilization & Restoration of the Drilling site**

❑ Restoration plan must be followed and site restored to its restoration original condition;
❑ Remove all debris and contaminated soils;
❑ Reform contours to natural surroundings;
❑ Restore natural drainage patterns;
❑ All residual solids and liner shall be covered with thick column of native soil. The cutting mud is inert and with appropriate lining of the pit in place it does not pose any scope of environmental hazard;
❑ Grading shall take place to ensure natural run-off;
❑ Any remaining topsoil that has been stocked during the site clearance shall be re-spread over appropriate portions of the site;
❑ Break-up base material/re-spread topsoil and brash, vegetation, leaf litter and organic material. Use specialized techniques where sensitivities dictate, e.g. brushwood barriers, seeding, turf, etc.
❑ Mud pits, where used, should be de-watered and filled in with1m cover of soil;
❑ Block access routes, or if required, hand over to local authorities;
❑ In the event that economic quantities of hydrocarbons are found, the well shall be suspended with a wellhead in place, but all other equipment and materials will be removed from the site;
❑ In the event that no economic quantities of hydrocarbons are found, a full abandonment plan shall be implemented for the drilling sites in accordance with the applicable national and international petroleum regulations. All concrete or steel installations would be removed to at least 1 m below ground level. So as to ensure that there are no protruding surface structures;
❑ All empty drums wastes, used and unused drilling fluids, fuel and lubricants shall be removed from the drilling site;
❑ Water supply and effluent discharge hoses and associated equipment shall be removed;

- ❑ The access road(s) would be reinstated; and
- ❑ Document and monitor site recovery;

Coloured photographs would be taken, wherever possible, before and after the drilling operations. These photographs would be properly identified and catalogued.

- ❑ **Campsite and Access**

- Ensure all requirements addressed in planning phase are fully met;
- Initiate consultation and liaison with local authorities;
- Use local expertise;
- Campsites would be located well away from major watercourses, springs, wells and pastoral property infrastructure;
- Disposal pits would be constructed above water table, away from watercourses, and water holes and shall be of an adequate size to contain all of the waste and to allow for deep burial;
- Kitchen and sanitary wastewater will be emptied into earthen drains that allow rapid infiltration, prevent discharge to surface waters and be of an adequate size to ensure that water is directed away from areas frequented by camp personnel and vehicles;
- Adequate and properly maintained firefighting equipment would be present at the campsite and all fires and ignition sources to be controlled to prevent bush fire;
- Litter, rubbish and other wastes that have not been buried must be removed from campsites within one week of abandonment and the sites put in such a condition as to encourage rapid rehabilitation;
- Rubbish, dumps, sewerage drains, etc; shall be filled to ensure a minimum cover of 1 meter, in such a manner as to restore the land surface and to avoid surface contamination and disturbance by animals. During construction topsoil would be stockpiled and returned after filling to encourage regeneration;
- There would be no burial in sensitive areas (wetlands, reserve forests, etc.). All rubbish would be removed and disposed of in a satisfactory manner;
- Workforce should keep within defined boundary and to the agreed access routes;
- Control workforce activities, e.g. hunting, interaction with local population. Purchase food from recognized local suppliers, not directly from local people without evaluating implications;
- Consult local authorities and other stakeholders regarding preferred location;
- Choose site to encourage natural rehabilitation by indigenous flora/ avoid removal of vegetation and topsoil/ preserve topsoil, and seed source for decommissioning;

- Select site to minimize effects on environment and local communities/minimize clearing;
- Use existing access if available;
- Avoid or minimize road construction/minimize clearing and disturbance/minimize footprint, use existing infrastructure;
- Use hand cutting techniques/ avoid use of heavy machinery e.g. bulldozers/ selectively use machinery;
- Minimize size of camp/ facilities consistent with operational, health and safety requirements;
- Take account of topography, natural drainage and site runoff;
- Ensure adequate and proper drainage;
- Ensure proper handling and storage of fuels and hazardous materials (e.g. explosives);
- Minimize waste, control waste disposal (solids, sewerage);
- Prepare contingency plans for spillages, fire risk; and
- Minimize extraneous noise and light sources.

4.4 IMPACT EVALUATION

The evaluation of the impacts of the proposed activities on the environment, both in terms of quality & quantity have been made. For quantification of impacts, matrix system as modified to some extent has been used as per given below:

For quantifying impacts on the environment, the guidelines and standards prescribed by national and international agencies are being considered. 1000 numbers are distributed as per the weightage to each parameter considered based on its importance as per given below in **Table 4.7**.

TABLE 4.7: EVALUATION OF IMPACT PREDICTION

Parameters	Importance Value
Air Quality	200
Water quality	100
Water resources	100
Noise and vibration	200
Soil & Solid waste	200
Land Use Pattern	50
Forest & Vegetation and wild life	50
Socio – economic	50
Employment	50

The severity has been divided in impact scores from 0-5 for calculating the severity of impacts on the environmental parameters due to various project activities as given below in **Table 4.8.**

TABLE 4.8: IMPACT ASSESSMENT SCORE

Severity criteria	Impact score
No impact	0
Significant impact-slight and short term	1
Significant impact-slight and long term	2
Moderate impact- short term	3
Moderate impact- long term	4
Major Impact - Permanent	5

The impact score can be negative or positive depending on whether the impact is adverse or beneficial.

Based on the above importance values and impact scores, the impact value (impact score x importance value) for each environmental parameters is calculated. The impact value for individual parameter is added to arrive at the total impacts value. The criterion used to make conclusive statement is based on the total impacts value without control measures is defined as given below in Table 4.9.

TABLE 4.9: IMPACT ASSESSMENT CRITERION

Total impact value	Conclusions
Upto (-)1000	No appreciable impact on environment
(-) 1000 to (-) 2000	Appreciable but reversible impact. Mitigation measures important.
(-) 2000 to (-) 3000	Significant impact which is mostly irreversible. Mitigation measures crucial.
(-) 3000 to (-) 4000	Major impact which is mostly Irreversible. Selection of process and raw material to be crucial.
Above (-) 4000	Permanent irreversible impact, alternative sites to be considered.

The environmental impact matrix based on the above principles has been attempted for the proposed exploratory drilling and are given in **Table 4.10.**

TABLE 4.10: IMPACT EVALUATIONS – EXPLORATORY DRILLING/TESTING

Environmental parameters	Importance value	Impact Score		Overall Value	
		Without EMP	With EMP	Without EMP	With EMP
Air Quality	200	(-)3	(-)1	-600	-200
Water quality	100	(-)3	(-)1	-300	-100
Water resources	100	(-)3	(-)1	-300	-100
Noise and vibration	200	(-)3	(-)1	-600	-200
Soil Quality & Solid waste	200	(-)3	(-)1	-600	-200
Land Use Pattern	50	(-)2	(-)1	-100	-50
Forest & Vegetation and wild life	50	(-)2	(-)1	-100	-50
Socio – economic	50	(+)1	(+)1	50	50
Employment	50	(+)1	(+)1	50	50
Total				**-2500**	**-800**

CHAPTER 5

ANALYSIS OF ALTERNATIVES

CHAPTER 5: ANALYSIS OF ALTERNATIVES

5.1 ALTERNATIVE LOCATION FOR THE PROPOSED PROJECT

The proposed onshore Block under Karimganj Dist. PML, Cachar Dist. PML and Sector-VC PML blocks of Assam state for exploration of hydrocarbons. A total of 26 exploratory locations are planned in these three PML blocks and Oil and Natural Gas Corporation Limited (ONGC) for exploration of hydrocarbons by Government of India (GOI). The Block area is located in Cahar District and Karimganj district of Assam.

No alternate site is examined as the proposed blocksarehaving oil & gas reserves and awarded by Ministry of Petroleum and Natural Gas, Government of India.

5.2 ALTERNATIVE DRILLING LOCATIONS

The identified locations for exploratory drilling have been selected based on data analysis and interpretation collected via seismic survey within the block area. However, all safe distances shall be kept as per relevant standards and guidelines.

5.3 ALTERNATIVE DRILLING TECHNOLOGIES

Standard practice shall be followed in which a standard electric onshore rig of 1400 HP (BHEL) with Rotary/Top drive System will be used (rotary drilling with WBM stabilization).

5.4 ALTERNATIVE RESOURCES

The entire water requirements will be met from water tankers to the drilling.

5.5 ALTERNATIVE TREATMENT OPTIONS

Drill cutting will be separated from drilling mud and analyzed for Oil and Grease (O&G) content. If O&G content is found to be less than 10 g/kg, the cutting will be disposed off (in-situ) in an impervious lined pit and after drying it will be covered by an impervious liner and soil layer. If O&G content is found to be higher than the 10 g/kg, drill cuttings will be temporarily stored in HDPE lined pits /packed in bags and then disposed to secured landfill site (TSDF).

However, mobile ETP shall be provided treat the waste water for reuse.

CHAPTER 6

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

CHAPTER 6: RISK ANALYSIS AND DISASTER MANANGEMENT PLAN

6.1 INTRODUCTION

Exploratory drilling and testing operations of hydrocarbon wells are considered hazardous in nature, which can pose risk to life and property in an unlikely event of sudden and violent release of hydrocarbon fluid and hydrogen sulfide (H2s) gas and due to other unsafe acts and conditions. Therefore, detailed hazard identification, risk assessment have been carried out and disaster management plan has been prepared for prompt response in the event of an emergency.

6.2 DRILLING OPERATIONS

ONGC owned electrical type rigs are proposed to be deployed for undertaking drilling in the blocks. The technical details of the proposed drilling activity are given below:

Well location / Depth	Karimganj Dist-PML/Cachar Dist. PML/Sector-VC PML / 3000m(Max.)
No. of wells to be drilled	Exploratory = 26 wells
Duration of Drilling	Approx 3-4 months for each well
Qty. of drilling fluid.	About 700 M^3 for each well
Qty. of cuttings, cu.m.	250-300 $M^3$for each well (approx.)
Qty. of drlg. Waste water, cu.m.	1000 M^3 for each well

Exploratory drilling and testing operations of hydrocarbon wells are considered hazardous in nature, which can pose risk to life and property in an unlikely event of sudden and violent release of hydrocarbon fluid and hydrogen sulfide (H2s) gas and due to other unsafe acts and conditions. Therefore, detailed hazard identification, risk assessment have been carried out and disaster management plan has been prepared for prompt response in the event of an emergency.

6.3 HAZARD IDENTIFICATION

Hydrocarbon exploration and testing 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 these factors. Fire, explosion due to hazardous release of crude oil, gas, H2S or a combination of these are the hazards associated with hydrocarbon exploration and testing operations. These have resulted in the development of more comprehensive, systematic and sophisticated methods of safety engineering, such as, hazard identification

and risk assessment to improve upon the integrity, reliability and safety of hydrocarbon operations.

The primary emphasis in safety engineering is to reduce risk to human life and environment. The broad tools attempt to minimize the chances of accidents occurring. Yet, there always exists, no matter how remote, that small probability of a major accident occurring. If the accident involves hydrocarbon in sufficient large quantities, the consequences may be serious to the project site, to surrounding area and the population therein.

Derrick floor is the center stage of all the exploratory drilling operations and it is most 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, numbers of equipment have been developed over a period to cater the need of smooth operation on derrick floor. Various standards are required to be referred to cover the variety of equipments used for safe operation in drilling and it is desirable to use a properly prepared manual for occupational safety while working or drilling over rig.

6.3.1 MINOR OIL SPILL

During hydrocarbon exploration and testing operations, minor oil spill is confined within the well plinth area. The conditions which can result in minor oil spill are as follows:

- **Diesel Fuel Storage System:** Oil spillage from tanker unloading, leaking valves, lines and storage tank.
- **Exploration or Testing Well Site:** Drill stem testing leading to an oil spillage from lines, valves, separator and tank failure.

During the exploration & testing operation of well, there exists a possibility of hydrocarbon oil & gases being released from a failure upstream of crude stabilization facilities. Once the flow of oil is stopped, then on-site access for clean-up is possible. If flow from well can not be stopped, a blowout situation exists.

6.3.2 MAJOR OIL SPILL

Significant hydrocarbon inventories are not maintained at a well drilling site. A major spill can, therefore, only arise as a result of an uncontrolled flow from a well either during drilling resulting from a failure of the surface equipment. Provided that ignition does not take place and the well head is not obstructed the well can be shut in manually at the wellhead. If ignition occurs or other damage prevents access to the wellhead then a blowout situation exists and appropriate measures must be implemented.

6.3.3 BLOWOUT

Blowout means uncontrolled violent escape of hydrocarbon fluids from a well. Blowout followed by ignition, which prevents access to the wellhead is a major hazard. Major contributors to blowout are:

Primary

- Failure to keep the hole full;
- Mud weight too low;
- Swabbing during trips;
- Lost circulation; and
- Failure of differential fill-up equipment.

Secondary

- Failure to detect and control a kick as quickly as possible;
- Mechanical failure of Blow Out Preventer (BOP);
- Failure to test BOP equipment properly;
- Damage to or failure of wellhead equipment;
- Failure of casing; and
- Failure of formation or cement bond around casing.

If the hydrostatic head exerted by the column of drilling fluid is allowed to drop below the formation pressure then formation fluids will enter the well bore (this is known as a kick) and a potential blowout situation has developed. Fast and efficient action by operating personnel in recognizing the above situations and taking precautionary measure can avert a blowout.

❑ **Presence of Sour Gas (Hydrogen Sulphide-H_2S) in Blowout**

As per available data, there is no chance of presence of H_2S, however, as a hypothertical case, scenario of presence of 3% H_2S has been considered for consequence analysis.

Presence of Sour Gas (H_2S) in blowouts wells can pose immediate dangers to life and health at and around the rig area. Operators drilling wells where H_2S is a known hazard may or may not have a clear-cut policy regarding ignition of the well if a blowout occurs. Burning H_2S creates sulfur dioxide (SO_2) that is also highly toxic. Therefore, the situation is still dangerous, and a safety system should be put in place to monitor for SO_2.

Hydrogen Sulphide gas (H_2S) is extremely toxic, even very low concentrations can be lethal depending upon the duration of exposure. Without any warning, H_2S may render victims

unconscious and death can follow shortly afterwards. In addition it is corrosive and can lead to failure of the drill string or other tubular components in a well.

The Occupational Safety and Health Act (OSHA regulations) set a 10 ppm ceiling for an eight hourly continuous exposure (TWA limit), a 15 ppm concentration for short term exposure limit for 15 minutes (STEL) and a peak exposure of 50 ppm for 10 minutes.

Important characteristics of H_2S gas are given below:

- ✓ *H_2S is a toxic colourless gas heavier than air.*
- ✓ *It has an odour of rotten eggs but see 'point 6' below.*
- ✓ *In concentrations greater than 100 ppm, it will cause loss of senses in 3 to 15 minutes and death within 48 hours.*
- ✓ *In concentrations greater than 600 ppm death occurs in less than 2 minutes.*
- ✓ *The safe concentration for a normal working period without protection is 10 ppm.*
- ✓ *In concentration greater than 10 ppm, the olfactory sense to smell the gas is lost, the need for detectors is apparent.*
- ✓ *It attacks the body through the respiratory organs.*
- ✓ *It dissolves in the blood and attacks through the nervous system.*
- ✓ *It is very irritating for the eyes as it forms sulphurous acid together with water.*
- ✓ *The Occupational Safety and Health Act (OSHA) sets a 10 ppm ceiling for an 8 (eight) hour continuous exposure (TWA limit), a limit of 15 ppm for short term exposure limit for 15 minutes (STEL) and a peak exposure concentration of 50 ppm for 10 minutes.*
- ✓ *The best protection is breathing apparatus, with mask covering the whole face and a bottle containing breathing air.*
- ✓ *It burns with a blue flame to sulphur dioxide which is almost as dangerous as H2S.*
- ✓ *It forms an explosive mixture with air at concentrations from 4% to 46%.*
- ✓ *Short exposure of high tensile steel to as little as 1 ppm in aqueous solution can cause failures.*
- ✓ *Concentrations greater than 15 ppm can cause failure to steel harder than Rockwell C-22. High stress levels and corrosive environments accelerate failures.*
- ✓ *When pH is above 9 and solubility is relatively high, it is readily soluble in mud and especially in oil muds.*
- ✓ *A 35% hydrogen peroxide solution will neutralize H_2S gas in the mud or 20 gallons of H_2O_2 per 100 barrels of mud.*
- ✓ *It occurs together with natural gas in all oil provinces of the world.*

- ✓ *In characteristic H2S gas areas concentration above 42% in natural gas have been reported.*
- ✓ *H2S may also be formed in significant amounts from the degradation of modified lignosulphonates at temperatures exceeding 2040C.*
- ✓ *Coughing, eye burning and pain, throat irritation, and sleepiness are observed from exposure to low concentrations of H2S.*
- ✓ *Exposure to high concentrations of H2S produces systems such as panting, pallor, cramps, paralysis of the pupil and loss of speech. This is generally followed by immediate loss of consciousness. Death may occur quickly from respiratory and cardiac paralysis.*

6.3.4 OTHER HAZARDS AT DRILLING RIG OPERATIONS

6.3.4.1 SETTING UP THE SUBSTRUCTURE

Equipment is unloaded and positioned at or near the exact location that it will occupy during drilling operation operations. The substructure is assembled, pinned together, leveled, and made ready for other rig components on the floor. Equipping the cellar begins but can be done throughout the rigging up process. This includes welding on a drilling nipple to the conductor pipe and attaching a flow line.

Potential Hazards

- Being struck by the crane, load, truck, or forklift tipping;
- Pinched fingers when assembling equipment;
- Burns from cutting and welding on the drilling nipple;
- Temporary eye irritation from welding light flash;
- Falling from heights; etc

6.3.4.2 HAZARDS DURING PREPARATION FOR SETTING UP THE SUBSTRUCTURE

Equipment is unloaded and positioned at or near the exact location that it will occupy during operations. The substructure is assembled, pinned together, leveled, and made ready for other rig components on the floor. Equipping the cellar begins but can be done throughout the rigging up process. This includes welding on a drilling nipple to the conductor pipe and attaching a flow line.

Potential Hazards:

- Being struck by the crane, load, truck.
- Pinched fingers when assembling equipment.
- Burns from cutting and welding on the drilling nipple.

- Temporary eye irritation from welding light flash.
- Falling from heights.

6.3.4.3 HAZARDS DURING SETTING UP THE RIG FLOOR AND MAST OR DERRICK

Once the substructure is set in place, the process of setting up the rig floor begins. Begin by installing stairways and guardrails to allow access to the rig floor. Then, the draw works is set in place and secured to the substructure. On mechanical rigs, the engines are set in place and the compound and associated equipment connected to the draw works. On electric rigs, the electric cables (lines) are strung to the draw works.

The bottom of the mast is raised to the rig floor and pinned in place. The crown section is then raised into place on the derrick stand. The "A-legs" are raised and pinned into place. The monkey board is pinned in place on the mast and all lines and cables are laid out to prevent tangling when the mast is raised. A thorough inspection of the mast should be made before raising the mast/derrick. The mast is now ready to be raised. The engines are started, and the drilling line is spooled onto the draw works drum. Once the mast has been raised and pinned, the remaining floor equipment can be set into place. If the rig has safety guy lines, they must be attached to the anchors and properly tensioned prior to continuing the rigging up process. A derrick emergency escape device is installed on the mast.

Potential Hazards

- Falling or tripping during rigging up;
- Falling from rig floor;
- Being struck by swinging equipment;
- Being struck by falling tools;
- Being crushed or struck by equipment due to failure or overloading of hoisting equipment;
- Getting entangled in lines during rising of the derrick or mast;
- Failure to properly install derrick emergency escape device; etc

6.3.4.4 HAZARD IN RIGGING UP THE CIRCULATING SYSTEM

While one crew finishes preparing the rig floor, another crew might be rigging up the circulating system. The mud tanks and mud pumps are set into the predetermined location. The mud lines are then connected and electric cords are strung.

Potential Hazards:

- Being struck by or crushed by equipment being set into place;
- Getting caught in pinch points;

- Being struck by crane, load, truck or forklift tipping;
- Being struck by hammer when connecting mud line unions; etc

6.3.4.5 HAZARDS DURING INSTALLING THE AUXILIARY EQUIPMENT

All remaining drilling and auxiliary equipment must be set into place and installed where needed. The catwalk and pipe racks are positioned and the pipe and drill collars are set on the racks.

Potential Hazards:

- Getting struck or pinched by, or caught in between, tubulars being loaded onto racks.
- Having feet pinched or crushed when setting up the pipe racks and catwalk.

6.4 CONSEQUENCE ANALYSIS

The risk presented by a blowout (hydrocarbons release event) is determined by the frequency and consequence of its possible outcomes. The consequence of igniting a hydrocarbon release during blowout depends on the type of material released, the mass release rate, the timing of the ignition, and the environment into which the hydrocarbon is released. Briefly, typical outcomes are:

- ***Jet fires:*** *produced by an ignited jet of gas or liquid spray released under pressure;*
- ***Pool fires:*** *produced by ignition of a liquid release that accumulates on the surface and ignites;*
- ***Flash fires:*** *produced by igniting a gas cloud so that a fire propagates through the gas cloud (without generating a significant overpressure);*
- ***Explosions:*** *produced by igniting a gas cloud in conditions where the resultant accelerating flame front produces a significant overpressure.*

Jet fire emanating from the release source may follow a flash fire or explosion.

I. Early Ignition

In the risk assessment, gas and two-phase events that ignite early are modeled as jet fires. Liquid releases that ignite early are modeled as pool fires.

Briefly, jet fires are modeled as follows:

- Mass release rate is determined (for each representative hole size) based on the operating temperature and pressure at the point of release.
- From the mass release rate, the jet flame length and associated fatality area.

II. Late Ignition

In the event of two-phase releases that ignite late are modeled as explosions.

Delayed ignition is not assumed to occur for oil releases. The consequential effect of a hydrocarbon gas explosion on personnel is determined by a variety of factors, including:

- Direct effects of blast overpressure;
- Whole body translation due to the blast wave;
- Thermal effects on personnel inside the burning gas cloud.

It is assumed that all personnel caught inside the burning gas cloud are likely to be fatally injured due to thermal radiation effects and inhalation of burning gases. Outside the gas cloud, personnel may still suffer from the effects of flash fire.

❑ **Thermal Radiation**

Thermal radiation from a hydrocarbon fire is a significant hazard to personnel. The degree of injury caused by thermal radiation is related to the intensity of the thermal radiation and the exposure time.

Thermal radiation effect modeling to estimate the likely injury or damage to people and objects from thermal radiation from incident outcomes is the most straightforward of the three types of physical exposure modeling referred to above.

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).

The following damage distances for thermal radiation have been used:

37.5 kW/m2	:	Damage to process equipment. 100% fatality in 1min. 1% fatality in 10sec.
12.5 kW/m2	:	First degree burn for 10 sec exposure
4.0 kW/m2	:	First degree burn for 30 sec exposure

❑ **Ignition of Blowout**

Surprisingly, few surface blowouts ever ignite. Less than 10 blowouts per year ever catch on fire, worldwide. Typically, large formation water flows lifted by the hydrocarbon flow make ignition difficult if not impossible. Water comes into the blowout zone, drawn in by low flowing bottom hole pressure; or adjacent wet zones are exposed to the flow path.

Highly flammable blowouts may never ignite if no ignition source is present and flow is quickly dispersed. Thus, knowledgeable and experienced blowout specialists always restrict blowout access and carefully inspect the area around blowouts for ignition sources, particularly areas within an explosive vapor cloud.

6.4.1 MODEL USED FOR CONSEQUENCE ANALYSIS

PHAST (Version 6.53.1) software of DNV has been used to perform the consequence calculations. PHAST is a consequence and risk assessment software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials. PHAST software allows detailed modeling and quantitative assessment of release of pure and mixtures of liquid and gaseous chemicals.

6.4.2 SCENARIOS WISE FINDINGS OF CONSEQUENCE ANALYSIS

Subsequent to the accidental release of hydrocarbon, the consequence depends on various factors e.g. type and quantity, presence and location of an ignition source, meteorological conditions, etc. The consequence analysis for the selected accident scenarios for hydrocarbon releases have been carried out to estimate the effect distances. Outcomes of consequence analysis have been described in subsequent sections.

- **Blowout during Drilling of Well**

Formation pressure in oil & gas wells is typically may be high, thus conventional BOP stack is used at drilling rig.

Release of Hydrocarbon through 150 mm hole containing 3 % H_2S gas due to Blowout

I. IDLH Concentration of 3 % H_2S

In the event of vertical release of hydrocarbon, IDLH concentration of hydrogen sulphide (H2S) will not reach to the ground. Therefore, no hazard is anticipated.

IDLH Concentration	Thermal Radiation Level Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s – E	1 m/s - F
100 ppm	No Hazard	No Hazard	No Hazard	No Hazard

II. UFL and LFL Concentration Distances

In the event of release of hydrocarbon during blow-out, hydrocarbon /fluid gas cloud will be formed, if it is not getting source of ignition. Computed hydrocarbon gas concentrations between UFL and LFL are as per given below:

Concentration	UFL and LFL Concentration Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
UFL	0.404159	0.152782	0.416789	0.293871
LFL	4.61949	3.10683	4.15458	3.75605
LFL Fraction (50%)	9.80738	9.64045	11.9256	10.6855

Heights (m) for above distances are given below:

Concentration	UFL and LFL Concentration Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
UFL	13.7872	16.2498	14.3967	15.4029
LFL	38.2636	51.8099	39.4372	44.1115
LFL Fraction (50%)	52.1327	76.1167	56.745	63.4986

III. Flash Fire Envelope

On ignition of Hydrocarbon gas within LFL, flash fire envelope will be formed as per details given below:

Concentration	UFL and LFL Concentration Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
Furthest	4.61949	3.10683	4.15458	3.75605
Furthest (50%)	9.80738	9.64045	11.9256	10.6855

Heights (m) for flash fire envelope are given below:

Concentration	UFL and LFL Concentration Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
Furthest	38.2636	51.8099	39.4372	44.1115
Furthest (50%)	52.1327	76.1167	56.745	63.4986

Flash fire envelope distances are depicted in Figure 6.2.

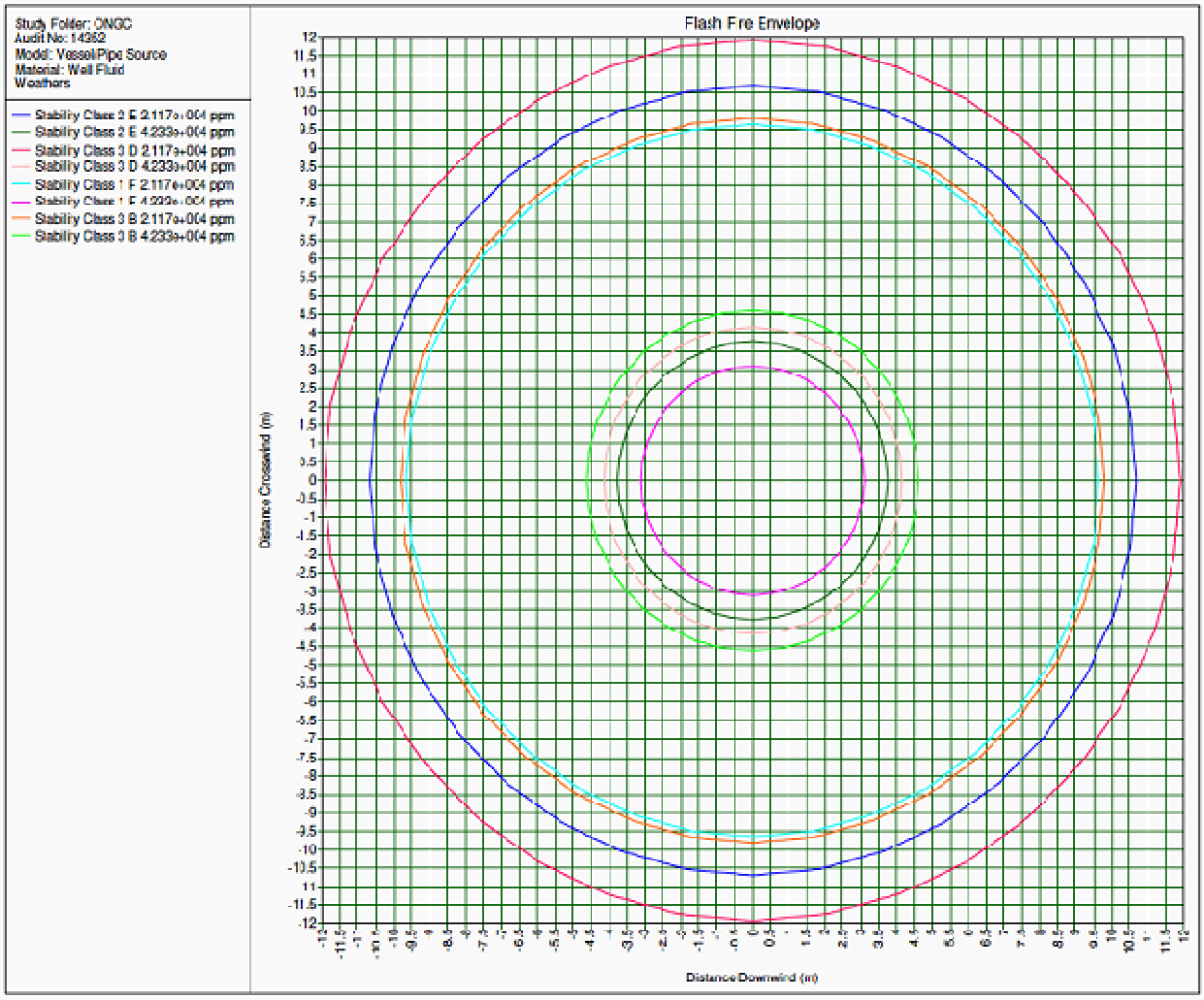


FIGURE 6.2: FLASH FIRE ENVELOPE

IV. Jet Fire on Immediate Ignition

In the event of ignition of blow out, computed thermal radiation distances resulting from jet fire are as per given hereunder:

Radiation Level	Thermal Radiation Level Distances (m)			
	1 m/s - B	3 m/s - D	3 m/s - E	2 m/s – F
4 kW/m^2	75.4995	55.3992	71.9165	63.3931
12.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached
37.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached

Thermal radiation distances and intensity radii from jet fire are depicted in Figure 6.3.

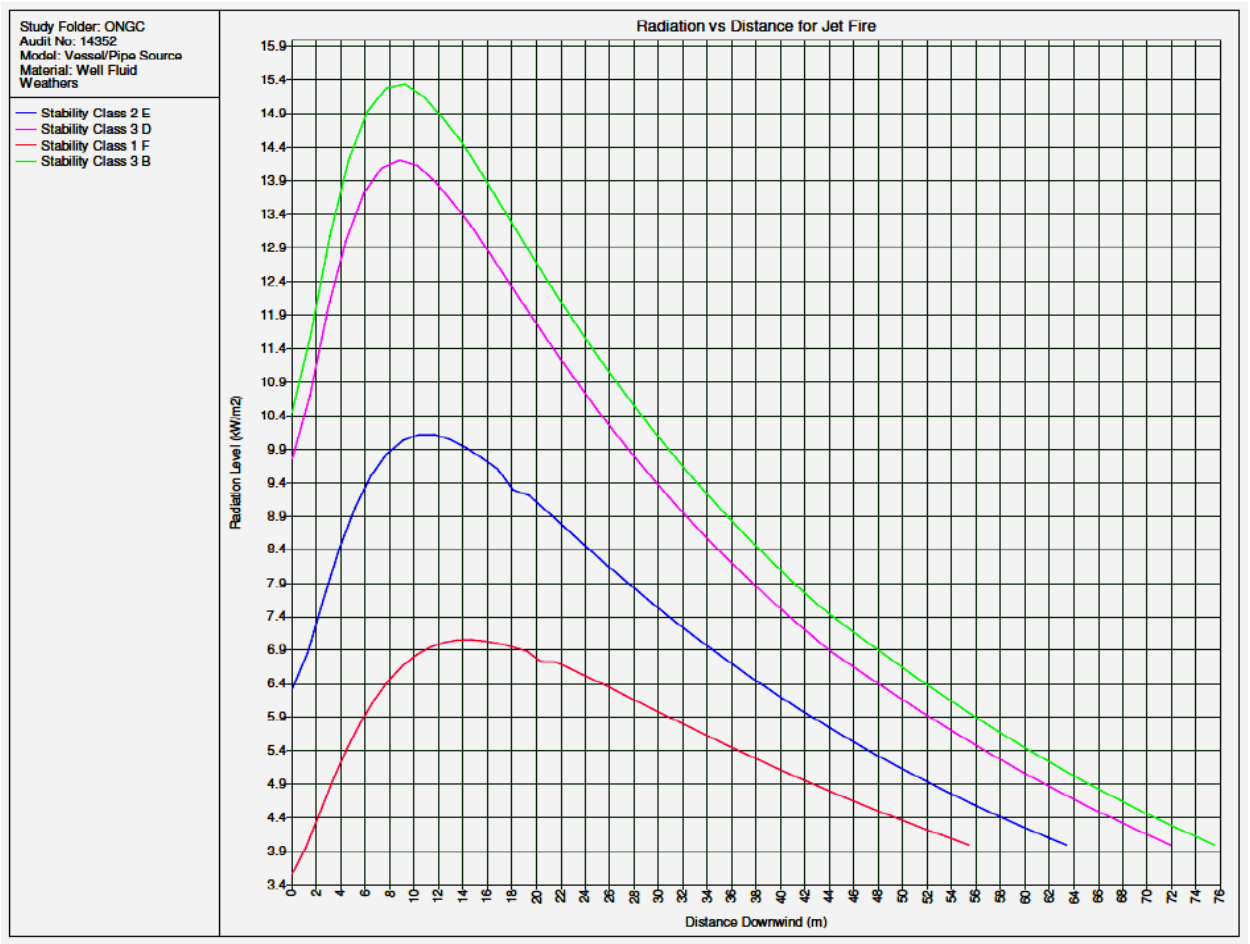


FIGURE 6.3: RADIATION VS DISTANCE FOR JET FIRE

6.5 FAILURE FREQUENCY

6.5.1 BLOWOUT AND WELL RELEASE FREQUENCIES

The study (Source: White Rose oilfield development on the Grand Banks, offshore Newfoundland by Husky Oil Operations Limited) estimates that there have been 51,000 development wells drilled in that period of 1955 to 1988 giving a frequency of 4/51,000 =7.8E-05 blowouts per well drilled.

The frequency of well blowout and well release is discussed in The International Association of Oil & Gas Producers Risk Assessment Data Directory. Table 6.2 shows the expected frequency of such events based on historical data from recent years.

TABLE 6.2: OGP BLOWOUT AND WELL RELEASE FREQUENCIES

Operation	Frequency			
Category	**Average**	**Gas**	**Oil**	**Unit**
Blowout	6.0E-05	7.0E-05	4.8E-05	Per drilled well
Well Release	4.0E-04	5.7E-04	3.9E-04	Per drilled well

OGP - Oil & Gas Producers

Additional correction factors could also be considered based on the likelihood that the wind is blowing in the direction of populated areas. Also for smaller releases it is believed that the well release could be isolated by mechanical means reducing the event duration.

The above estimate is, however, still very conservative for a number of reasons. The data on which the above frequency is based cover several decades.

In past years, drilling technology has improved significantly since that time and the risk of a development drilling blowout will inevitably be lower than the above frequency suggests. Finally, the drilling rig will operate in accordance with stringent operating procedures and these will be in line with the best practice of well drilling operation worldwide.

6.5.2 STRUCTURAL FAILURE FREQUENCY

Det Norske Veritas (DNV 1997) states that the total structural failure frequency is comprised of:

- Structural failure within design: 2.4E-05 per year;
- Structural failure due to extreme weather: 1.2E-05 per year;
- Structural failure due to ballast failures: 1.2E -05 per year;

Therefore, the total structural failure frequency is 4.8E-05 per year, including failure in design, extreme weather and ballast failures.

6.6 RISK MITIGATION MEASURES

This section discusses the measures for risk reduction and enhancement of safety at the exploratory drilling operations:

6.6.1 RISK MITIGATION TO CONTROL HAZARDS

Occurrence of blowout and sour gas (H2S) are the two major hazards. Occurrence of H2S along with oil and gas is the major hazard during exploratory drilling and production testing (The past experience and historical information available for drilling, exploration and production of hydrocarbons in the area revel that H2S gas shall not befound in hydrocarbon reserves of the region. In the event of occurrence of H2S during drilling operations,

associated hazards and risk are considered for completeness of the study). Control measures for occurrence of blowout and H2S gas are discussed in following sub-sections:

6.6.2 BLOWOUT

The precautionary and control measures used for blowout prevention are discussed below:

- **Precaution against Blowout**

The following control equipments for drilling mud system should be installed and kept in use during drilling operations to prevent the blowout:

- A pit level indicator registering increase or reduction in the drilling mud volume and shall include a visual and audio –warning device near the driller stand.
- A device to accurately measure the volume of mud required to keep the well filled at the all times.
- A gas detector or explosimeter at the primary shale shaker and connected to audible or visual alarm near the driller stand.
- A device to ensure filling of well with mud when the string is being pulled out.
- A control device near driller stand to close the mud pump when well kicks.
- Blowout prevention drill shall be carried out once every week near the well during drilling.
- Suitable control valves shall be kept available near the well which can be used in case of emergency to control the well.
- When running in or pulling out tubing, gate valve and tubing hanger shall be pre-assembled and kept readily available at the well.

- **Precaution after Blowout**

On appearance of any sign indicating the blowout of well, all persons, other than those whose presence is deemed necessary for controlling blowout, shall be withdrawn from the well.

During the whole time while any work of controlling a blowout is in progress, the following precautions shall be taken:

- A competent person shall be present on the spot throughout.
- An area within the 500 meters of the well on the down wind direction shall be demarcated as danger zone.
- All electrical installations shall be de-energized.
- Approved safety lamps or torches shall only be used within the danger zone.
- No naked light or vehicular traffic shall be permitted within the danger zone.

A competent person shall ascertain the condition of ventilation and presence of gases with an approved instrument as far as safety of persons is concerned.

Two approved type of self containing breathing apparatus or any other breathing apparatus of approved type for use in an emergencyshall be available at or near the place,. Adequate firefighting equipment shall be kept readily available for immediate use.

- **Blowout preventor Assembly**

To prevent the blow out during drilling operations following steps should be taken:

- After the surface casing is set in a well no drilling shall be carried out unless blowout preventor assembly is securely installed and maintained.
- Blowout preventor assembly shall consist of:
  - One bag type of preventor for closing regardless whether drilling equipment is in the hole or not.
  - One blind ram preventor closing against an open hole.
  - One pipe rampreventor closing against drill pipe in use in the hole.

In blow out preventor assembly, two seamless steel pipes at least 50 mm of diameter connected below each set of blow out preventor, (one for bleeding off pressure and the other for killing the well) shall be provided. These pipes shall be straight and lead directly into the well.

Each pipeline shall consist of component having a working pressure equal to that of the blowout preventor.

- **Blowout Preventor (BOP) Control Units: Location and Conditions**

- BOP control units should be located at a distance of nearly 30 m from well center.
- Status of following should be checked and maintained in good condition:
  - Pressure gauges;
  - Pressure steel lines/fire resistant hoses;
  - Level of hydraulic oil;
  - Charging of unit; and
  - Availability of sufficient number of charged bottles.

- **Control System for Blowout Preventors**

- All manual control for manually operated blowout preventor shall be located at least 0.60 meters outside the derrick substructures. Instructions for operating the controls shall be posted prominently near the control wheel.

- A control of power operated blowout preventor shall be located within easy reach of driller floor:
- A remote control panel for blowout preventors shall also be installed around floor level at a safe distance from the derrick floor.
- All control for blow out preventors shall be clearly identified with suitable markers.

6.6.3 CONTROL MEASURES FOR H2S DURING DRILLING

❑ **H2S Detection System**

A four channels H2S gas detection system should be provided. Sensors should be positioned at optimum points for detection, actual locations being decided on site but likely to be:

- Well Nipple
- Rig Floor
- Shaker header tank
- Substructure cellar

The detection system should be connected to an audio visual (siren and lights) alarm system. This system should be set to be activated at a concentration of 15 ppm H2S.

The mud logging will have a completely independent detection system which is connected to an alarm in the cabin. This system will be adjusted to sound an alarm at a concentration level of 10 ppm H_2S as suggested in the Drilling and Production Safety Code for Onshore Operators issued by The Institute of Petroleum.

A stock of H2S scavenger will be kept at drilling site for emergency use.

❑ **Small Levels of H2S**

Small levels of H2S (less than 10 ppm) will not activate the well site alarms. Such levels do not create an immediate safety hazard but could be a first indication of high levels of H2S to follow.

H2S will cause a sudden drop of mud pH. The mud man will therefore organize and supervise continuous pH checks while drilling. Checks should be as frequent as required depending on ROP and always made following a formation change.

Following control measures will be taken in case of small level of detection:

- Add H2S scavenger to mud.
- Check H2S levels at regular intervals for possible increase.
- Inform all personnel of the rig about the presence of H2S and current wind direction.

- Commence operations in pairs.
- Render sub base and cellar out-of-bounds without further checking levels in this area.

❑ **High Levels of H2S**

Higher levels of H2S (greater than 10 ppm) do not necessarily cause an immediate safety hazard. However some risk does exist and, therefore, any levels grater than 10 ppm should be treated in the same manner. Occurrence of 10 ppm or greater H2S concentration will sound an alarm in the mud logging unit.

If higher levels of H2S greater than 10 ppm are found, following steps will be taken:

- Driller to shut down rotary and pumps, pick-up the string so that drill pipe is in the BOP and chain down the break.
- One pre-assigned roughneck will go to the doghouse and put on the breathing apparatus. All other rig personnel will evacuate the rig and move up wind to designated muster points.
- Driller and roughneck will return to the rig floor and commence circulating H2S scavenger slowly and reciprocating the pipe string.
- The level of H2S will be checked in all work areas. H2S scavenger will be added to the mud and circulated. If H2S levels drop, drilling will be continued with scavenger in the mud. Approximately 30 % of hydrogen peroxide (H2O2) solution will neutralize H2S gas in the mud at 20 gallon of H2O2 per 100 barrels of mud.

❑ **Control Measures for H2S During Experimental Production Testing**

H2S scavenging chemicals (caustic soda solution, calcium hydroxide or iron oxide slurry) will be continuously injected in the recovered gas/oil/formation water after pressure reduction through choke before sending the same to separator.

6.6.4 SAFETY SYSTEM FOR DRILLING RIGS

Operational Safety is the foremost concern while working on drilling rig. Derrick floor is the center stage of all the operations and it is most susceptible to accidents. Safety precaution with utmost care is required to be taken as per the prevailing regulation and practice 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 derrick floor. Various standards are required to be referred to cover the variety of equipment used for safe operation in drilling and become cumbersome at times to refer standards for each equipment.

- Twin stop safety device (crown-o-matic and floor-o-matic)

- Fall prevention device on mast ladder with safety belt.
- Emergency Escape device for top man.
- First aid box with Stretcher and Blanket.
- Fire bell /siren.
- Emergency vehicle.
- Fire extinguishers
- Flame proof portable hand lamp /safety torch
- Railling with toe board
- Guards on all moving parts.
- Breathing apparatus (wherever required)
- Gas detector for hydrocarbon gas & H2S gas (if required)
- Safety lines for power tongs
- Rotary brake
- Hoisting brake lever with safety chain
- Emergency shutoff system for draw works
- Safety chain for inclined ramp (to prevent fall of any person)
- safety belt for top-man with lane yard
- Railing on stair case at mud tank/walkways and derrick floor etc.

6.6.5 ENSURE AVAILABILITY AND PROVISIONS BEFORE SPUDDING OF THE WELL

To enhance the safety at the drilling rig during drilling operation following should be ensured:

- Geo-technical Order (GTO)/drilling program with shift in-charge;
- PPE for crew should be available;
- First aid box ;
- Wash pipe should be greased and after every 8 hours or as specified by the manufacturer;
- Kelly bushes to be greased after every 24 hours or as specified by the manufacturer;
- Lower & upper kelly cock (its operating lever should be kept at designated place at derrick floor);
- Kelly saver sub on Kelly;
- Mud check valve /full opening safety valve;
- BOP control panel on derrick floor;
- Before lowering casing, inspect all the instruments such as, weight indicator, pressure gauges, rotary torque, SPM counter, RPM counter mud volume totaliser, flow meter & trip tank;
- Required Number of drill collars and heavy weight D/Ps;

- Ensure availability of two mud pumps in good working condition;
- Rat hole and mouse hole be drilled; and
- Twin stop safety device should be made in working order.

6.6.6 GENERAL SAFE PRACTICES DURING DRILLING OPERATION

- Penetration rate shall be monitored. In case of any drilling break, stop rotary table, pull out the Kelly, stop mud pump and check for self flow;
- Different type of drill pipes should not be mixed up during making up the string;
- Protectors should be used on drill pipes while lifting and laying down the pipes on catwalk;
- Drill pipe rubber protector should be installed on drill pipes body while being used inside the casing;
- Before starting drilling, hole should be centered to avoid touching of kelly with casing / wellhead and ensure that no damage is done to well head and BOP;
- Continuous monitoring of the gain/loss of mud during;
- BOP mock drill should be carried during drilling / tripping and under mentioned operations;
- Safe Working Conditions and Practices to be Adopted During Drilling Operations; etc

6.6.7 EMERGENCY PREPAREDNESS

- BOP drills and trip drills should be done once a week;
- Deficiency observed in BOP drill should be recorded and corrective measures should be taken; etc

6.6.8 FIRE FIGHTING FACILITY FOR DRILLING RIG

To detect the release of hydrocarbon during exploration and testing, hydrocarbon detectors should be placed, so that control measures may be taken to prevent fire and explosion.

A temporary closed grid hydrant system with monitors, hydrant points and fire hose boxes may be installed to cover exploration wells, oil and gas production facilities and oil and diesel fuel storage tanks. Portable fire extinguishers of DCP, mechanical foam and CO2 types of sufficient capacity and in sufficient numbers along with sand buckets should also be placed at strategic locations.

Electrical and manual siren systems should be provided at the Security Gate of the experimental production facility. Electrically operated siren of 500 m range along with push buttons at appropriate locations to operate the siren should be installed.

Adequate personal protective equipments including sufficient number of breathing apparatus must also be kept ready in proper working condition.

Emergency control measures should also be adopted as per Mines Act 1952, Oil Mines Regulation 1984 and Oil Industry Safety Directorate Standard 2000.

As per Oil Industry Safety Directorate (OISD) Standard, for the drilling rigs and well testing following fire fighting system/equipments should be provided:

- Fire water system; and
- First aid fire fighting system.

❑ **Fire Water System**

- One water tank/pit of minimum capacity of 50 kl should be located at the approach of the drilling site.
- For experimental production testing, one additional tank/pit of 50 kl should be provided.
- One diesel engine driven trailer fire pump of capacity 1800 lpm should be placed at the approach area of drilling site.
- One fire water distribution single line with minimum 4 " size pipe/casing should be installed at drilling site with a minimum distance of 15 m from the well.

❑ **First Aid Fire Fighting Equipments at Drilling Rig**

Portable fire extinguisher will be installed as per IS: 2190 on the drilling rig. The minimum quantities of fire extinguishers at various locations should be provides as per the following:

Sl. No.	Type of Area	Portable Fire Extinguisher
1.	Derrick floor	2 nos. 10 kg DCP type extinguisher
2.	Main Engine Area	1 no. 10 kg DCP type extinguisher for each engine
3.	Electrical motor/pumps for water circulation for mud pump	1 no. 10 kg DCP type extinguisher
4.	Mud gunning pump	1 no.10 kg DCP type extinguisher
5.	Electrical Control Room	1 no. 6.8 kg CO_2 type extinguisher for each unit
6.	Mud mixing tank area	1 no. 10 kg DCP type extinguisher
7.	Diesel storage area	1 no. 50 lit mechanical foam
		1 no. 50 kg DCP type extinguisher
		2 nos. 10 kg DCP type extinguisher
		2 nos. sand bucket or ½ sand drum with spade
8.	Lube Storage Area	1 no. 10 kg DCP type extinguisher
		1 no. sand bucket

Sl. No.	Type of Area	Portable Fire Extinguisher
9.	Air Compressor area	1 no. 10 kg DCP type extinguisher
10.	Fire pump area	1 no. 10 kg DCP type extinguisher
11.	Near Dill In-charge Office	One fire extinguisher/shed with 3 nos. 10 kg DCP type extinguisher and 2 sand buckets
12.	Fire bell near bunk house	1 no. 10 kg DCP type extinguisher

6.6.9 MEDICAL FACILITIES

First aids should be made available at the core drilling site and a 24 hour standby vehicle (ambulance) should also be available at the well site for quick transfer of any injured personnel to the nearest hospital, in case an accident occurs and medical emergency arises. Prior arrangements should be made with the nearby hospitals to look after the injured persons in case of medical emergency during core hole drilling and experimental production testing operations.

6.7 DISASTER MANAGEMENT PLAN

6.7.1 INTRODUCTION

In view of the hazards associated with the Oil Exploration and Production industry, it is essential that a disaster control plan be evolved to effectively deal with the situation utilizing the available resources. There are many agencies involved in the activities associated with a disaster e.g. Government, Fire Service, Medical, Police, Army, Voluntary Organization etc.besides the various departments of the concerned organization itself which requires an organized multi - disciplinary approach to the problem. Oil & Natural Gas Corporation Ltd. is a public sector Oil Company presently engaged in the exploration, drilling and production of Crude Oil & Natural Gas from Offshore & Onshore fields. A&AA Basin, with its headquarters at Chinamara, Jorhat is responsible for entire hydrocarbon exploration activities of ONGC in Northeastern part of India.

For meeting the emergencies caused by major accidents, planning response strategies are termed as Disaster Management Plan (DMP). DMP cannot be considered in isolation or act as a substitute for maintaining good safety standards during drilling operation. The best way to protect against major accidents occurrence is by maintaining high levels of safety standards.

6.7.2 PURPOSE OF THE PLAN

The purpose of this Disaster Management Plan (DMP) is to set out the appropriate course of action to mitigate the impact of an emergency event. The plan provides for a procedure allowing all those involved to mobilize their resources in an orderly way and to react in time

effectively. Disaster, in present context means an occurrence resulting in uncontrolled release of oil & gas and other associated developments. Most disasters have three common characteristic features i.e. loss of control, unwanted release of energy and failure to arrest chain of events. These may result in loss of life, damage to property, adverse effect on the environment and ecological imbalance.

This plan therefore aims at :

1. *To visualize the possible emergency scenario that are likely to occur*
2. *To evolve a pre-planned methodology of carrying out various emergency combating plans*
3. *To prepare detailed responses for each type of emergencies*
4. *To train operating personnel by means of mock drills, so as to make them well acquainted with the response action*
5. *To minimize the damage to the environment during emergency*

The plan therefore, aims at immediate response to an emergency event to prevent escalation to a disaster and also the response in the event of such escalation.

Generally, the following five phases are involved in an emergency:

1. Discovery and Notification: An event with an imminent threat of turning into an accident must first be discovered and the discoverorquickly notifies the same to the plant safety officer.
2. Evaluation and Accident Control Initiation: Based on the evaluation of available information, the safety officer makes a rapid assessment of the severity of the likely accident and initiates the best course of action.
3. Containment and Counter Measures: Action is first taken to contain and control the accident by eliminating the causes which may lead to the spread of accident. Measures are also taken to minimize the damage to personnel, property and environment.
4. Clean-up and Disposal: After the accident is effectively contained and controlled, the cleanup of the site of the accident and safe disposal of waste generated due to the accident are undertaken.
5. Documentation: All aspects of accidents, including the way it started and progressed as well as the steps taken to contain and the extent of the damage and injury, must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment. It may be noted that

some aspects of documentation, such as, photographs of the site of accident and main objects involved in the accident, survey for damage estimation, etc. may have to be carried out before the cleanup and disposal phase. However, the effort in all cases is to recommence the operation as soon as possible.

6.7.3 CRISIS MANAGEMENT TEAM

ONGC will develop on site and off site emergency plan. These plans will consider linkages with local administration, local communities and other operators in the area to provide necessary support to ONGC to manage the emergency and also to disseminate information on the hazards associated with the emergency.

ONGC will follows safety guidelines and emergency response procedures as per the detailed regulations given in the Oil Mines Regulation 1984 and Oil Industry Safety Directorate (OISD) Standard 2000. However, we are providing a brief outline of a desirable onsite Disaster Management Plan (DMP). Proposed On site DMP is discussed in the following sub-sections.

6.7.4 EMERGENCY CLASSIFICATION

Severity of accident and its likely impact area will determine the level of emergency and the disaster management plan required for appropriate handling of an emergency. Emergency levels and the action needed for each level are indicated below:

6.7.4.1 LEVEL 1 EMERGENCY

Disaster would be one in which emergency response personnel within the installation would be able to contain and deal effectively with the disaster and its aftermath. In this level of emergency, the response is site specific where site personnel are involved and it takes into account the proposition that the situation is controllable with the help of resources available at site. An installation-specific ERP is available at each installation for this level.

6.7.4.2 LEVEL 2 EMERGENCY

Disaster would require efforts from ONGC resources at the work centres. Level II response is normally activated when the incident Coordinator reaches the site and after an assessment and taking initial actions decides that the situation requires still bigger response by higher authorities of the company, due to severity of the incident, lack of resources or adverse media publicity, community response etc. From this point, the steps of this DMP are applicable.

6.7.4.3 LEVEL 3 EMERGENCY

Disaster would be of such a magnitude that it would be beyond the containing ability of work centre and would require mobilisation of resources through local administration, mutual aid agencies and State / Central Govt. assistance. The CEC (Chief Emergency Co-ordinator) then activates the offsite DMP.

An accident involving a very serious hazard and with likely impact area extending beyond 500 m from the operational area, that is, drilling area limits, such as, major fire, very large release of inflammable material. Major fires will usually have the triggering effect resulting in the propagation of explosion. In a level 3 emergency, evacuation of population in villages, if any, adjoining the operational area may sometime become necessary if threatened area extend to populated village area adjoining the site of the primary accident in a direction of maximum impact.

6.7.4.4 LEVEL 4 EMERGENCY

Disaster response is initiated when the Company authorities after implementation and assessment of emergency procedures decides that the local resources are not capable to cope-up with the emergency situation. There are adverse business implications and the situation is worsening and drawing more and more adverse reactions which would require the intervention of Corporate & National level. For such responses, Corporate DMP has been prepared and available at each installation.

Finally, since every emergency situation is unique in characteristics, the exact plan would be decided by the competent authorities. This plan would, at best, serve as guide for drawing the exact plan.

On-site Disaster Management Plan (DMP) will meet the hazards created due to all Level 1 emergencies and most of the Level 2 emergencies. In addition to on-site DMP, off-site DMP may also have to be put into operation for some Level 2 and all Level 3 emergencies.

Luckily the maximum vulnerable zone may not be extended much beyond exploratory drilling and testing area due to blow out and fire around HSD storage area in a sparsely populated area around chosen drilling locations. Therefore, Level 3 Emergency requiring evacuation of surrounding village population is not applicable in case of drilling and testing area. Even the Level 2 emergency is likely to be confined within a limited distance from the drilling site and HSD storage area, the evacuation of personnel only from affected area will be required. Even under the worst accident scenario, evacuation of less than 30 persons may be involved

and damage, if any, to nearby installations is expected to remain confined within the operational area.

6.7.5 LEGAL REQUIREMENTS FOR DISASTER PLANNING

Relevant statutory requirements, as given below and asamended from time to time, inter alia, are applicable for emergency response preparedness in E&P industry:

1. *Oil Mines Regulation (OMR), 1984*
2. *Central Electricity Authority Regulation, 2010*
3. *Manufacture, Storage and Import of Hazardous Chemicals (MSHIC) Rules, 1989*
4. *The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996*
5. *Explosives Rules, 2008*
6. *Atomic Energy (Radiation Protection) Rules, 2004*

Additionally, all statutory requirements notified by the Central Government or States, from time to time, shall be complied with, as applicable. Clause-72 of Oil Mines Regulations (OMR), 1984 requires the Mines owner to formulate a contingency plan for fire and clause-64 requires development of an emergency plan for petroleum pipelines specifying actions to be taken in the event of fire, uncontrolled escape of petroleum from pipelines. Also, Clause - 45(3) requires preparation of emergency plan for blow-out of oil and gas wells. The rules on "Chemical Accidents (Emergency Planning, Preparedness and Response) – 1996 compliments the set of rules on accident prevention and preparedness notified under the Environment (Protection) Act, 1986, in 1989 entitled "Manufacture,Storage and Import of Hazardous Chemicals Rules"and envisages a 4-tier crisis management system in the country.

6.7.6 ON-SITE DISASTER MANAGEMENT PLAN

The On-site Disaster Management plan is activated in case the emergency requires mobilization of resources from the A&AA Basin. This plan is activated by the Chief Emergency Coordinator (CEC). Basin Manager of A&AA Basin is the CEC at Basin level and will exercise control through the Basin Emergency Control Room (ECR).

6.7.6.1 EMERGENCY ORGANIZATION

The existence of a well-defined emergency organization is the most vital part of an emergency preparedness plan drawn up to combat any emergency situation. On-site emergency organization chart (Fig 6.4) will be appropriately activated and made functional while combating an emergency situation. The core action group of the emergency organization comprises of the various functionaries of the Basin.

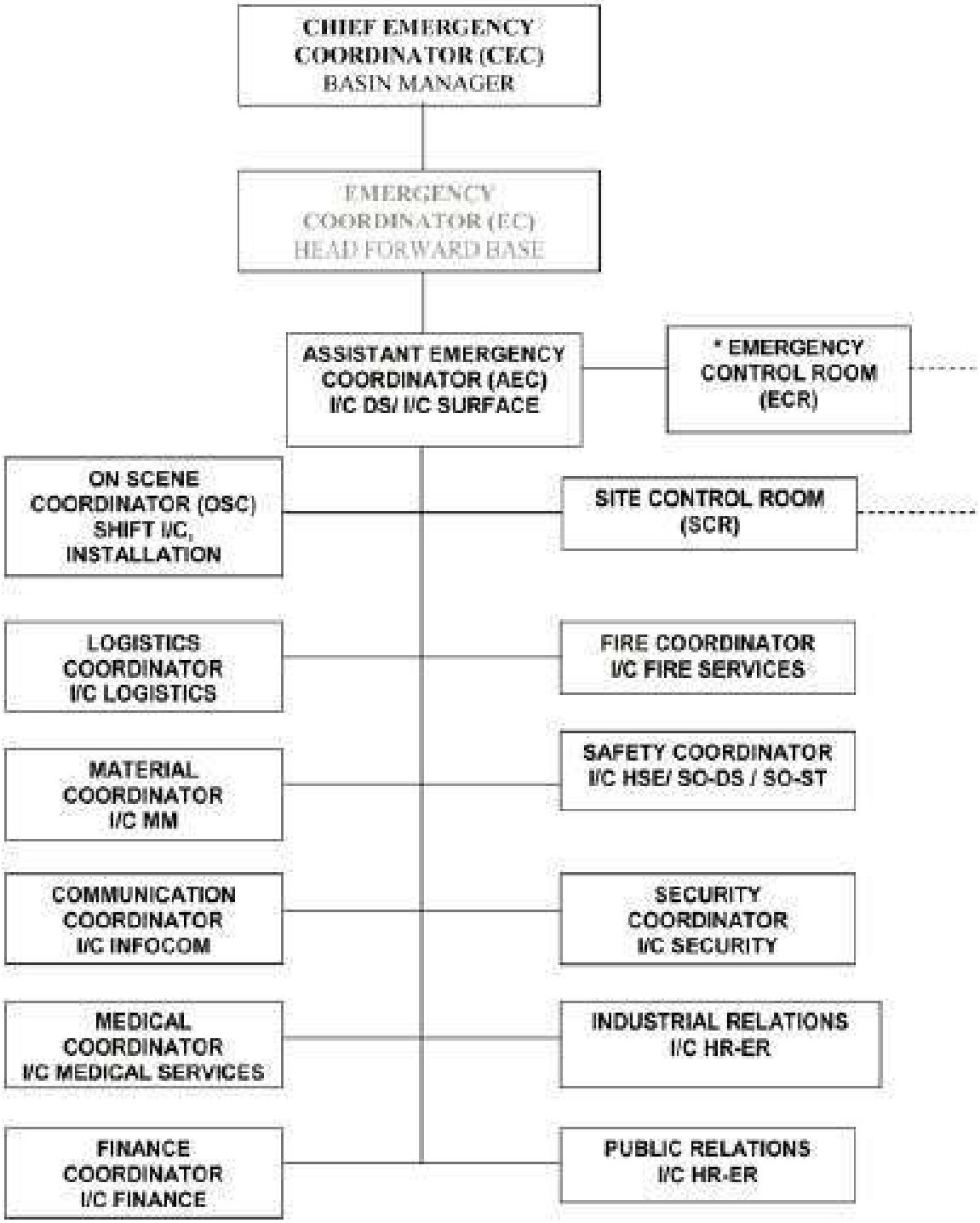
The Basin Manager, A&AA Basin is head of the On-site emergency organization and is designated as the Chief Emergency Coordinator (CEC) at Basin level. He will exercise control through the Basin Emergency Control Room (ECR). The CEC is assisted by an expert team drawn from various disciplines.

The Chief Emergency Coordinator (CEC) will assume control through the Assistant Emergency Coordinator (AEC). The Chief Emergency Coordinator (CEC) may appoint Head Drilling Services / Head Well Services/Surface Area Manager as Assistant Emergency Coordinator (AEC).

The AEC will have the following expert representatives / services to function under his direct control and provide all the necessary assistance and inputs of men and material.

Chief Emergency Coordinator (CEC)	*Basin Manager, Assam & Assam Arakan Basin*
Assistant Emergency Coordinator	*Head - DrillingServices /Well Services / Geophysical Services and Surface Are Manager*
On-Scene coordinator (OSC)	*Shift I/C in the initial phase & Installation Manager RIC in the intermediate phase*
Logistics Coordinator	*I/C Logistics*
Safety Coordinator	*I/C HSE*
Material Coordinator	*Support Manager*
Medical Coordinator	*I/C Medical Services*
Finance Coordinator	*I/C Finance*
Security Coordinator	*I/C Security*
Fire Safety Coordinator	*I/C Fire Services*
Communication Coordinator	*I/C Infocom Services*
Public Relation Coordinator	*I/C Corporate Communication*
Welfare Coordinator	*I/C Industrial Relations*

FIGURE 6.4: ORGANIZATIONAL SETUP FOR THE ON-SITE DMP

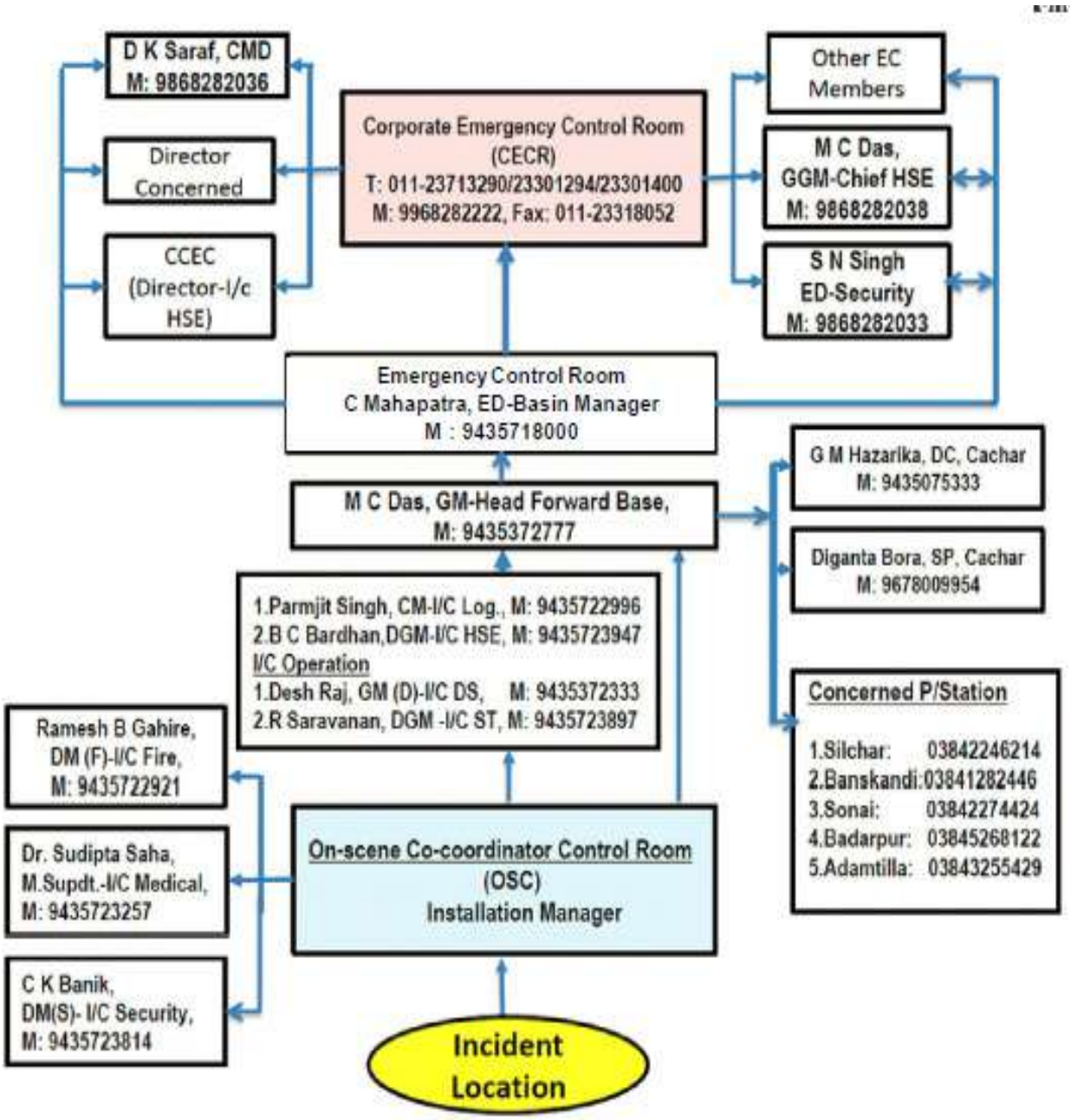


6.7.6.2 EMERGENCY CONTROL ROOM

An Emergency Control Room is the place from where the operation to handle the Emergency are directed and coordinated. The ECR should be equipped with good

communication facilities like Telephone (2 nos.), Radio Equipment, Wall Chart showing Locations of Installations, fire station, copy of the Disaster Management Plan, List of Key personnel, their addresses and telephone numbers, note pads etc.

Drilling Oil Mines	*ECR will function from Drilling Services Control Room, Jorhat.*
Production&Work Over Oil Mines	*ECR will function from Surface Team Control Room, Jorhat*
CACHAR FORWARD BASE	*ECR will be established in Srikona Office Complex*



6.7.6.3 ORGANIZATION DURING EMERGENCY

- **Site Control Room (SCR)**

LOCATION: In case of Emergency at Site, a Site Control Room will be set up at a safe distance near the Site by the Mines Manager.

DUTY OFFICER: A team consisting of two – four officers not below E-4 to E-5 level will be deputed in SCR on 12 hr. Shift basis by the Mines Manager, assisted by equivalent number of E-0 to E-2 level officers. In case of Emergency in Surface Team installations, the concerned Mines Manager will nominate Duty Officers at the time of Emergency. List of Duty Officers for Drill site / Installation Emergency is given in Annexure-I.

FACILITIES: Emergency vehicle, Communication facilities, Mobile Van, Ambulance, Lighting arrangement and Food shall be provided at the SCR in the minimum possible time.

FUNCTIONS: Assessment of situation and requirements, for mobilization of equipment/resources etc.

- ✓ To pass on the information regarding latest positions to Emergency Control Room
- ✓ To keep record of all decisions and messages received
- ✓ To keep records of all materials received at site during Emergency.

- **Emergency Control Room (ECR)**

DUTY OFFICERS: Head of services will depute Two Officers not below E-4 level on 12 hrs. Shift in ECR. The names of the Duty Officers are given in Annexure-I

One Finance Officer of E-4 or above level will also be deputed in ECR by concerned Head of services/ Head of Finance to extend financial concurrence for rescue operations, procurement of various materials required to handle the Emergency.

FUNCTIONS:

- ✓ Command and Control of entire operations.
- ✓ Information to all officers as per standing list given in Annexure-1
- ✓ Round the clock monitoring and flow of information to & from the site of emergency.
- ✓ Maintenance of running record of events & action taken Casualty list & information to next of Kin.
- ✓ Preparation of Management Report on the situation at every 12 hr. interval.
- ✓ Co-ordination with the key personnel for guidance and assistance required at site.
- ✓ Co-ordination with other Oil companies
- ✓ Co-ordination with Local authorities– Police, Civil Administration, Hospital & Fire etc.
- ✓ Sanction and procurement of the items required during emergency.

- ✓ Arrangement of food, water, shelter, medicine & logistics etc.,
- ✓ Information to Public.
- ✓ Co-ordination with Regions / Projects and Head – Quarter.
- ✓ Co-ordination with fire brigade & fire tender facilities available with different organisations nearby.

- ❑ **On Scene Coordinator (OSC)**

At initial stage, someone close enough to the scene of Emergency (Installation Manager / DIC / senior most people) will exercise as On Scene Coordinator. He will take the charge of the situation immediately before Mines Manager reaches the site and takes over from him.

In case of unmanned location, anyone noticing the hazards will inform the control room on receipt of the information. The control room will direct at least two persons from the nearest installation to visit the site with walkie–talkie and safety torch.

RESPONSIBILITIES:

The responsibilities of the OSC are as follows

- ✓ Initial assessment at the spot and need for mobilization of resources.
- ✓ Inform Emergency Control Room in case, the communication is lost due to disaster. Seek assistance from nearby rig or installation for communication.
- ✓ In case of fire, commands the fire fighting operations till fire service assistance reaches on the scene.
- ✓ Arrange ambulance & doctor if required.

- ❑ **Chief Emergency Coordinator (CEC)**

The Head of the concerned Operational Group will be the Chief Emergency Coordinator and will exercise control through ECR. He will keep record of messages and decisions taken to control the Emergency. He will also appraise the Basin Manager from time to time on steps taken to control the situation and status of Emergency.

- ❑ **Crisis Management Team (CMT)**

The Crisis Management Team of ONGC is headed by Head CMT Corporate stationed at Mumbai and comprises of four Regional Teams stationed at Rajahmundry, Mumbai, Baroda & Sivasagar headed by the respective Head RCMT. In A&AA Basin there is an additional CMT consisting of three officers, stationed at Jorhat base office.

REGIONAL CRISIS MANAGEMENT TEAM (RCMT)

Regional Crisis Management Team comprises of officers having experience in handling major emergency. The RCMT is expected to be informed within 30 minutes of occurrence of incident by the Mines Manager / Emergency Control Room. The Team will immediately proceed to the location and take action to bring the situation under control.

FUNCTION OF THE RCMT:

- ✓ Familiarise itself thoroughly with the manual and its implications.
- ✓ To plan strategies for different Crisis situation so that all necessary inputs can be mobilized without loss of time. Frequent mock drill to be carried out.
- ✓ In the event of Crisis, go to the scene of emergency, assess the situation and take over all fronts out and / or fire up to the point of normalizing the well.
- ✓ Determine the type of assistance required for handling the emergency.
- ✓ To seek guidance and assistance from coordinator group.
- ✓ Updating the action plan of Disaster management on the basis of their experience.
- ✓ Keep them well informed of the technical development through various journals / magazines, suggest scope of improvement in equipment and practices.

- **Support Services Group**

The Support Services Group will comprise of coordinators from Central Workshop, Electrical, Civil, Logistics, E&T, Health Services and HR/ER, Geology and Reservoir etc. They will provide all necessary help required by emergency control room / Site Control Room / RCMT be in constant touch with Emergency Control Room and may have to stay at the site of Emergency. The name & telephone numbers of the coordinators are given in Annexure-I.

TABLE 6.2: FUNCTIONS AND RESPONSIBILITIES

Sl.No.	Coordinator	Functions/ Responsibilities
1	Support Manager (HR)	Relief and welfare operations ✓ To identify location of relief camp at a safe distance from the affected area and arranegement for shelter (Tent, cot, chair, blanket etc) ✓ To arrange food, drinking water, beverage at relief camps ✓ Maintenance of record of Casualties ✓ Coordinate with local Authorities
2	Fire Service	Monilise fire fighting persons and equipments to the site
3	Info-com (E&T)	✓ Ensure communication facilities ✓ Set up Emergency communication (Walkie-talkie, VHF etc) at the Site Control Room
4	Electrical	Arrangement of Emergency DG and Flame proof lighting at

		the site
5	Logistics	Arrangement of transport facilities, cranes, moles etc. for men and materials
6	Central Workshop	Aarrangement of fabrication of any device or gadget on priority as required by Emergency team
7	Material Management	✓ To assist in issuing of materials ✓ Arrangment of equipmen, materials, expertise etc., as per requirement of ECR
8	Civil	Civil jobs such as construction of temporary road, control of Oil spread by sand bags or digging of pits, water pumping and storage arrangements etc.
9	Chemistry	Arrangement of chemicals and additives required for mud preparation
10	Medical (Health Service)	Mobile first-aid team with adequate medical facility and ambulance at emergency site
11	Security	✓ Deployment of Security personnel at vulnerable locations ✓ Cordoning off the affected site Police Help
12	Sub Surface Team (Geology & Reservoir)	To assist in Geological/ Reservoir information about the well
13	Helicopter Services	To seek permission of Chief Emergency Coordinator/ H-ES for shifting of seriously injured persons to Hospitals by Helicopter
14	Corporate Communication (CC)	Press Briefing with approval of Basin Manager

6.8 CONTINGENCY PLAN TO PREVENT BLOW-OUT

The following actions shall be taken by the Shift – in charge to bring the situation under control.

A. On experiencing Kick, following safety actions to be taken, if BOP fails to seal Well Mouth

Sl.No.	Situations	Actions
1	Alert crew to ensure escape if situation worsens	Shift I/C
2	Divert flow partially, intermittently or fully to waste pit (safe distance)	Drilling crew
3	Send SOS message to Base Office, (i) By EPABX (II) By Emergency Vehicles	Shift I/C

Sl.No.	Situations	Actions
4	Switch off all engines/ generators	I/C Mech/ Elect
5	Remove all inflammable material away	Rig Crew (Drilling/ Mech./ Elect.)
6	Remove important Records to Safe place	Rig Crew (Drilling/ Mech./ Elect.)
7	Remove costly instruments/ equipments to safe place	Rig Crew (Drilling/ Mech./ Elect.)

B. If the Blow out issudden and massive while initial safety action could not be performed

Sl.No.	Situations	Actions
1	Carry out rescue operation for Top man and move other Rig crew to safe distance	Shift I/C
2	Send SOS message to Base Office, (i) By EPABX (II) By Emergency Vehicles	Shift I/C
3	Reorganise to try operations like BOP, Diversion of flow etc. as listed in (A), if situation permits	Shift I/C
4	If heavy spillage occurs, try to contain in the restricted area	Shift I/C
5	Alert the inhabitants, if private residence near	Geologist/ Chemist

As soon as an Emergency is declared and the site is evacuated, Site Control Room will be established near the Drill site at a safe distance.

When well is out of control, blow-out will be declared. The contingency plan for prevent blow-out is given Figure 6.5.

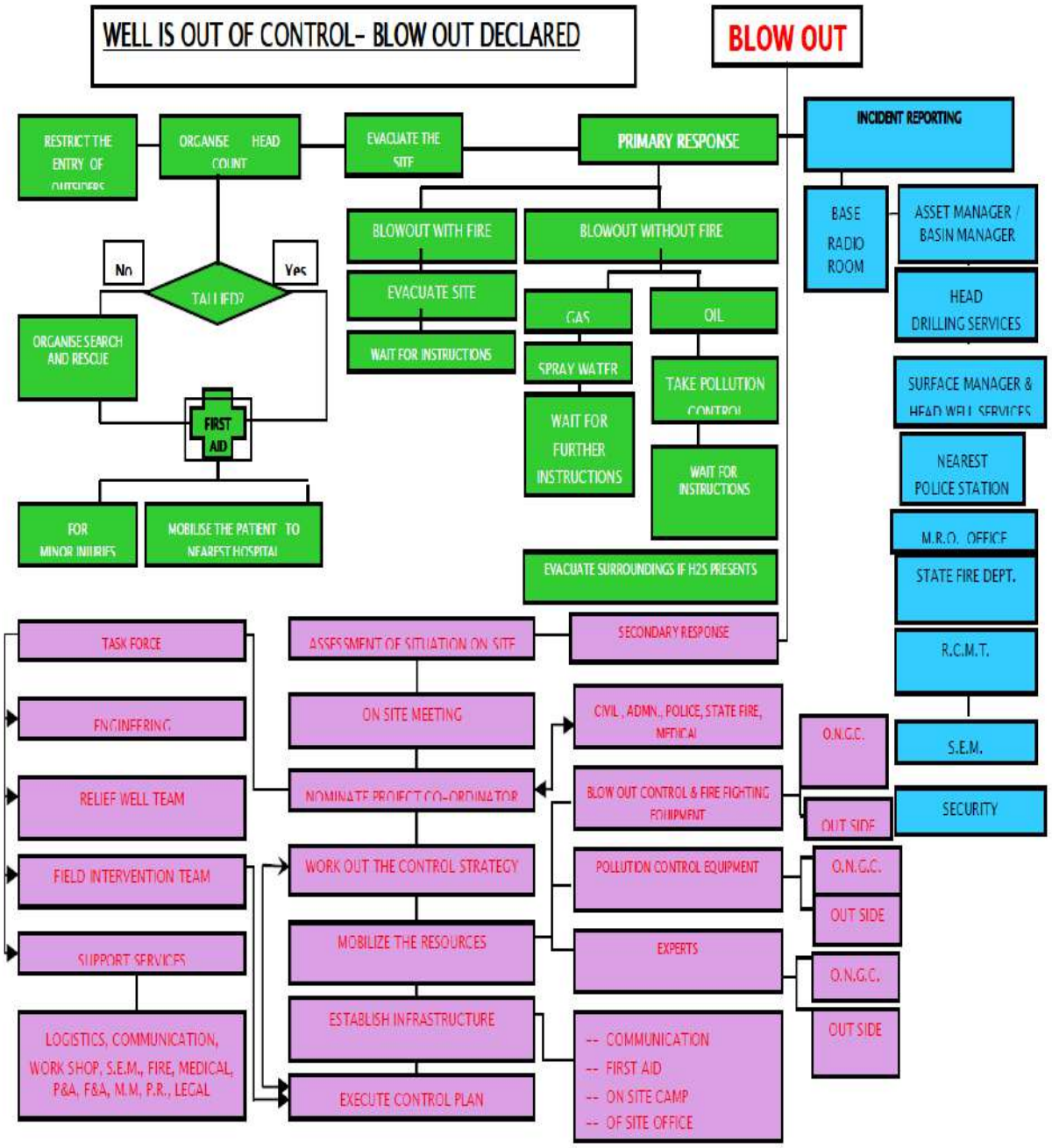


FIGURE 6.5: CONTINGENCY PLAN TO PREVENT BLOW-OUT

6.9 CONTINGENCY PLAN TO PREVENT TERRORIST ATTACK

In the recent years, activities of the militant organization in the North East region has been increased manifold and incident of militant attack on oil installations, Telephone exchanges, Police Stations, Electrical Sub Stations, Air Force Stations and on Armed Force personnel have been experienced. In such incidents huge properties are at stake & number of lives are at risk. In view of the same it is essential to prepare a plan to effectively deal with the situation utilizing the available resources. Also, there is a need for appropriate action by the existing force contingent, Local Govt., Fire Service, Medical, Police, Army and various departments of ONGC, A&AA Basin, Jorhat for organized and appropriate approach for the problem arisen.

Sl.No.	Situations	Actions
1	Immediately inform Shift I/C or Post commander CISF at site, I/C security control room of the site. Further he will also sound alarm to alert people	First Person notice
2	Quickly communicate the message by means of VHF, HF set/ Telephone personally to the nearest Police Station/ CISF/ CRPF/ ARMY/ Assam Police as the case may be & ONGC Security Control Room	Sift I/C, First Person noticed
3	The I/C control room on receipt of such information will inform Commandant CISF, ED Basin Manager, Head Security, I/C Fire of ONGC and Local Fire Bridget, DC & SP of the district	First Person noticed/ Control Room
4	Alert everybody in the site	First Person noticed
5	Immediately instruct/ advice the staffs to adopt appropriate measures to save themselves and to minimnize the possible loss/ damage	First Person noticed
6	He will also ensure evacuation of the staff affected by the attack and rescue them to safer place whatever is possible. He shall also advice people to assemble at the specified assembling point.	First Person noticed
7	Inform all First Line Managers/ Base Fire Station/ Base Control office. Information should be given to the Sector Commander, CISF, Borholla and Sarupathar as the case may be for immediate action by CISF	First Person noticed
8	Try to save lives and property	Security I/C, Shift I/C
9	In case of fire try to extinguish with available resources. Simultaneously inform nearest fire station	First Person noticed
10	The place of attack should be evacuated and isolated	First Person noticed
11	In case all communication system failure, information to be passed personally by any other means	Sift I/C, First Person noticed

Sl.No.	Situations	Actions
12	Entry at Main gate should be regulated	Security I/C
13	First aid and Madical treatment should be provided if required	Medical officer

6.10 FIRST AID FACILITIES

6.10.1 SPECIFIC SAFETY PROVISIONS FOR THE SAFE FIRST AID PROCEDURES

First Aid Kits are to be maintained at each installation/ WorkCentre as per OISD GDN-204.

S No	Name of Item	Quantity	Units	Purpose
1.	Tincture Iodine	30	ml	Cuts/ Wounds
2.	Tincture Benzoin	30	ml	Cuts/ Wounds
3.	Rectified Spirit	30	ml	Clean wounds
4.	Antiseptic Solution (e.g. Dettol, Savlon)	100	ml	Clean wounds
5.	Cotton Absorbent	1	Roll	
6.	Dressing gauge, sterile	6	Packets	
7.	Bandage, roller	2"	6 nos	
8.	Bandage, roller	4"	6 nos	
9.	Adhesive plaster	2"	1 roll	
10.	Scissor, stainless steel	4"	1 nos	
11.	Blade, new	12	nos	
12.	Bandage, Triangular	3	nos	
13.	Medicinal Adhesive strip (eg. band Aid)	24	nos	
14.	Tab Paracetamol (eg. Crocin)	10	nos	Fever,body/head ache
15.	Tab Antacid (eg. Digene)	10	nos	Indigestion
16.	Tab Antispasmodic (e.g. Cyclopan)	10	nos	Pain Abdomen
17.	Tab Salt	24	nos	Vomiting
18.	Tab Anti emetic (vomiting, e.g. Avomine)	10	nos	
19.	Oral Rehydration Solution (e.g. Electoral)	12	12 sachets	Lose motion
20.	Antibiotic skin powder (e.g. Nebasulph)	2	nos	Dressing of wounds
21.	Antibiotic eye drops (e.g. Sophramycin)	2	nos	
22.	Antibiotic skin ointment (e.g. Neosporin)	2	nos	
23.	Assorted sized Splints	4	nos	Immobilisation
24.	Tourniquet	1	nos	Stop bleeding/Snake bite

6.10.2 ADMINISTRATION OF ARTIFICIAL RESPIRATION

1. Put victim on back, tilt his head back to get a straight neck.
2. Place thumb in the mouth, fingers on outside of lower jaw. Pull jaw upward.
3. Open your mouth wide open, place firmly your mouth over the mouth of victim while your free hand pinches nose of the victim shut.
4. Blow with some force into the adult victim's chest (gently in child) until the movement is seen.
5. Repeat this 12 times a minute (20 times a minute for child).
6. If still some blockade is noticed, then turn adult victim on side, give sharp blow on shoulder blades several times, clean his mouth, reposition the head of victim for artificial respiration and try again and again.
7. In case of child, to clear the blockades, hold the child upside down by feet on your arm, child's face downand give it several sharp pats between shoulder blades, clean mouth of the victim, reposition its head and give artificial respiration. If victim is vomiting, turn his head, clean the mouth and resume artificial respiration.

6.10.3 ELECTRIC SHOCK

After releasing victim, loosen the clothes, and extinguish all clothing that may be smouldering. Stop bleeding once by applying a suitable bandage. Ascertain whether the victim has sustained any burns, and if he is breathing. Examine the burns, and lay the victim in a suitable position. If possible, arrangement may be made to send for a doctor, but start Artificial respiration without the least waste of time, if breathing is stopped. Method to adopt: - When there are no burns on the chest or abdomen use Schaffer's Prone Pressure method. If there are burns, use Silvestre's method.

6.11 CONTACT PHONE NUMBERS IN CASE OF EMERGENCY

1. CRISIS MANAGEMENT TEAM (CMT)

Name	Designation	Telephone No.	
		Office	Mobile
Debashish Pramanik	GM(D)-Head CMT	022- 24088209 022-24088935 (fax)	9969222371
RCMT-SIVASAGAR			
P Babu Rao,	DGM(D)-Head	45501	9435716881
Anil Kumar,	CE(M)	45447	9435717237
G Srinivas,	CE(P)	45511	9435716697
SE(D)	SE(D)	45504	9435717393
Subrato Das,	DYSE(D)		9435717223
AV Ramarao,	DYSE(D)	45506	9435716969
Sanjeev Kumar,	DYSE(D)	45502	9435717238
Jagroop Yadav,	EE(D)	45424	9435716793
BR Konwar,	EE(M)		9435717224
PC Rabha,	EE(D)		9435716145
CMT-JORHAT			
Subhash Babu Sharma	CE(D)-I/C CMT	0376-2707258	9435718930
Jiten Yien,	SE(D)	0376-2707302	9435718497
PC Bora			9435718071

2. EMERGENCY CONTROL ROOM (DRILLING SERVICES)

Name	Designation	Telephone		
		Office	Residence	Mobile
D. Bhattacharyya	DGM (D)-I/C Safety, DS	7358	7736	9435718271
S. J. Dutta,	SE (D)	7280	7280	9435718075
Shri B. K. Das	Dy. SE (D)	7308	7846	9435718135

3. EMERGENCY CONTROL ROOM (SURFACE)

Name of Employee	Designation	Office	Mobile
Dr. A. K. Samant	DGM (Chem.)	7591	9435718283
Sushil Chandra Kalita	SE (P)	7596	9435718774

4 EMERGENCY CONTROL ROOM (WELL SERVICES)

Name of Employee	Designation	Office	Mobile
A.J. DAS	DGM (P)	7598	9435992708
S.N. BORPUZARI	CE (P)		9435992706

5. ENGINEERING SERVICES

Name of Employee	Designation	Telephone		
		Office	Residence	Mobile
D.K.Goswamy.	DGM(Civil)	7390	7773	9435718710
N.K.PANDIT	CE (E)	7632	7793	9435718023

6. IMPORTANT TELEPHONE NUMBERS OUTSIDE AGENCIES

6.1 DIRECTOR GENERAL OF MONES SAFETY

Agency	Tel No. Office	Tel No. Resi/Mob.	Fax No.
Director General of Mines Safety, Dhanbad	0326- 2221000	0326-2221041	0326- 2221027
Director General of Mines Safety, Sitarampur	0341- 2510713	0341-2510713	0341- 2510717
Director of Mines Safety, Guwahati- Mr. D. K. Sahu	0361- 2550129	9435674412	
DDMS, Digboi	03751- 264371	03751-264371	03751-264456

6.2 POLLUTION CONTROL BOARD ASSAM

AGENCY	TEL NO: Office	MOBILE
Member Secretary, PCBA, Guwahati	(0361)–2652774	
Regional Exe. Engineer, PCBA, Golaghat	(03774)-280039	**8811013007**
Regional Exe. Engineer, APCB, Shivasagar	(03772)-222823	

6.3 OIL INDIA LTD.

Sh.A.K.Acharya, Head Safety & Environment, Duliajan (0374) 2800542 (0374)2800433

6.4 OISD (DELHI)

NAME	DESIGNATION	TEL NO: Office
Shri Hirak Dutta,	Executive Director	0120-2593800/33
Shri Tarsem Singh	Director(E&P)	0120-2593832

7. IMPORTANT TELEPHONE NUMBERS A&AA BASIN, JORHAT. STD Code: 0376

NAME	DESIGNATION	OFFICE	
		BSNL	EPABX
ONGC Health Centre,Cinnamara		2360031	7554 / 7555
ONGC Dispensary(Jorhat City)		2320810	
L S Sehdeva	CM(S), I/C-Security, Nazira		41009
Shri D.K.Taye	DM(S), Sivasagar		41020
Dinesh Kumar	CM (Fire),I/C Fire, Shivasagar		45854
Nitya Dutta	Sr Fire Officer , Nazira		41755
Ramesh B Gahire,	DM-I/C Fire Services-Silchar	03842-254281	5556
C K Banik,	DM, I/C Security		
N C Das,	FO, Silchar		5557
Security control room, Cinnamara		2361513	7213
Fire control room, Cinnamara			7086/7088
CISF control room, Cinnamara		2360113	7424 / 7256
Transport control room, Cinnamara			7676 / 7677
Wireless control room, Cinnamara			7630
Production control room, Cinnamara			7592
Fire station, Borholla GGS			7650 / 7654
Fire station, Koraghat GGS II			7688 / 7690

13. CACHAR FORWARD BASE – Contact Numbers

Junction line Tel No: 229018/229019/229020/229021/229030 FAX: 03842-254044, 0382-254546, ICENET FAX: 7762-4202 Wireless Control Room: Extn. 4212 P&T – 268532

Name	EPABX	DIRECT	Direct #	MOBILE	RESIDENCE
Mukul Chandra Das GM (Geology)- Head Forward Base	5400	285400	254548	9435372777	229044
Bimal Chandra Bardhan DGM(CHEM) I/C Mis	5402	285402		9435723947	229050
HR-ER					
K.R.Narayanan Chief Manager (HR)- I/C HR	5500	285500	254549	7086007000	
FINANCE					
Naveen kumar Sidana CM(F&A) I/C F&A	5520	285520		9435723677	229028
INFOCOM SERVICES					
Akhilesh DGM(E&T) I/C INFOCOM SERVICES	5570	285570	254544	9435372444	229040
LOGISTICS & AUTO					
Parmjit Singh, CM(Logistics) I/C Logistics	5561	285561		9435722986	264229
Transport Control Room	5609	285609	254547		
MATERIAL MANAGEMENT					
Rajvinder Singh (CM)-I/C (MM)	5536	285536		9435723845	
FIRE SECTION					
Ramesh B Gahire, DM(Fire Services),I/C Fire Services.	5556	285556	254281	9435722921	229033
N C Das, FO	5555	285555		9435706871	
Fire Control Room	5555	285555	254281		
SECURITY SECTION					
C K Banik,DM, I/C Security	5557	285557		9435723814	222034
M K Das, Sr SO	5558	285558		9435723889	
Security Control Room	5666	285666			

MEDICAL SERVICES					
Dr.Sudipta Saha, Medical Supdt.	5567	285567		9435723257	229026
Dr. P S Ghosh (MO)	5569	285569		9435723459	
DRILLING SERVICES					
Desh Raj, GM(Drilling)- HDS	5600	285600	254543	9435372333	229025
DRILLING					
Chandan Paul, DGM(Drill)	5630	285630		9435723245	222125
Gopal Choudhary,DGM(D)	5541	285541		9435723953	229047
V.N.Rao, DGM(D) LM(D)	5602	285602		9435723804	265248
Amitabha Majumdar, DGM(D)	5613	285513		9435723943	264138
E-I400-XII-Drilsite		381	2909501		
E-1400-XII-DSA		381	2909503		
Rig E-760-IX Drill site (WLL)		03843-211751			
Rig E-760-IX DSA (WLL)		03843-211494			
CFB (IP PHONE)				862-500 / 862-502	
FCT RIGXI				9435723851	
FCT RIGXII				9435723852	
CEMENTING					
Kamal Kumar Jotwani, DGM(D), LM-Cmtg	5630	285630		9435723800	267161
DRILLING- ELECTRICAL					
B P Singh, DGM(E)	5603	285603		9435722905	267025
DRILLING- INSTRUMENTATION					
Swamy Venkateshwar ,SE	5609	285809		9435723908	
DRILLING- MECHANICAL					
M Akilan, DGM(Mech)	5608	285608		9435723899	267065
U H Adhatrao, SE(M)				9435722924	
MUD SERVICES					
Ambreish Kumar, Chief Chemist LM-(MUD)	5445	285445		9435722643	
ENGINEERING SERVICES					
B N Jayasimha, DGM(Civil)	5450	285450		9435723514	264493
ELECTRICAL					
S Bhattacharjee, SE(E) I/C Electrical	5441	285441		9435723825	
MECHANICAL					
P.B. Ezhil Kandavel,CE(Mech)	5440	285440		9435723904	
SURFACE					
R Saravanan, DGM(Prodn)	5650	285650		9435723897	268005
S K Swain, CE(P)	5652	285652		9435722998	
Rakesh Kumar, CE(P)	5654	285654		9435723783	
Adamtila GCS (WLL)		03843-211508			
Adamtila GCS (IP PHONE)		862-200			
Baskandi EPS (LL)		03841-266888			
Baskandi EPS (WLL)		03842-218426			
Panchgram, BP#16 (LL)		03844-273986			
Geology					
D. Lokanath, DGM (Geolo)	5420	285420		9435723495	264401
H.K Singha, Chief.Geophy(S)	5592	285592		9435722610	

PUBLIC UTILITIES					
Location	**BSNL Numbers**				
Cachar Cancer Hospital	235135				
Fire Brigade, Silchar	101	245801			
Green View Nursing Home	234043	238406			
Lions Eye Hospital	237977	237978	231601		
Mediland Hospital	230145				
Mousami Hospital	230152				
Nightangale Hospital	230626				
SMC Casuality	234196	233832			
South City Hospital	240991				
Valley Hospital	242847				

14. IMPORTANT TELEPHONE NOS. OF KEY PERSONNEL, CACHAR FORWARD BASE:

Name of Key Personnel	STD Code	Tel. No. Office	Tel Residence	Fax Number
Dy. Commissioner, Cachar	03842	245056	245054	03842-233905
ADC Cachar	03852	233831	236747	
Dy. Commissioner, Karimganj	03843	262345	262103	03843-264150
Dy. Commissioner, Hailakandi	03844	222251	222204	03844-244496
Circle officer, Hailakandi	03844	222268	--	--
DIG(SR) Silchar	03842	254911	261825	03842-245911
Sup. of Police, Cachar, Silchar	03842	245866	245057	03842-231525
SDPO Lakhimpur	03842	267536	--	--
ASP Cachar	03842	245860	237398	--
Sup. Of Police, Karimganj	03843	262371	262030	--
ASP, Karimganj(HQR)	03843	262823	262821	--
S.P ,Hailakandi	03844	222242	222492	03844-223846
S.P Kailasahar (Tripura)	03824	2222392	2322236	--
SDPO,Dharmngr (Tripura)	03822	220309	220309	--
ASP, Karimganj(Nodal Officer)	03842	262624	262818	--
ADIG (CID) GUWAHATI	--	--	--	2547648
IGP (security) GUWAHATI	--	--	--	2380620
SP (Guwahati)	0361	2546286		
Law & Order IGP (GHY)	0361	2455126		

CHAPTER 7

ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

CHAPTER 7: ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

7.1 PREAMBLE

Environmental Management Plan is the key to ensure that the environmental quality of the area does not deteriorate due to the proposed exploratory drilling.

The Environment Management & Monitoring Plan (EMMP) focuses on direct impacts, which are identified as having the potential to cause significant impacts on the environment and identifies:

- Specific control measures that will be taken to prevent, reduce or manage the environmental impacts during proposed activities; and
- Where it is not possible to specify these at this stage, the level of environmental performance that will be expected during proposed activities.

ONGC's management is committed of using best environment management practices during proposed exploratory drilling of wells. ***ONGC*** will ensure that environmentally critical actions are undertaken as per the various regulatory requirements. There will be an Environment Management Cell (EMC) overseeing all environment and safety responses to ensure that implementation of mitigation measures and monitoring programme including findings / recommendation of third party audit and monitoring results.

❑ **Corporate EHS Policy**

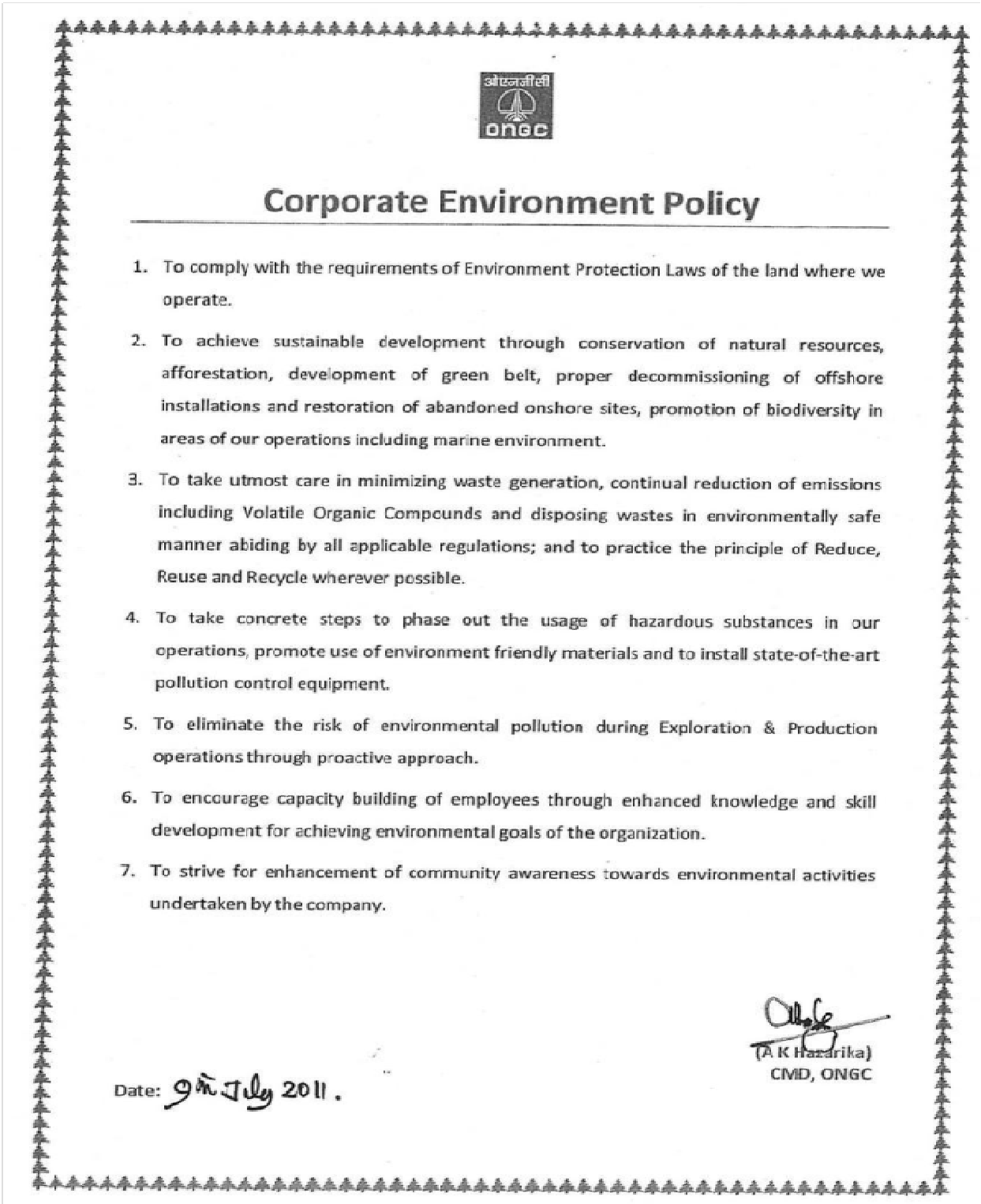
The corporate Environmental and Health Safety & Environment policies of ONGC are as per depicted in Figure 7.1 & Figure 7.2 respectively.

7.2 GOOD NEIGHBOUR PRACTICES

A number of probable negative impacts on environment due to exploratory drilling have been identified. These impacts can be mitigated or neutralized if proper environmental control measures are undertaken. It may be noted that there needs to be specific environmental clauses in the contract for contracted work to ensure maintaining environmental quality.

ONGC is dedicated to responsible development of oil and natural gas resources. Responsible development includes good relationships with neighbors and a commitment to environmental protection and compliance with all applicable federal, state, and local regulations.

FIGURE 7.1: CORPORATE ENVIRONMENT POLICY OF ONGC



Corporate Environment Policy

1. To comply with the requirements of Environment Protection Laws of the land where we operate.
2. To achieve sustainable development through conservation of natural resources, afforestation, development of green belt, proper decommissioning of offshore installations and restoration of abandoned onshore sites, promotion of biodiversity in areas of our operations including marine environment.
3. To take utmost care in minimizing waste generation, continual reduction of emissions including Volatile Organic Compounds and disposing wastes in environmentally safe manner abiding by all applicable regulations; and to practice the principle of Reduce, Reuse and Recycle wherever possible.
4. To take concrete steps to phase out the usage of hazardous substances in our operations, promote use of environment friendly materials and to install state-of-the-art pollution control equipment.
5. To eliminate the risk of environmental pollution during Exploration & Production operations through proactive approach.
6. To encourage capacity building of employees through enhanced knowledge and skill development for achieving environmental goals of the organization.
7. To strive for enhancement of community awareness towards environmental activities undertaken by the company.

(A K Hazarika)
CMD, ONGC

Date: 9th July 2011.

India's energy anchor

ONGC

Oil and Natural Gas Corporation Ltd.

Assam & Assam Arakan Basin, Jorhat

স্বাস্থ্য, সুৰক্ষা আৰু পৰিবেশ নীতি

১. আমি ফলদায়ক সম্ভাব্য HSE বিপদ ব্যৱস্থাপনাৰ জৰিয়তে পেশাগত, স্বাস্থ্য, সুৰক্ষা আৰু পৰিবেশ সংৰক্ষণৰ উচ্চতম মানদণ্ড বজাই ৰখাৰ প্ৰতি প্ৰতিশ্ৰুতিবদ্ধ।

২. আমি বজাই ৰাখিব পৰা বিকাশৰ হেতু পেশাগত স্বাস্থ্য, সুৰক্ষা আৰু পৰিবেশ সংৰক্ষণ আগবঢ়াই নিবলৈ সকলো প্ৰযোজ্য আইন, নিয়মাবলী, মান তথা আবশ্যকীয়তাখিনি মানি চলিম।

৩. আমি সফল আৰু আধুনিক জৰুৰীকালীন প্ৰতিক্ৰিয়া আঁচনিৰ জৰিয়তে জৰুৰী অৱস্থাৰ প্ৰত্যাহ্বান জনাবলৈ সদায় সতৰ্ক সুসজ্জিত তথা সাজু থাকিম।

৪. আমি পৰিবেশ প্ৰদূষণ লাঘৱ কৰিবৰ উদ্দেশ্যে বিপৰজ্জনক পদাৰ্থৰ আকস্মিক নিৰ্গমণ পৰিহাৰ কৰিবলৈ ব্যৱস্থা তথা প্ৰণালীৰ অখণ্ডতা ৰক্ষাৰ বাবে সকলো আবশ্যকীয় কাৰ্য্য হাতত লম।

৫. আমি পেশাগত স্বাস্থ্য, সুৰক্ষা আৰু পৰিবেশ সংৰক্ষণৰ উদগনিৰ হেতু সকলো হিতাধিকাৰীৰ মাজত সজাগতা আৰু অংশগ্ৰহণ বৃদ্ধি কৰি যাম।

৬. আমি আন্তৰাষ্ট্ৰীয় মাপ-কাঠিৰ সৈতে লক্ষ্য নিৰ্ধাৰণ কৰিম আৰু সুৰক্ষা-সংস্কৃতিৰ নিৰবচ্ছিন্ন উন্নতিৰ উদগনি যোগাবলৈ চেষ্টা কৰিম।

স্বাক্ষৰ/-

(ডি. কে. চৰাফ)

তাৰিখঃ ৭ আগষ্ট, ২০১৪ অধ্যক্ষ তথা পৰিচালন সঞ্চালক

स्वास्थ्य, संरक्षा एवं पर्यावरण नीति

1. हम प्रभावी एचएसई जोखिम प्रबंधन के जरिए व्यावसायिक स्वास्थ्य, संरक्षा एवं पर्यावरण संरक्षण के उच्चतम मानकों को कायम रखने के लिए प्रतिबद्ध हैं।

2. हम भारणीय विकास हेतु व्यावसायिक स्वास्थ्य, संरक्षा एवं पर्यावरण संरक्षण को बढ़ावा देने के लिए सभी लागू विधानों, संहिताओं, मानकों और अपेक्षाओं का अनुपालन करेंगे।

3. हम प्रभावी एवं अद्यतन आपाती अनुक्रिया योजना के माध्यम से आकस्मिक घटनाओं पर कार्रवाई करने के लिए सदैव सतर्क, उपकरणों से सुसज्जित और तत्पर रहेंगे।

4. हम पर्यावरणीय प्रदूषण को कम से कम रखने के लिए जोखिम भरे तत्वों के दुर्घटनावश रिसाव का परिहार करने के लिए उपकरण और प्रणाली संपूर्णता के संरक्षण के लिए सभी आवश्यक कार्रवाई करेंगे।

5. हम व्यावसायिक स्वास्थ्य, संरक्षा एवं पर्यावरण संरक्षण को बढ़ावा देने के लिए सभी हितधारकों में जागरूकता और सहयोग की भावना बढ़ायेंगे।

6. हम अंतरराष्ट्रीय बेंचमार्कों के प्रति लक्ष्य निर्धारित करेंगे और सतत सुधार हेतु सुरक्षा संस्कृति को बढ़ावा देने का प्रयास करेंगे।

(दि. के. सरफ)

दिनांक: 7 अगष्ट, 2014 अध्यक्ष एवं प्रबंध निदेशक

HSE Policy

1. We are committed to maintain highest standards of occupational health, safety and environ- mental protection with effective HSE risk 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 occu- pational health, safety and environment protection.
6. We shall set targets against the international benchmarks and strive to promote safety culture for continual improvement.

(D. K. Sarraf)

Date: 7th August, 2014 Chairman & Managing Director

FIGURE 7.2: HSE POLICY OF ONGC

To be a "good neighbor" in the areas, three objectives are to be followed:

- Protection of public safety;
- Protection of the environment; and
- Respect for the property rights of others.

These objectives shall be achieved through use of sound management processes as part of the responsibility to act as a "good neighbor."

- **Listen to the land owner or surface user concerns and respond appropriately**
  - Respect rights-of-way;
  - Take precautions to protect livestock;
  - Take precautions not to harm wildlife with our operations;
  - Drive safely;
  - Report damages to public or private property to the appropriate parties;
  - Maintain production equipment and systems; and
  - Train personnel on the rules and regulations applicable to operations.
- **Communicate with land owners and surface users**
  - Be willing to discuss issues with respect to surface use rights and compensation due to temporary loss of crops and others;
  - Designate a company contact person who is responsible for responding to community questions;
  - Listen to and discuss the concerns of the land owner or surface user affected by operations; and
  - Attempt to notify the landowner or surface user when commencing significant activity that will impact their land.
- **Respect the property and the rights of others**
  - Minimize surface disturbances;
  - Take precautions to protect livestock with appropriate measures;
  - Practice good housekeeping;
  - Remediate and restore the site in a timely manner in compliance with applicable regulations; and
  - Drive responsibly on public and private roads.
- **Promote safety of the general public**
  - Train personnel in safe operating practices;
  - Conduct emergency planning where applicable; and
  - Post signage and warnings in accordance with regulations.

- **Protect the environment:**
  - Train personnel on environmental protection in compliance with applicable regulations; and
  - Maintain equipment and utilize good work practices;
  - Seek to understand the land owner, and surface user concerns and possible questions regarding:
  - Groundwater aquifers and surface water;
  - Air quality;
  - Wildlife and livestock protection;
  - Housekeeping;
  - Noise;
  - Surface disturbance;
  - Noxious weeds and brush; and
  - Follow regulations for waste management and environmental protection.

7.3 ENVIRONMENT CONTROL MEASURES (ECM)

Details of proposed ECM during exploratory drilling of wells in addition to mitigation measures mentioned in Chapter-2 and Chapter-4, are as per given in **Table 7.1** respectively. This is subjected to be modified as per condition(s) stipulated by MoEF&CC and ASPCB.

7.4 ENVIRONMENT MONITORING PROGRAM (EMP)

Prior to exploratory drilling of Twenty Six (26) wells, the following aspects shall be identified and information used in consultation with the relevant parties (e.g., Administrative authorities, Department of Archaeological Survey, Divisional & local Forest and Irrigation Departments, and all concerned State government agencies) for logistical and planning purposes with respect to affected area.

- Ecological details;
- Land use pattern;
- Details of land ownership;
- Details of habitat and other infrastructure;
- Pollution and waste management;
- Safe working practices;
- Rehabilitation (when applicable);
- Employment;
- Compensation; and

- Cultural heritage

ONGC is committed to implement good environmental and community management practices to be able to ensure site-specific environmental, social impacts of project actions are understood and minimized. During the period of exploratory drilling of wells, ***ONGC*** would evaluate and assess aspects as given above on regular basis through its field management personnel and prepare a monthly monitoring report.

Environmental monitoring and audits will be carried out before, during & after the proposed exploratory drilling of wells to check that the environmental management measures are being satisfactorily implemented and that they are delivering the appropriate level of environmental performance.

7.4.1 ROLE OF ONGC

ONGC has the ultimate responsibility for implementing the provisions of the EMP. The role includes ongoing management of environmental impacts and measuring environmental performance through inspections/audits and monitoring. The contractor performance as well as development of mechanism for dealing with HSE is an integral part of the environment management. It is recommended that HSE requirements shall be made integral part of contract document and prior to tender for assigning any contract.

7.4.2 ROLE OF CONTRACTOR

ONGC's management shall be responsible for the performance of all it's contractors/sub-contractors and ensuring that all commitments and policy requirement are translated into contractor's requirements and implemented to the full intent and extent of ***ONGC***'s commitment.

TABLE 7.1: ENVIRONMENT MANAGEMENT PLAN DURING EXPLORATORY DRILLING OF WELLS

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
1	Land Use	• Site selection; • Acquisition of land on lease for exploratory drilling and access road; • Preparation of site and access road; and • Decommissioning & Restoration	• Consult local authorities and other stakeholders regarding preferred location for drilling sites, camps and access/maximize use of existing infrastructure. • Where possible use existing road/water infrastructure. • All necessary protocols shall be followed and legal requirements shall be implemented with respect to local regulation pertaining to use of land; • Mark out the site boundaries to ensure that land taken is restricted to pre-agreed area; • Minimize the disturbance of vegetation present in and around area proposed to be used, if any; • Minimum utilization of land and clearing of site; • In-house audit before and after exploratory drilling: etc	ONGC/ Contractor
2	Ecology	• Preparation of site and access road • Mobilization and demobilization of drilling rig and others; • Test flaring; • Camp site; • Decommissioning & Restoration etc.	• Siting to minimize impacts on ecology, water resources, and landscape. Consider using site that has been cleared/disturbed previously or of low ecological value, or which may be more easily restored, e.g., agricultural land; • Choose site to encourage natural rehabilitation by indigenous flora/avoid removal of vegetation and topsoil/preserve topsoil, and seed source for restoration after decommissioning. • Mark out site boundaries; • Avoid uprooting vegetation to the possible extent; • Take account of topography, natural drainage and site runoff. Ensure adequate and proper drainage. • Ensure proper handling and storage of fuels and hazardous materials. • For cleared areas, retain top soil in stockpile where possible on boundary of drilling site for subsequent re-spreading onsite during restoration; • Retain vegetation on edge of site to serve as seed bank for future site re-	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
			vegetation during restoration; • Minimize cleared area and size of site/maximize perimeter to area ratio to aid natural re-vegetation. • Use hand cutting to clear vegetation initially—where necessary be selective in using machinery. • All bulldozer operators involved in site preparation shall be trained to observe the defined site boundaries; • Kerosene oil/LPG shall be used for domestic purpose; • Distance in case of test flaring as suggested in Chapter-2 shall be maintained; • Initially land shall be taken on temporary basis and shall be returned back to owner after restoration, in case no economic findings of petroleum hydrocarbons otherwise shall be acquired for development and production activities; • In-house audit before and after exploratory drilling operation: etc	
3	Water Resources	• Preparation of site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well • Camp site; and • Decommissioning & Restoration.	• Siting to minimize impacts on water resources; • Avoid areas prone to flooding; • Where water courses and aquifers are deemed sensitive, consider a fully sealed site, avoid use of mud pits, preferentially use steel tanks, but if used must be lined. Pits if used must be lined; • Consider aquifer protection and proper plugging; • Adequate water supply arrangement shall be made at drilling site and camp site; • Continuous attempt shall be made to avoid wastage and leakage of water; • Continuous attempt shall be made to optimize/reduce the use of water;. • Drilling shall not be carried out during monsoon season; • If an aquifer is breached, the drilling crew can cement the hole to prevent leakage; etc • Toilets and bathrooms on temporary basis shall be provided at drilling and	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
			camp site; and • In-house audit before and after exploratory drilling: etc	
4	Air Emissions (Dust and gaseous emission)	• Preparation of site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring; • Operation of DG sets • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	• Emission from flaring of petroleum hydrocarbons, DG sets and other machinery shall confirm the standards as prescribed by MoEFCC/APCB; • Well testing (flaring) to be undertaken so as to minimize impacts of emissions by ensuring: ○ duration of testing minimized by careful planning; and ○ high combustion efficiency, smokeless flare/burner to be used. • Any dry, dusty materials (chemicals, construction materials etc) shall be stored in sealed containers and fenced storage yard; • Detectors for CH_4 and H_2S shall be placed at adequate locations; • Arrangement of water spray at drilling site and access road to the possible extent shall be made; • Preventive maintenance of vehicles and machinery; • Regular testing of the combustion efficiency of the vehicles/machinery; and • Regular monitoring and In-house audit as per details given in this chapter.	ONGC /Contractor
5	Noise and Vibration	• Preparation of drilling site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring; • Operation of DG sets; • Traffic movement; • Camp site; • Decommissioning &	• Selection of low noise generating machinery/equipment; • Engineering specifications for machinery/equipment shall be stipulated during tendering as a condition for contractor to maintain noise level not more than 85 dB(A) at 1 m from each source; • Provision of rubber padding/noise isolators/silencers to modulate the noise generated by machinery/equipment, wherever possible; • Use experienced and skilled personnel; • Train personnel of standard operating procedures for handling and shooting of explosives; • The high noise zones within ROW shall be demarcated and temporary enclosures & barriers, if required shall be provided; • Provision of protective devices like ear muff/ plugs to the workers; • Preventive maintenance of machinery/equipment and vehicles;	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
		Restoration; etc	• All employees shall be encouraged to cooperate in using agreed safe work practices; • Information on noise, the risks of exposure to noise and the appropriate control measures shall be disseminated in a manner appropriate to the workplace; • All employees shall receive appropriate training and education as and when required; • In no case, workers shall be exposed more than 85 dB (A) at 1m from source; • Regular monitoring and In-house audit as per details given in this chapter; etc.	
6	Water Quality	• Preparation of drilling site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring; • Operation of DG sets; • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	• Incorporate drainage and minimize disturbance to natural drainage patterns. Engineer slopes and drainage to minimize erosion. Design for storm conditions/ensure offsite natural runoff does not wash over site/use perimeter drainage ditches. • Potable ETP shall be used to treat the process waste water while domestic waste water shall be discharged to soak pits. • All the debris resulting from the site shall be isolated from the waste water and disposed off separately; • Seal bund and ensure proper drainage of machinery areas, fuel and chemical storage, and mud mixing areas; • Provide base material compatible with local ground conditions. Hard core should be laid on geo-textile membrane. Avoid concreting sites; • Protect water courses from contamination and siltation; • Protect groundwater from drill stem penetration and shallow aquifers from possible site contamination; • Where water courses and aquifers are deemed sensitive, consider a fully sealed site, avoid use of mud pits, preferentially use steel tanks, but if used must be lined. Pits if used must be lined;	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
			• Mud and burn pits, if used, must have adequate contingency capacity especially for rainfall, and must be fully lined and bunded. • At camp site, effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials to be used for fuel lubricants and chemicals storage area; • Non-contaminated and potentially contaminated run-off shall be kept separately. Non-contaminated run-off shall be routed to off-site areas via silt traps. Potentially contaminated surface run-off shall be routed through oil traps; • The storage areas shall be inspected and cleaned at regular intervals; • Oil drip pans shall be used wherever there is significant potential for leakage including, but not limited to; o Electric generator engine, DG sets, earth moving machinery/equipment etc; o Compressors, pumps or other motors; o Maintenance areas; o Fuel transfer areas; etc • All spills/leaks to be contained, reported and cleaned up immediately; • Oil absorbent /spill containment material to be deployed to contain large spills; • Adequate sanitary facilities shall be provided; • Minimize suspended solids loads to watercourses by installing appropriate surface run-off drainage systems (e.g., silt traps); • No untreated discharge to be made to water course/land; and • Regular monitoring and In-house audit as per details given in this chapter.	
7	Soil quality	• Preparation of access road and clearing of drilling site; • Mobilization and	**<u>Soil Erosion</u>** • Minimize area and extent of site clearance, by staying within defined boundaries; • Stockpile of topsoil wherever possible at the edge of site;	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
		demobilization of drilling rig and others; • Drilling and completion of well; • Camp site; • Decommissioning & Restoration; etc	• Limit erosion potential/avoid steep slope and drainage courses/avoid cut and fill techniques/incorporate proper drainage, culverting and bridging techniques; • Avoid removing undergrowth where possible so as to retain land stability; **<u>Fuel, Lubricants and Chemical Management</u>** • All fuels, lubricants, surface treatment materials, welding rods/ gases, chemicals etc to be placed in controlled storage i.e. properly fenced area and in clearly marked vessels and containers; • Storage and liquid impoundment areas for fuels, construction materials, solvents, chemicals and waste should be designed with secondary containment (e.g., dykes and berms) to prevent spills and the contamination of soil, groundwater, and surface waters; • Impervious liners shall be in place for fuel, lubricants and chemicals storage area; • Impervious liners shall be in place for pits for storage of drill cutting and mud; • Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials to be used for fuel lubricants and chemicals storage area; • Non-contaminated and potentially contaminated run-off shall be kept separate. Non-contaminated run-off will be routed to off-site areas via silt traps. Potentially contaminated surface run-off shall be routed through oil traps. • In-house audit shall be carried out before and after exploratory drilling operation.	
8	Disturbance to community resources &	• Preparation of site and access road; • Mobilization and	• Advance notice to local administration about the activities; • Minimize use of roads by planning vehicle movements; • Proper cordon off the site with sign boards;	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
	safety	demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring; • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	• Adequate communication with locals which may be impacted during exploratory drilling; • Diversion of traffic, if required; • Placing the warning board on the vehicles during transportation of machinery and materials; • Proper training to drivers about public safety. • Spray down dirt roads if too dusty; • In-house monitoring and audit; etc	
9.	Employment and Socio economic	• Loss to local habitants due to land acquisition on temporary/permanent basis; • Direct and indirect employment; • Loss due to test flaring; • Utilization of local available resources; etc	• Preference shall be given to locals for temporary direct and indirect employment; • Local employment (unskilled) should be provided in a manner, giving fair representation to all section; • Where ever local skilled labour is available, should be preferred to be hired for the respective job; • Local suppliers for machineries and construction materials shall be given preference; • Local transporters shall be preferred for transportation of machinery/materials. • Close monitoring on the type of loss to local habitats, if any. In case of any loss to locals, adequate compensation shall be provided as per the law or on mutually agreed terms; • Third part audit after completion of activities;	ONGC /Contractor
10.	Culture, Aesthetics and Archaeological sites	• Preparation of site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and	**<u>Culture</u>** • Discourage interaction of outsiders with locals, however if any issue arises, Senior officials of ONGC/ Contractor should communicate with the elders/ sarpanch of village and settle down the issue; • All workers should respect the local norms of communities.; • Control workforce activities, e.g. hunting, interaction with local population.	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
		completion of well' • Test flaring; • Operation of DG sets; • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	Purchase food from recognized local suppliers, not directly from local people without evaluating implications; • Monitoring and control of activities of work force that may affect women in the villages; • No interruption to culturally important sites; • Contractor should not utilize the local village's drinking water resources and must not damage the existing infrastructure; • Community complaint registers must be placed at site and all complaints to be documented and strict compliance to be undertaken; • Consultations with locals must be done by the contractor before making access roads; etc **<u>Aesthetics</u>** • Strict compliance to Environment Management Plan (EMP) ; • Camp should be constructed away from sensitive habitats; etc **<u>Archaeological sites</u>** • Due care should be taken in case drilling site selected is near to any archaeological site; • Immediately cordon off the area in case of new discovery of archaeological sites. Contact local administration, police and cultural and archaeological departments and handover the site to these departments; etc	
12	Occupational Health & Safety	• Preparation of site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring;	• Due care shall be taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated during drilling operation to the possible extent; • Any worker found to develop symptoms of dust related diseases will be changed over to other activities in cleaner areas; • General Safety Measures: ○ Employees shall be provided with helmets, safety boots, eye and ear protection, and snug fitting gloves as appropriate;	ONGC /Contractor

Sl. No.	Component	Main Source of Risk	Mitigation Measures	Primary Responsibility
		• Operation of DG sets; • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	○ Masks and dust-proof clothing shall be provided to personnel; and ○ Procedures shall be strictly enforced for the drilling, storage, handling, and transport of explosives, flammable and hazardous materials. ❑ General Health Measures: ○ Sanitary facilities shall be well equipped with supplies and employees shall be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens; ○ Personnel required to work in areas with high humidity shall be allowed to take frequent breaks away from these areas; and ○ Pre-employment medical examinations of all personnel shall be made mandatory for contractor.	
13	House keeping	• Preparation of site and access road; • Mobilization and demobilization of drilling rig and others; • Drilling and completion of well; • Test flaring; • Operation of DG sets; • Traffic movement; • Camp site; • Decommissioning & Restoration; etc	• The facilities should be kept clean, maintained, and operated in a safe and environmentally sound manner; • Facilities should be cordoned off in a manner to prevent access to the facility by the general public, livestock, where appropriate; • Signs should be posted in conspicuous locations to notify employees and the public of any dangerous situations such as, flammable conditions, high voltage, and toxic; • All equipment should be painted and/or kept clean to present an acceptable appearance and to provide protection from external corrosion; • Waste receptacles should be provided at appropriate locations for collecting discarded paper, rags, etc. and emptied on a regular basis; etc	ONGC /Contractor

7.5 SPILL MANAGEMENT

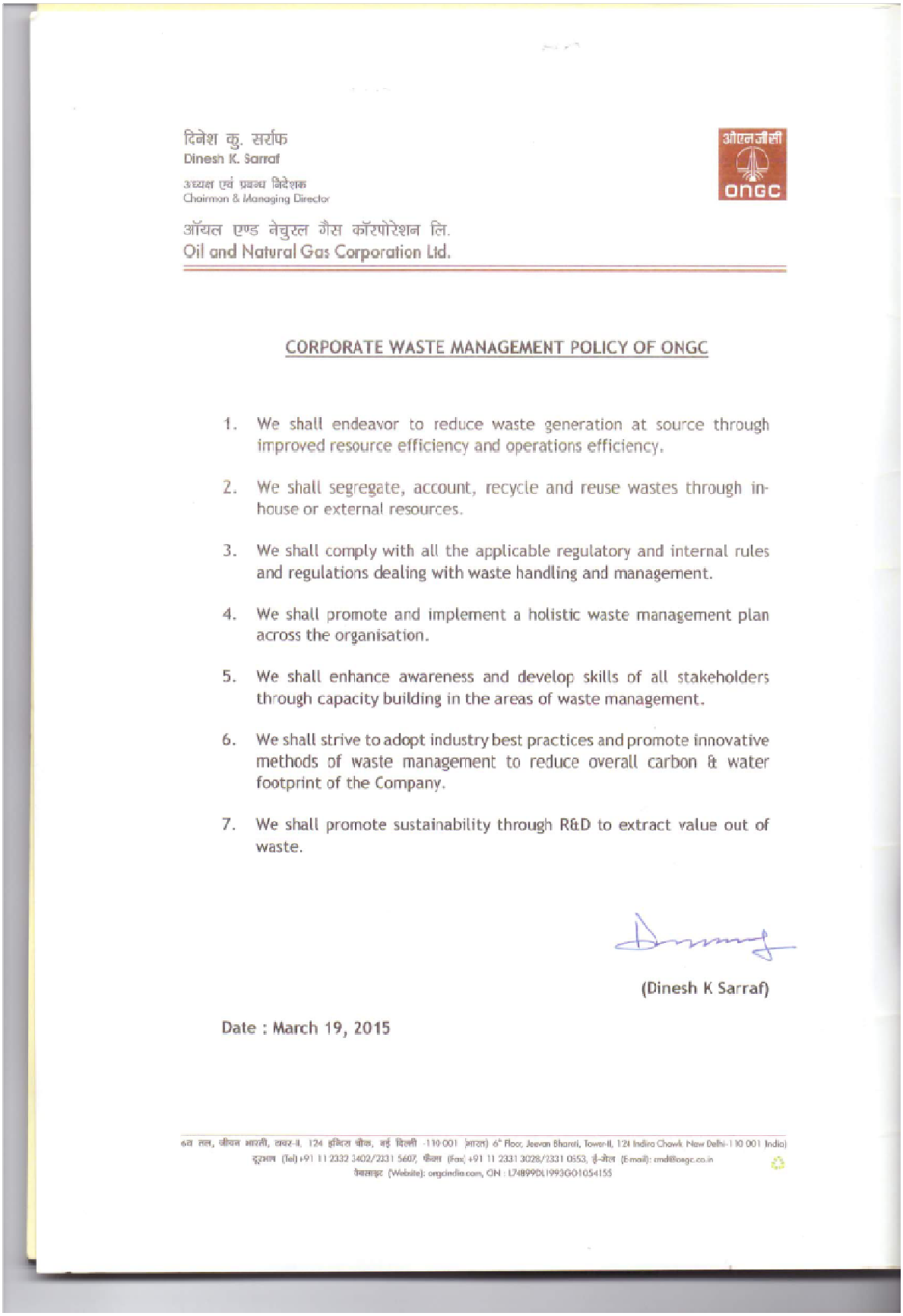
A number of chemicals and Oil (diesel) will be stored on site, improper handling or accidents are likely to result in spills which have a potential for contaminating the land and water. ONGC would develop and educate the Contractors/personnel working to prevent such spills and also develop a proper spill response and management plan. As best practices to avoid/contain any spill ONGC would ensure:

- All chemicals are stored within the designated area. To an extent possible all such areas would away from drainage channels;
- The flooring of the storage area should be impervious (paved or HDPE lining) and bunding to be provide on all sides of the chemical storage areas;
- The chemical storage area to be covered to ensure it has the minimum runoff;
- All transfers of chemicals to be done with proper care and under the supervision of the Store supervisor.;
- Fuelling will take place in designated areas and no oil transfers will occur, unless adequate protection is in place
- ONGC's spill management plan would aim to control the spill to a limited area and take necessary mitigative actions. The following additional measures will be implemented for spill management:
    - Spill management plan for each substance/chemical to be stored shall be in place based on its hazardous properties. MSDS for each substance/chemical to be stored shall be available;
    - Adquate training shall be provided on spill management plan of each chemical to be stored;
    - Adequate PPE and resources shall be provided;
    - First step as containment of spill of a sunstance/chemical shall be done by applying necessary absorbent like saw dust for a liquid spill;
    - Thereafter, the substance/chemical will be properly collected and stored in a separate labeled container marked "hazardous waste – do not burn";
    - Truck it away to the hazardous waste pit site and dispose it.

7.6 WASTE MANAGEMENT PROGRAMME

The Waste Management Plan (WMP) is applicable for all process and non-process waste streams which are generated during various phases of ONGC's proposed exploratory drilling of hydrocarbons in all 5 Blocks. The major waste streams covered under this plan includes drill cuttings, waste drilling mud cuttings, rig wash water, kitchen waste and other wastes. In addition, used/ spent oil and lead acid batteries generated from the proposed project activities and will be dealt as per the ONGC's Waste Management Policy.

The Waste Management Plan 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 corporate HSE Policy & Corporate Waste Management Policy (Figure 7.3). The plan also outlines roles and responsibilities of both ONGC and the contractors involved in the implementation of the plan.



दिनेश कु. सर्राफ
Dinesh K. Sarraf
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लि.
Oil and Natural Gas Corporation Ltd.

ओएनजीसी ONGC

CORPORATE WASTE MANAGEMENT POLICY OF ONGC

1. We shall endeavor to reduce waste generation at source through improved resource efficiency and operations efficiency.
2. We shall segregate, account, recycle and reuse wastes through in-house or external resources.
3. We shall comply with all the applicable regulatory and internal rules and regulations dealing with waste handling and management.
4. We shall promote and implement a holistic waste management plan across the organisation.
5. We shall enhance awareness and develop skills of all stakeholders through capacity building in the areas of waste management.
6. We shall strive to adopt industry best practices and promote innovative methods of waste management to reduce overall carbon & water footprint of the Company.
7. We shall promote sustainability through R&D to extract value out of waste.

(Dinesh K Sarraf)

Date : March 19, 2015

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FIGURE 7.3: WASTE MANAGEMENT POLICY OF ONGC

- **Mitigation Measures**

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

Type of wastes	Amount	Mitigation measures
Drilling Mud and wash water	1500 m^3/ well	❑ Use of water based mud or eco-friendly synthetic based mud as the drilling fluid; ❑ Barite used in the preparation of drilling fluid shall not contain Hg>1mg/kg and Cd>3mg/kg; ❑ The drilling fluid pit will be bunded to prevent water overflow during heavy monsoon; ❑ Use of low toxicity chemicals for the preparation of drilling fluid; ❑ Temporary storage of drilling fluid and wash waste water will be done in an impervious pit lined with HDPE; ❑ Disposal of drilling wash water will be achieved through necessary treatment through onsite Effluent Treatment Plant (ETP) to comply with the Standards for Liquid effluents of CPCB effluent discharge standard for oil drilling and gas extraction industry. Recycling of drilling mud will be ensured to the maximum extent possible; etc
Drill Cuttings	225 m^3 Per well	❑ The drilling cuttings pit will be bunded and kept covered using tarpaulin sheets during monsoon; ❑ The waste pit after it is filled up will be covered with impervious liner over which a thick layer of native top soil with proper top slope will be provided; ❑ Drill cuttings separated from drilling fluid will be adequately washed and temporarily stored and disposed in an impervious pit lined by HDPE; ❑ Feasibility study for use of drill cuttings for lining or capping of landfill sites, or as a road construction material in consultation with nodal authorities Periodic monitoring and analysis of drill cuttings will be undertaken to establish its nature and characteristics. Earlier test reports of drill cuttings from nearby wells have shown the absence of hazardous nature of the soil; etc.

Type of wastes	Amount	Mitigation measures
Used/ spent oil	2-3 KL per well	❑ The hazardous waste (waste and used oil) will be managed in accordance with Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008. Authorization for collection and storage shall be obtained from ASPCB and disposed of by authorized vendors; ❑ The hazardous waste will be stored in properly labeled and covered bins located in paved and bunded area; ❑ The hazardous waste so stored (not more than 90 days) to be periodically sent to ASPCB registered used and/or waste oil recyclers/ facilities; ❑ Necessary spill prevention measures viz. spill kit will be made available at the hazardous material storage area; ❑ Adequate care will be taken during storage and handling of such waste viz. use of proper PPEs by personnel; ❑ Storage details of onsite hazardous waste generated will be maintained and periodically updated; ❑ Proper manifest as per HW (MH&T) rules, 2008 to be maintained during storage, transportation and disposal of hazardous waste; etc
Lead acid batteries	2-3 Batteries per drilling of well	❑ Proper manifest will be maintained as per Batteries (Management & Handling) Rules, 2001. Will be recycled through the vendors supplying lead acid batteries as required under the Batteries (Management & Handling) Rules, 2001.
Recyclables viz. paper, plastic, packaging waste etc.	Small amount	❑ Proper segregation and storage of recyclable waste in designated bins onsite. ❑ Recyclables will be periodically sold to local waste recyclers.
Kichen waste	-	❑ Shall be collected in dust bin and transported to nearby solid waste disposal site by vendor;

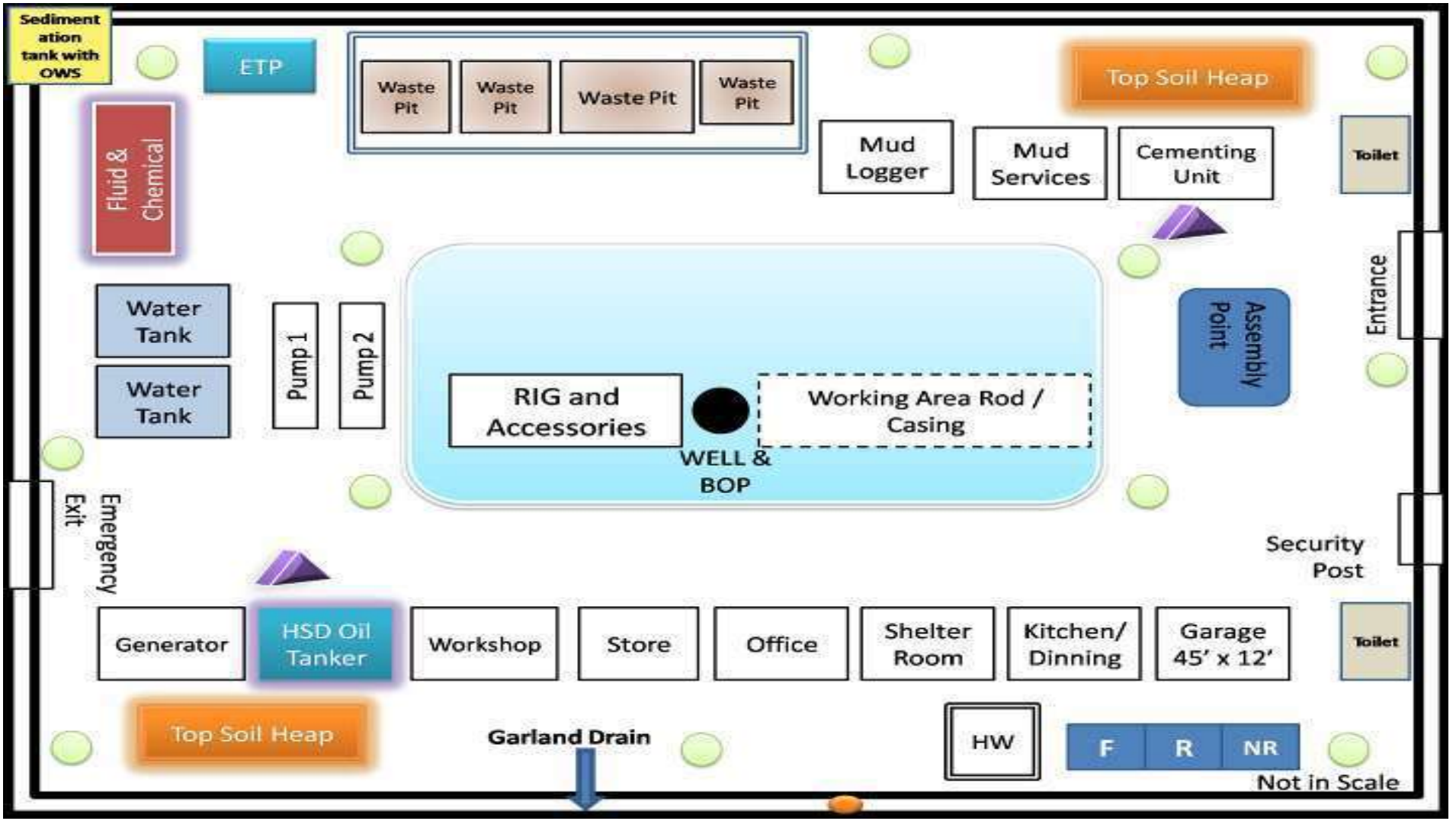
In addition to the management measures specified for the major waste stream, ONGC will prepare and update periodically a waste inventory of all waste streams identified for the proposed project. Necessary measure will also be taken by ONGC to incorporate appropriate waste management and handling procedures in the contractor work document and conduct periodic training of personnel involved in waste handling onsite to ensure proper implementation of the Waste Management Plan. In this regard, necessary inspection,

record keeping, training program and monitoring procedures will be established by ONGC and made operational to achieve proper management of all wastes generated on site.

A typical layout of the waste management facilities on a well site is given in Figure 7.4. The salient features of measures taken to safeguard the environment are given below:

- The drill pad will be elevated and concretized;
- The Hazardous waste will be separated from Non-hazardous waste and stored separately in enclosed area;
- Recyclable and non-recyclable waste will be collected and stored separately;
- The Waste pits will be bunded to prevent the overflow of wastewater;
- Mobile Effluent Treatment Plant will be installed at each well site;
- Fluid and chemicals will be stored in enclosed area with restricted access;
- The top soils will be heaped and bounded by a retaining wall;
- Oil spill kits will be available near Drill pad and Oil storage area;
- A garland drain will be constructed within the external boundary of the site that will have a sedimentation tank with oil and water separator; and
- Sufficient lighting will be provided at rig.

FIGURE 7.4: WASTE MANAGEMENT SCHEME OF ONGC



7.7 AUDIT

The audit program shall include pre-commissioning audits of the activities focusing on the compliance of procedures to deliver the specified level of performance of equipment/machinery and to ensure that all environmental and safety requirements are met. This includes:

- Integrity and function of physical systems;
- Compliance with operating procedures and standards;
- Compliance with prescribed relevant environment standards;
- Testing and review of emergency procedures;
- Compliance with maintenance of procedures and records; and
- Competence and training of operatives and field management staff.

Audit results shall be reported to management and field staff responsible for the process or equipment in question, where audits reveal non-compliance with requirements, corrective actions shall be implemented.

These will be prioritized according to the significance of the environmental risks arising. In-house Environment Management Cell (EMC) shall conduct audit on fortnight basis during exploratory drilling mainly on following aspects:

- Pollution and waste management;
- Safe working practices;
- Ecology ;
- Habitat and other infrastructure;
- Employment;
- Losses/damage caused to surrounding areas;
- Compensation;
- Rehabilitation (when applicable); and
- Cultural heritage.

After completion of proposed exploratory drilling of each well, an in-house and/or third part audit shall be carried out, focusing on following aspects:

- Restoration of site;

- Habitat and other infrastructure
- Losses to crops and ecology to the surrounding area;
- Compensation; etc.

7.7.1 PERFORMANCE MONITORING

❑ **Environment & Safety Aspects**

Safety features, ambient working environment and Occupational Health and Safety (OHS)-indicators are subjected to regular monitoring and review. The compiled information and any corrective measures taken shall be applied in a continuous process to improve the OHS management system (OHSMS) which will be responsible for management of environment, health and safety aspects related perataining to proposed exploratory drilling of wells.

The OHSMS shall include specifications for performance monitoring, evaluation, and improvement of the system including recording and reporting accidents.

- **OHSMS:** The performance and achievements of the OHSMS responsible for management of overall environment, Health & Safety aspects shall be re-assessed on fortnightly basis.
- **Safety Inspection, Testing and Calibration:** ***ONGC*** shall arrange for in-house and/or third party inspection and testing of all safety features including gas detectors and hazard control measures once during exploratory drilling of each well. The inspection will focus on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection shall ensure that issued personal protective equipment continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters shall be regularly tested and calibrated. Records shall be kept of all inspections, tests, and calibrations.
- **Monitoring of the Working Environment:** Environment Monitoring shall be carried out by using an appropriate combination of portable and stationary sampling and monitoring instruments for keeping healthy and hygienic environment to the possible extent. The monitoring as per details given hereunder **Tables 7.2** (subjected to be modified as per conditions stipulated by MoEF&CC and ASPCB) shall be carried out during exploratory drilling of 26 no.s of well:

TABLE 7.2: ENVIRONMENT MONITORING PLAN DURING EXPLORATORY DRILLING

Sl. No.	Component	Parameter	Locations	Frequency
1	Ambient air	PM_{10},$PM_{2.5}$, SO_2, NOx, CO, H_2S and HC (methane and non-methane)	1-2 locations at drilling site of well and nearest habitation of well site	12 hourly samples twice during drilling of each well
2	Waste water	for relevant parameters	At drilling site of well	Once during drilling phase
3	Noise Level	Hourly Leq	3-4 locations at the boundary of the drilling site well and nearest habitation	Continuously during working hour, twice in a week during drilling phase
4	Drilling Cutting for toxicity	for relevant parameters	At drilling site of well	Once during the during drilling phase
5	Drilling Fluid for toxicity	for relevant parameters	-	At the time of disposal

- **Surveillance of Worker's Health:** ONGC shall provide appropriate and relevant health surveillance to workers with special emphasis to the dust and hydrocarbon prior to first exposure and at regular intervals thereafter.
- **Training:** Training activities for employees and visitors shall be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises including drills shall be adequately documented. Service providers and contractors are contractually required to submit the adequate training documentation before start of their assignment.

❑ **Social Aspects**

This shall include:

- Interaction with direct affected families before, during and after the execution of proposed exploratory drilling on the following aspects;
  - *Pollution and waste management;*
  - *Safe working practices;*
  - *Ecology ;*
  - *Habitat and other infrastructure;*

- *Employment;*
- *Losses/damage caused to surrounding areas;*
- *Compensation;*
- *Rehabilitation (when applicable); and*
- *Cultural heritage.*

- Monitoring of project impacts and verification of damage to resources; and
- Reporting so as to required.

7.8 ENVIRONMENT MANAGEMENT CELL (EMC)

It is necessary to have a permanent organizational set up charged with the task of ensuring effective implementation of all identified mitigation measures. Conscious of this, ONGC already has an Environment Management Cell (EMC) consisting of officers from various disciplines to coordinate the activities concerned with the management and implementation of the environmental control measures during proposed exploratory drilling. ONGC has already developed a well-documented system to monitor and control pollution which shall be implemented during the proposed exploratory drilling. The organization and responsibility of the Environmental Management Cell (EMC) is presented below in Figure 7.5.

Basically, this department will undertake monitoring of the environmental pollution levels by measuring fugitive emissions, ambient air quality, water and effluent quality, noise level etc., either departmentally or by appointing external agencies wherever necessary. In case, the monitored results of environmental pollution are found to exceeding the allowable values, the EMC suggests remedial action and gets these suggestions implemented through the concerned head of activities. EMC shall also co-ordinate all the related activities such as collection of statistics With respect to health of workers, restoration of site, losses to crops and ecology and compensation. ONGC's environmental officer for investigation shall have the following responsibilities in general:

- Shall modify proposed EMP as described in **Table 7.1** and monitoring plan as mentioned in Table 7.2 in line with the conditions stipulated by MoEF&CC and ASPCB.
- Thoroughly familiarize himself with the existing information about habitat, sensitivities and baseline environment scenario etc present in the study area, making use of the EIA report;
- If applicable, liaise with the contractor in order to develop a common understanding of the goals of the EMP during execution of various activities for completion of the proposed exploratory drilling;

- To work actively with the teams involved in vegetation clearing so as to identify any specific local areas of habitat sensitivity;
- In the event presence of 'sensitive area' but not described in the EIA report, then a brief account of the nature of the sensitivity, its physical dimensions and the area of the exploration drilling that would be affected by avoidance of sensitive area would be prepared. It would also be discussed with the contractor's site manager as to how access to the site would be achieved without impacting on the sensitive area; etc.

Data shall be recorded with respect to type of land covered by well drilling sites to establish specific termination points, if possible. It is also recommended to appoint a community-facilitation officer who shall have the following responsibilities during planning and implementation phases;

- Identification of affected villages and individuals during planning and also making contact with village sarpanch and elder citizens and appraise them about the purpose and likely effect of their operation including Dos' and Donts' during the survey by the nearby habitants;
- Inspection and documentation of the conditions preceding the drilling in the area of operations to account for any permitting/operational damage which may occur through dialogue with the owners of the resources and village Head;
- Negotiation and agreement concerning asset inventories and payment of compensation as per land revenue records of land yields;
- Monitoring of project impacts and verification of damage to resources; and
- Reporting so as to required.

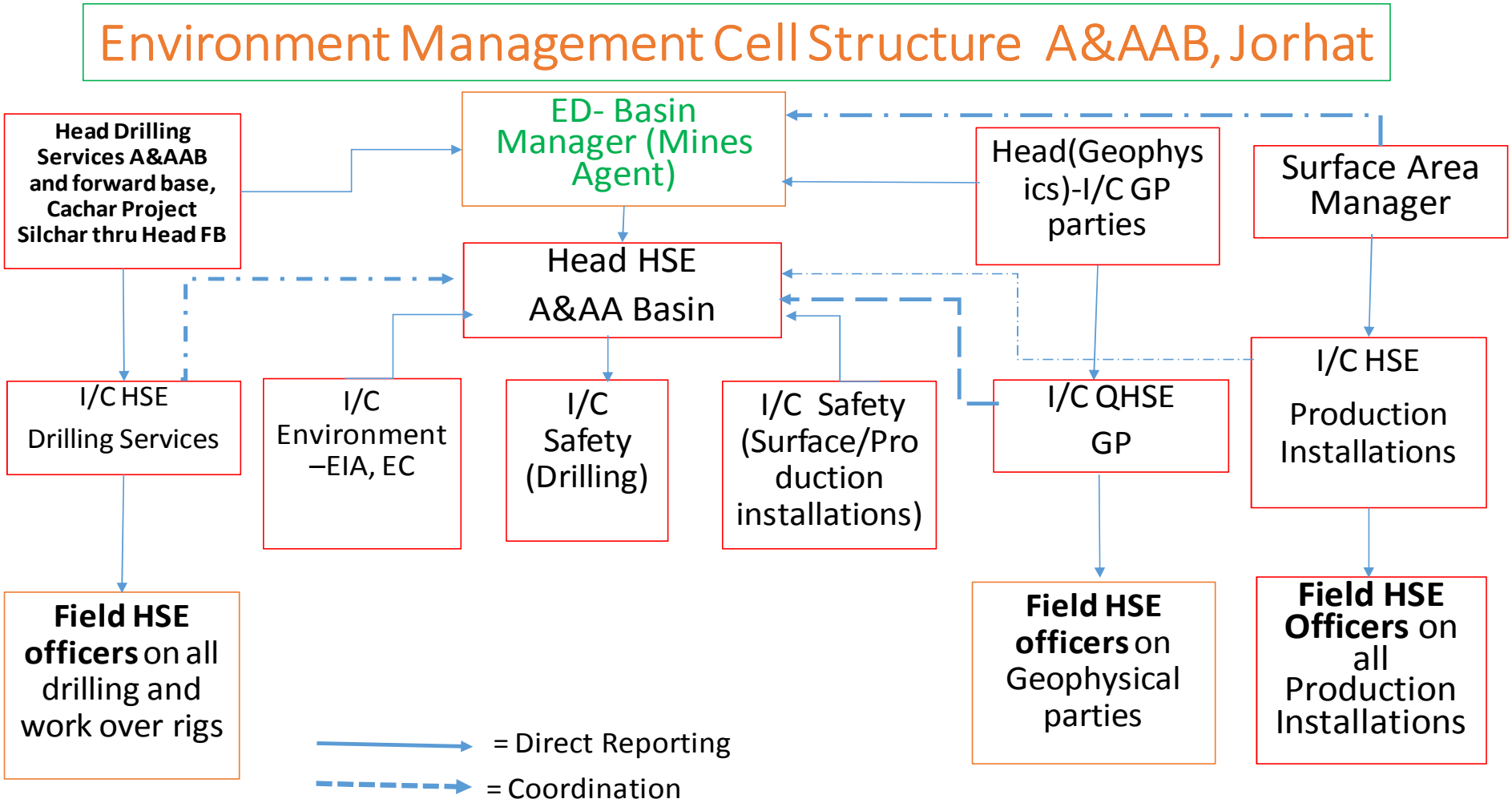


FIGURE 7.5: ENVIRONMENT MANAGEMENT CELL

7.9 TRAINING

To achieve the objective of environment management, it is essential not only to provide best pollution control system but also to provide trained manpower resources to operate the same. Training facilities shall be in place for environmental control. This training shall cover the items listed below:

- *Awareness of pollution control and environmental protection;*
- *Operation and maintenance of pollution control equipment;*
- *Knowledge of norms, regulations and procedures; and*
- *Occupational health and safety.*

ONGC shall ensure that workers prior to commencement of new assignments receive adequate training and information enabling them to understand the hazards of work and to protect their health from hazardous ambient factors that may be present. The training will adequately cover:

1. *Knowledge of materials, equipment, and tools;*
2. *Known hazards in the operations and how they are controlled;*
3. *Potential risks to health;*
4. *Precautions to prevent exposure;*
5. *Hygiene requirements;*
6. *Wearing and use of protective equipment and clothing; and*
7. *Appropriate response to operation extremes, incidents and accidents.*

A basic occupational training program and specialty courses shall be provided as needed to ensure that workers are oriented to the specific hazards of individual work assignments. Training shall generally be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Training shall also be provided to account for new or changed risks whenever procedures are altered or new materials/equipment introduced. The salient features of the training program are as given hereunder:

- Employees will be trained on the hazards, precautions and procedures for the safe storage and handling of equipments/machinery, material etc relevant to each employee's task and work area;
- Training will incorporate information from the Material Safety Data Sheets (MSDSs) for all material proposed to be handled;

- Personnel will be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities;
- Training will also include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, and proper response actions for each foreseeable emergency situation;
- Training will be repeated periodically and supported by feasible incentives;
- Workers with rescue and first-aid duties will receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.; and
- ONGC through appropriate contract specifications and monitoring shall ensure that service providers, as well as contracted and subcontracted labor is appropriately trained before start of their assignments.

7.10 RECORD KEEPING

Records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and leaks/spills, fires and other emergencies shall be maintained. Recorded information will be reviewed and evaluated to improve the effectiveness of the, health, safety and environmental program by ONGC.

CHAPTER 8

PROJECT BENEFITS

CHAPTER 8: PROJECT BENEFITS

8.1 PREAMBLE

The proposed exploration program of 26 wells in five blocks will establish hydrocarbons. In case of establishment of commercial viable hydrocarbon reserves, development of the oil field will result in considerable growth of service sector and will also generate new industrial and business opportunities in the area/region/nation. Small and medium scale industries may be developed as consequence. 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 will also lead to investment in Assam, bringing oil and gas revenues both to the State and to the Central Government. The presence of ONGC in the region will substantially improve the socio-economic conditions of the region.

In Operation phase, ONGC will require work force of non-technical and technical persons. Migration of persons with better education and professional experience will result in increase of population and literacy in the surrounding villages.

8.2 BENEFITS FOR THE COUNTRY

The demand for petroleum has recorded a considerable increase over the year from 30 million tons in 1980-81 to about 170 million tons at present. This growing demand poses a big challenge to oil producing company including ONGC. Also new oil/gas finds in the 5 blocks will lead to reduction in India's dependence on imported crude oil and thereby results in considerable saving in foreign exchange in case presence of commercial viable hydrocarbon reserves.

8.3 BENEFITS FOR THE REGION

- ***Employment***

The impact of the project on the economic aspects can be clearly observed. The proposed project activities will provide employment to persons of different skills and trades. The local population will be given preference to employment. The employment potential will ameliorate economic conditions of these families directly and provide employment to many other families indirectly who are involved in business and service oriented activities.

The employment of local people in primary and secondary sectors of project shall upgrade the prosperity of the region. This in-turn will improve the socio-economic conditions of the area.

- ***Improvement in the Social Infrastructure***
  - Increased revenue to the state by way of royalty, taxes and duties;
  - Increase in purchasing power and improved standard of living of the area;
  - Establishment of small and medium scale industries may be developed as consequence;
  - Regular Fund flow to local market;
  - The basic amenities viz., roads, transportation, proper sanitation, educational institutions, medical facilities, entertainment, etc. will be developed as far as possible;
  - Overall the proposed project will change living standards of the people and improve the socio-economic conditions of the area.

CHAPTER 9

SUMMARY AND CONCLUSIONS

CHAPTER 9: SUMMARY AND CONCLUSIONS

Oil and Natural Gas Corporation Limited (ONGC), a public sector petroleum company in India operating along the entire hydrocarbon value chain has been awarded onshore Block under Karimganj Dist. PML, Cachar Dist. PML and Sector-VC PML blocks of Assam state for exploration of hydrocarbons. A total of 26 exploratory locations are planned.

As per notification dated 14th September 2006, proposed exploratory drilling of 26 no.s of wells is designated as "Category A" project and requires Environment Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC), Govt. of India, Delhi.. M/s SGS India Private Limited (hereinafter referred as SGS) Gurgaon, has been engaged by ONGC to carry out an Environment Impact Assessment (EIA) study and to prepare an Environment Management Plan (EMP) for getting environment clearance as per TOR prescribed by MoEF& CC. The study has been carried out as per the guidelines of Ministry of Environment, Forests & Climate Change (MoEF&CC) and Assam State Pollution Control Board (ASPCB).

The baseline environmental data have been collected from 26th January 2015 to 17th April 2015.

9.1 SALIENT FEATURES OF THE PROJECT

Sl. No.	Features	Details
1	Location Details	The identified blocks Cachar Dist. PML, Karimganj Dist. PML, Sector-VC PML, Banaskandi PML, Adamtila PML, North Patharia PML lies in the proven petroliferous Assam-Arakan Basin.
2	Number of exploratory wells to be drilled	ONGC proposed to drill 26 wells for exploration of hydrocarbons
3	Depth of drilling	Maximum upto 3000 m/Basement
4	Activity involved	Purchase of land/Temporary land lease, Site and access road preparation, drilling of exploratory wells and testing operation
5	Area required	1.69 hect for each well and 1.5 -2.5 hec for camp site
6	Cost of project	330 Crore INR
7	Drilling fluid	Water based mud (WBM)
8	Manpower requirement	50 workmen in two shifts will be employed on site
9	Water requirement	Approximately 20-25 kilolitres per day (KLD) with 75-90 days on well for each well.
10	Waste water disposal	Concrete pads will be built to collect wastewater from kitchens, toilets, bathing and washing areas.
11	Domestic waste water	Wastewater from toilets shall be sent to soak

Sl. No.	Features	Details
		pit after passing through Septic tank while same from other sources shall be sent to soak pit for final disposal
12	Generation of drill cuttings and disposal	Around 250-300 m3 /well of drill cuttings shall be generated as solid waste which shall be stored in a well designed pit lined with impervious liner located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005. At the end, it shall be disposed in secured land fill.
13	Generation of Drilling mud	About 1500 m3/well of drilling mud will be generated which will be analysed through MoEF/ ASPCB authorised laboratory and then disposed on-site in HDPE lined pits located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.
14	Generation of used oil and disposal	Spent oil shall be given to authorized vendor by SPCB for disposal. Un-used mud shall be disposed off in HDPE lined pit as secured land fill.
15	Power requirement	**For Exploratory Drilling** • 4 DG sets each of capacity 1430 KVA for drilling operation. Three DG sets shall be in operation at a time except during test flaring. • 1 DG set of capacity 250 KVA shall be used at rig. • 1 DG set of capacity 100 KVA shall be used at camp site • About 6 KL/day fuel (HSD) is required for the activity.

9.2 SALIENT FEATURES OF THE BASELINE

The baseline environmental status were assessed was undertaken during the study period i.e., from 26th January 2015 to 17th April 2015.

Micrometeorology: Maximum and minimum temperature was observed 42.1℃ and 12.1℃, relative humidity was recorded between 27.5% - 94.7%. Wind speed varied from 0 to 15.8 km/hr and blow from North, North East during the period January 2015 to April 2015.

Ambient Air Quality: Out of the 8 locations, maximum concentration for PM10 of 92.2 µg/m3 was recorded at Kaligara village (AAQ5) & minimum of 35.8 µg/m3 at Gougrakona (AAQ8). Oxide of Nitrogen (NOx) varies between 19.0µg/m3 to 32.2 µg/m3 & AAQ5 had

maximum 32.2 µg/m3 and AAQ8 had minimum 19.0 µg/m3. Sulphur Dioxide (SO2) varies between 5.0 to 11.9 µg/m3 & AAQ5 have maximum 11.9µg/m3. The VOCs of all the location are Below Detection Level.

Noise Level: Out of 15 locations, highest values of noise level observed at Katigara (N5) and lowest value recorded at Ghukrakona (N11).

Water Quality: Out of 5 locations of Ground water, pH varied from 5.43 to 7.4. TDS varied between 116 and 350 mg/l. Total Hardness varied from 50 to 110 mg/. Chloride varied from 10 to 100 mg/l and Nitrate varied from 2.6 to 5.7 mg/l. Heavy metals like Arsenic, Manganese, Chromium, Lead, Mercury, Cadmium were found to be below detection limit at all locations. Groundwater quality of the samples conforms to the IS 10500:2012 standards for Drinking Water Quality at almost all locations. Out of 5 locations of Surface Water, pH varied from 6.86 to 7.62. TSS varied between 8 and 14 mg/l. TDS varied from 68 to 120 mg/l. BOD found to be higher in SW3 (12 mg/l) and minimum at SW2 (5 mg/l). Dissolved Oxygen varied from 5.2 mg/l to 5.5 mg/l. Heavy metals like Chromium, Mercury and Lead were found to be below detection limit at all locations. Total Coliform count varies between 1536 to 2325 cfu/100ml and maximum at SW3.

Soil Quality: Out of 9 locations, pH varied from 6.84 to 7.35. Electrical conductivity found within a range from 168 µmhos/ cm to 250 µmhos/ cm. The texture of soil is Sandy clay to clay. Available Nitrogen ranged from 246 kg/ha to 310 kg/ha, Potassium ranged from 165 kg/ha to 215 kg/ha, Available Phosphorus ranged from 65 kg/ha to 106 kg/ha.

Ecology & biodiversity: Study conducted around 1 km radius of each well and some important tree species are *Alistonia scholaris, Anthrocephalus sinensis, Azadirchta indica, Acacia auriculoformis, Artocarpus heterophyllus, Delonix regia, Phyllanthus embilica, Ficus religiosa, Mangifera indica, Lagerstroemia speciosa, Dalberjia sisso, Terminalia arjuna, Salix tetrasperma, Terminalia belerica, Ficus cunia, Azadirachta indica, Acacia nilotica, Anthocephalus kadamba, Saraca indica, Tamarindus indica*. About 27 Mamalian species, 79 avifauna, 15 reptiles were recorded within the study area.

Socio economic status: The study conducted within 1 km from centre of each proposed well. Total population in the study area is 67827 comprise 46416 people (from 10052 households) of Cachar district and 21411 people (from 4380 households) of Karimganj district. The majority of scheduled caste and scheduled tribe population exist in the Cachar distinct i.e. 20% and 10.6% respectively. The scheduled tribe population was found to be insignificant in Karimganj district. Sex ratio in the study area is 943 females per 1000 male, which is below sex ratio of Cachar and Karimganj district (Rural) as per the latest reports of Census Directorate 2011. The literacy rate of Cachar and Karimganj district (rural) is 77.1% and 76.1%.

9.3 SALIENT FEATURES OF THE IMPACT AND MITIGATION MEASURES

Sl. No.	Component	Mitigation Measures
1	Land Use	• Consult local authorities and other stakeholders regarding preferred location, • All necessary protocols shall be followed and legal requirements shall be implemented for use of land, site boundaries to be marked; Minimize the disturbance of vegetation present in and around area, Minimum utilization of land and clearing of site, For cleared areas, retain top soil in stockpile where possible on boundary of drilling site for subsequent re-spreading onsite during restoration etc
2	Ecology	• Siting to minimize impacts on ecology, water resources, and landscape. • Choose site to encourage natural rehabilitation by indigenous flora/avoid removal of vegetation and topsoil/preserve topsoil, • Ensure adequate and proper drainage. • Ensure proper handling and storage of fuels and hazardous materials. • Minimize cleared area and to aid natural re-vegetation. • All bulldozer operators involved in site preparation shall be trained to observe the defined site boundaries; • LPG shall be used for domestic purpose etc
3	Water Resources	• Siting to minimize impacts on water resources; • Avoid areas prone to flooding; • Where water courses and aquifers are deemed sensitive, consider a fully sealed site, avoid use of mud pits, preferentially use steel tanks, but if used must be lined. Pits if used must be lined; • Consider aquifer protection and proper plugging; • Adequate water supply arrangement shall be made at drilling site and camp site; • Continuous attempt shall be made to avoid wastage and leakage of water; • Continuous attempt shall be made to optimize/reduce the use of water; • Drilling shall not be carried out during monsoon season; • Toilets and bathrooms on temporary basis shall be provided at drilling and camp site.
4	Air Emissions (Dust and gaseous emission)	• Emission from flaring of petroleum hydrocarbons, DG sets and other machinery shall confirm the standards as prescribed by MoEFCC/APCB; • Well testing (flaring) to be undertaken so as to minimize impacts of emissions by ensuring: o duration of testing minimized by careful planning; and o high combustion efficiency, smokeless flare/burner to be used. • Any dry, dusty materials (chemicals, construction materials etc) shall be stored in sealed containers and fenced storage yard; • Detectors for CH_4 and H_2S shall be placed at adequate locations; • Arrangement of water spray at drilling site and access road to the possible extent shall be made; • Preventive maintenance of vehicles and machinery; • Regular testing of the combustion efficiency of the vehicles/machinery
5	Noise and Vibration	• Selection of low noise generating machinery/equipment; • Engineering specifications for machinery/equipment shall be stipulated and to maintain noise level not more than 85 dB(A) at 1 m from each source; • Provision of rubber padding/noise isolators/silencers by machinery/equipment; • Provision of protective devices like ear muff/ plugs to the workers; • Preventive maintenance of machinery/equipment and vehicles etc.
6	Water Quality	• Incorporate drainage and minimize disturbance to natural drainage patterns. Engineer slopes and drainage to minimize erosion.

Sl. No.	Component	Mitigation Measures
		• Potable ETP shall be used to treat the process waste water while domestic waste water shall be discharged to soak pits. • All the debris resulting from the site shall be isolated from the waste water and disposed off separately; • Protect water courses from contamination and siltation; • Protect groundwater from drill stem penetration and shallow aquifers from possible site contamination; • Pits if used must be lined; • Non-contaminated and potentially contaminated run-off shall be kept separately. Potentially contaminated surface run-off shall be routed through oil traps; • The storage areas shall be inspected and cleaned at regular intervals; • All spills/leaks to be contained, reported and cleaned up immediately; • Adequate sanitary facilities shall be provided; • Minimize suspended solids loads to watercourses by installing appropriate surface run-off drainage systems (e.g., silt traps); • No untreated discharge to be made to water course/land;
7	Soil quality	**Soil Erosion** • Minimize area and extent of site clearance, by staying within defined boundaries; • Stockpile of topsoil wherever possible at the edge of site; • Limit erosion potential/avoid steep slope and drainage courses/avoid cut and fill techniques/incorporate proper drainage, culverting and bridging techniques; • Avoid removing undergrowth where possible so as to retain land stability; **Fuel, Lubricants and Chemical Management** • All fuels, lubricants, surface treatment materials, welding rods/ gases, chemicals etc to be placed in controlled storage i.e. properly fenced area and in clearly marked vessels and containers; • Storage and liquid impoundment areas for fuels, construction materials, solvents, chemicals and waste should be designed with secondary containment (e.g., dykes and berms) to prevent spills and the contamination of soil, groundwater, and surface waters; • Impervious liners shall be in place for fuel, lubricants and chemicals storage area; • Impervious liners shall be in place for pits for storage of drill cutting and mud; • Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials to be used for fuel lubricants and chemicals storage area; • Non-contaminated and potentially contaminated run-off shall be kept separate. Non-contaminated run-off will be routed to off-site areas via silt traps. Potentially contaminated surface run-off shall be routed through oil traps. • In-house audit shall be carried out before and after exploratory drilling operation.
8	Disturbance to community resources & safety	• Advance notice to local administration about the activities; • Minimize use of roads by planning vehicle movements; • Proper cordon off the site with sign boards; • Adequate communication with locals which may be impacted during exploratory drilling; • Diversion of traffic, if required; • Placing the warning board on the vehicles during transportation of machinery and materials;

Sl. No.	Component	Mitigation Measures
		• Proper training to drivers about public safety. • Spray down dirt roads if too dusty; • In-house monitoring and audit; etc
9.	Employment and Socio economic	• Preference shall be given to locals for temporary direct and indirect employment; • Local employment (unskilled) should be provided in a manner, giving fair representation to all section; • Where ever local skilled labour is available, should be preferred to be hired for the respective job; • Local suppliers for machineries and construction materials shall be given preference; • Local transporters shall be preferred for transportation of machinery/materials. • Close monitoring on the type of loss to local habitats, if any. In case of any loss to locals, adequate compensation shall be provided as per the law or on mutually agreed terms; • Third part audit after completion of activities;
10	Occupational Health & Safety	• Due care shall be taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated during drilling operation to the possible extent; • Any worker found to develop symptoms of dust related diseases will be changed over to other activities in cleaner areas; • General Safety Measures: o Employees shall be provided with helmets, safety boots, eye and ear protection, and snug fitting gloves as appropriate; o Masks and dust-proof clothing shall be provided to personnel; and o Procedures shall be strictly enforced for the drilling, storage, handling, and transport of explosives, flammable and hazardous materials. ❑ General Health Measures: o Sanitary facilities shall be well equipped with supplies and employees shall be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens; o Personnel required to work in areas with high humidity shall be allowed to take frequent breaks away from these areas; and o Pre-employment medical examinations of all personnel shall be made mandatory for contractor.
11	House keeping	• The facilities should be kept clean, maintained, and operated in a safe and environmentally sound manner; • Facilities should be cordoned off in a manner to prevent access to the facility by the general public, livestock, where appropriate; • Signs should be posted in conspicuous locations to notify employees and the public of any dangerous situations such as, flammable conditions, high voltage, and toxic; • All equipment should be painted and/or kept clean to present an acceptable appearance and to provide protection from external corrosion; • Waste receptacles should be provided at appropriate locations for collecting discarded paper, rags, etc. and emptied on a regular basis; etc

CHAPTER 10

DISCLOSURE OF CONSULTANTS

CHAPTER 10: DISCLOSURE OF CONSULTANTS

PROJECT PROPONENT:	**M/S OIL & NATURAL GAS CORPORATION LIMITED (ONGC)**
PROJECT NAME:	**ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED EXPLORATORY DRILLING OF EXPLORATORY WELLS (26 NOS.) IN PML BLOCKS OF CACHAR BLOCKS OF CACHAR FORWARD BASE IN ASSAM BY M/S ONGC LTD.**
CONSULTANT:	**SGS INDIA PVT. LTD.**

SGS India Private Limited, a member of SGS (Société Générale de Surveillance), is one of the pioneers in providing Inspection, Testing, Certification and Consultancy services to the trade in India.

SGS is represented in more than 140 countries, by 210 affiliated companies. Vast network of companies yields more than 2,000 offices (39,000 employees) that maintain over 340 laboratories. SGS is recognized globally for analytical and technical excellence in environmental assessment. This undisputed reputation is based upon an exceptional record of progressive growth and development by continuing to exceed the standards of most full-service environmental laboratories. SGS India was founded in 1950 and has expanded Environmental Services and resources at Gurgaon, Bangalore, Ahmedabad, Chennai and Kolkata. The growth of SGS India Private Limited is a prodigy of SGS's strength and experience, designed to fulfill the necessary demands of our Clientele by keeping abreast with ever-changing environmental standards.

This report is released for the use of M/s. Oil & Natural Gas Corporation Ltd, Regulators and relevant stake holders solely as a part of the subject project's Environmental clearance process.

PROJECT DETAILS					
Name of Publication	M/s. **OIL & NATURAL GAS CORPORATION LIMITED (ONGC)** **ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED EXPLORATORY DRILLING OF EXPLORATORY WELLS (26 NOS.) IN PML BLOCKS OF CACHAR BLOCKS OF CACHAR FORWARD BASE IN ASSAM BY M/S ONGC LTD.**				
Project Number	**IN/ES-EIA/2014-161**	**VERSION**	**1**	**RELEASED**	**AUGUST 2015**

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DISCLAIMER

DECLARATION BY EXPERTS CONTRIBUTING TO THIS REPORT

"I, hereby, certify that I was a part of the EIA team in the following capacity that developed this Report".

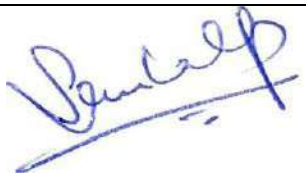
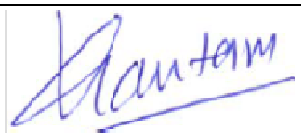
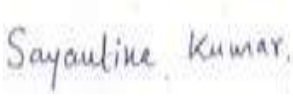
EIA Sector Number as per NABET	2	**Name of Sector as per NABET**	Offshore and onshore oil and gas exploration, development and production

EIA COORDINATOR

Name	Sunil C Gupta	
Period of involvement	From: **June 2014 – Ongoing**	**Signature & Date**
Contact Information	Address: 13/342, Near Azad Public School & Rajeshwari Public School, Bulandshahr-203001 (UP), India. Mobile No: +91 9759955477	
SGS Team Member Assisting EIA Coordinator	Mr. Abhik Saha	

FUNCTIONAL AREA EXPERTS (FAE)

Functional Areas	Name of the Expert	Signature & Date	Involvement (Period & Task)
Water Pollution (WP), Ecology and Biodiversity (EB) and Solid Hazardous Waste (SHW)	Abhik Saha		**Period of Involvement**: November 2014 – Ongoing **Tasks:** Project and client coordination; Site visit for primary and secondary data collection, discussion with client and Forest officials etc. and preparation of relevant sections in the EIA report.
Landuse (LU), Geology (Geo) and Hydrogeology (HG)	MS Bhaskar		**Period of Involvement**: November 2015 – Ongoing **Task:** Client coordination for public hearing, Site visit for primary and secondary data collection, ground truthing, discussion with client and preparation of relevant sections in the EIA report.

Functional Areas	Name of the Expert	Signature & Date	Involvement (Period & Task)
Air Pollution Monitoring & Control (AP), Air Quality Modeling and Prediction (AQ) and Noise	Dr. Sankalp Anand		**Period of Involvement**: January 2015 – May 2015 **Tasks:** Site visit for identification of ambient air quality, meteorology, traffic and noise location, discussion with client and preparation of relevant sections in the EIA report.
Socio-Economics (SE)	Suchitra Bisen		**Period of Involvement**: January 2015 – Ongoing **Tasks:** Site visit for primary and secondary data collection, discussion with client and revenue officials, sarpanch etc. and preparation of relevant sections in the EIA report.
Risk and Hazard Assessment	Vinod Gautam		**Period of Involvement**: February 2015 – Ongoing **Tasks:** Risk modeling and preparation of management plan.
Soil Conservation	Dr. Asish Chakraborty		**Period of Involvement**: February 2015 – Ongoing **Tasks:** Soil quality analysis and preparation of management plan.
Land use and Hydrogeology	Dr. Rajkumar Kaliyan		**Period of Involvement**: March 2015 – Ongoing **Tasks:** Site visit for collection of primary and secondary data and preparation of relevant baseline section in the EIA report.
Air Pollution Monitoring & Control (AP), Air Quality Modeling and Prediction (AQ) and Noise	Sumit kumar Das		**Period of Involvement**: December 2014 – Ongoing **Tasks:** Involvement of air quality sampling locations finalization, collection of secondary data and as a part of EIA team.
Water Pollution (WP) and Solid Hazardous Waste (SHW)	Sayantika Kumar		**Period of Involvement**: December 2014 – Ongoing **Tasks:** Involvement of completion of primary and secondary data collection related to water quality and

Functional Areas	Name of the Expert	Signature & Date	Involvement (Period & Task)
			waste water quality and as a part of EIA team.

Declaration by the Head of the Accredited Consultant Organization:

I, **Sanjeev Kumar**, hereby, confirm that the above-mentioned experts prepared the EIA Report for the proposed exploratory drilling of 26 wells for production of hydrocarbons in PML Blocks of Cachar Blocks of Cachar Forward Base.

I also confirm that SGS India Pvt. Ltd. shall be fully accountable for any mis-leading information mentioned in this statement.

_____

Name: **Sanjeev Kumar**

Designation: **Head Environmental Studies and Climate Change Program at SGS India**

Name of the EIA Consultant Organization: **SGS India Pvt. Ltd.**

QCI-NABET ACCREDITATION CERTIFICATE – SGS INDIA PVT. LTD.

Scheme for Accreditation of EIA Consultant Organizations

Scope of Accreditation — **Annexure I**

NAME OF THE CONSULTANT ORGANIZATION: **SGS India Pvt. Ltd.**
250, Udyog Vihar, Phase IV,
Gurgaon - 122015

Sl. No.	Sector number		Name of Sector	Category A/B
	As per MoEF Notification	As per NABET Scheme		
1.	1(a) (i)	1	Mining of minerals including Opencast / Underground mining	A
2.	1(b)	2	Offshore and onshore oil and gas exploration, development & production	A
3.	1(c)	3	River Valley, Hydel, Drainage and Irrigation projects	B
4.	1(d)	4	Thermal Power Plants	A
5.	3(b)	9	Cement plants	A
6.	4(a)	10	Petroleum refining industry	A
7.	4(c)	12	Asbestos milling and asbestos based products	A
8.	5(c)	18	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	A
9.	5(e)	20	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	A
10.	5(f)	21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates **excluding** drug formulation; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A
11.	6(b)	28	Isolated storage & handling of Hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	B
12.	7(a)	29	Air ports	A
13.	7(e)	33	Ports, harbours, jetties, marine terminals, break waters and dredging	
14.	7(f)	34	Highways, railways, transport terminals, mass rapid transport systems	A
15.	8(a)	38	Building and large construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions	B
16.	8(b)	39	Townships and Area development projects	B
Total = 16 Sectors *Individual EIA Coordinators approved for different sectors are mentioned in Annexure II*				

(Vipin Sahni)
C.E.O.

ANNEXURE

ANNEXURE 1: VILLAGE WISE DEMOGRAPHIC PROFILE OF THE BLOCK AREA

District	Sub-Division	CD Block	Village	Area Type	No of House hold	Population			Population (0-6 yrs)			Population		Literates		
						Total	Male	Female	Total	Male	Female	SC	ST	Total	Male	Female
Cachar	Silchar	Katigora	Niz Leverpute Pt II (Lavarputa II)	Rural	432	2014	999	1015	390	188	202	643	4	1217	662	555
			Saidpur Pt I	Rural	212	950	492	458	141	80	61	655	1	632	343	289
			Saidpur Pt II	Rural	269	1125	572	553	194	96	98	303	0	724	423	301
			Saidpur Pt III	Rural	140	654	331	323	109	58	51	631	11	409	216	193
			Chandi Nagar Pt II	Rural	531	2453	1232	1221	516	256	260	285	0	1660	889	771
			Hari Nagar Pt I	Rural	305	1517	834	683	224	133	91	300	0	1069	629	440
			Hari Nagar Pt II	Rural	308	1363	703	660	232	118	114	47	0	1030	550	480
			Hari Nagar Pt III	Rural	143	724	371	353	120	58	62	47	0	505	283	222
			Niz Hari Tikar Pt II	Rural	489	2192	1127	1065	333	173	160	465	0	1561	837	724

			Karai Kandi Pt I	Rural	124	663	338	325	135	73	62	302	3	400	212	188
			Nazat Pur	Rural	434	2036	1045	991	339	168	171	440	0	1480	812	668
			Lathimara (Latimara)	Rural	669	3250	1689	1561	584	303	281	371	0	2253	1282	971
			Siddeswar Pt I (Sidheswar-I)	Rural	73	292	154	138	32	18	14	5	0	259	135	124
			Gobindapur Pt III	Rural	738	3392	1785	1607	466	234	232	1363	0	2582	1422	1160
			Kalinagar	Rural	308	1285	645	640	221	107	114	317	0	876	482	394
			Sripur Pt I	Rural	344	1617	844	773	257	126	131	644	0	1113	628	485
			Chandranath Pur	Rural	705	2781	1402	1379	366	181	185	105	25	1527	863	664
			Mulidahar Grant	Rural	259	1157	609	548	166	87	79	438	17	673	406	267
			Leburbond	Rural	207	849	418	431	114	52	62	194	72	604	324	280
			Borodudhpatil Grant	Rural	858	3657	1883	1774	636	323	313	143	0	1807	1078	729
			Dudhp	Urba	919	4121	2092	2029	449	242	207	3	0	3441	1778	1663

			atil Pt V (CT)	n											
			Niz Katigorah Pt II	Rural	607	2437	1282	1155	329	175	154	694	0	1987	1068	919
			Siddeswar Pt II	Rural	514	2415	1222	1193	359	205	154	1105	0	1816	928	888
			Sidhipur	Rural	364	1763	907	856	258	119	139	934	0	1361	732	629
Cachar	Silchar	Salchapra	Bhangerpar Pt IV	Rural	672	3201	1645	1556	681	373	308	107	0	2054	1110	944
			Chandpur Pt IV	Rural	431	1780	932	848	266	141	125	0	0	1313	730	583
			Pratapi Para	Rural	94	400	213	187	67	39	28	68	0	284	148	136
			Ujan Gram	Rural	432	1996	1013	983	359	174	185	0	0	1402	760	642
			Bhairab Nagar	Rural	685	2703	1395	1308	328	166	162	304	0	1900	1068	832
			Nischintapur	Rural	292	1392	712	680	193	106	87	0	0	1032	550	482
Cachar	Silchar	Borkhola	Sunapur Pt I (Sonapur Pt I)	Rural	1026	4775	2399	2376	945	455	490	309	0	2870	1566	1304
			Sunapur Pt II	Rural	169	943	496	447	158	80	78	434	0	720	393	327
			Sunapur Pt III	Rural	231	1001	511	490	208	105	103	0	0	541	298	243

			Rangar Pt I	Rural	293	1499	762	737	250	137	113	161	0	944	515	429
			Rangar Pt III(Ranggghar Pt III)	Rural	93	420	231	189	36	20	16	88	0	378	206	172
			Heirbond Pt II	Rural	146	746	375	371	141	74	67	247	0	453	228	225
			Chutra Sangan	Rural	74	330	165	165	53	30	23	320	0	249	125	124
			Masimpur Grant	Rural	317	1771	1193	578	212	109	103	47	19	1380	1012	368
			Dudhpatil Pt V (CT)	Urban	919	4121	2092	2029	449	242	207	3	0	3441	1778	1663
			Masimpur Pt II	Rural	460	2364	1450	914	287	156	131	70	0	1893	1263	630
			Ardvallik	Rural	163	789	421	368	125	64	61	549	0	540	309	231
			Dudhpatil Pt III	Rural	119	527	259	268	88	39	49	435	0	400	214	186
Cachar	Silchar	Kalain	Digor Mahadevpur	Rural	64	284	156	128	53	30	23	159	0	138	84	54
			Kushierkul (Kushiyarkul)	Rural	144	618	323	295	67	33	34	207	0	500	266	234

			Ratha Cherre Khasia Punjee	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Suna Cherra Mikir Punjee	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Mahad evpur Pt I	Rural	237	1185	635	550	188	88	100	683	0	829	469	360
			Mahad evpur Pt II	Rural	136	771	419	352	150	82	68	704	1	376	223	153
			Mahad evpur Pt III	Rural	169	759	385	374	144	71	73	537	0	327	171	156
			Mahad evpur Pt IV	Rural	171	832	416	416	163	71	92	780	4	316	175	141
			Sarasp ur	Rural	350	1508	770	738	272	139	133	629	4	941	512	429
			Talkar Beel	Rural	11	56	32	24	11	7	4	34	6	27	16	11
			Rajyes warpur Pt II(Raje swarpu r	Rural	335	1592	806	786	218	102	116	291	1	1045	578	467
			Rajyes warpur Pt I	Rural	185	886	444	442	165	74	91	165	0	536	297	239

			Chandipur (Chondipur)	Rural	316	1441	752	689	238	127	111	132	0	1048	563	485
			Paikan	Rural	594	2848	1455	1393	583	301	282	3	0	1751	986	765
			Khelma Pt VIII	Rural	463	2269	1137	1132	516	270	246	84	0	1431	754	677
			Khelma Pt VII	Rural	546	2565	1323	1242	440	224	216	341	0	1747	918	829
			Khelma Pt VI	Rural	640	2737	1421	1316	438	230	208	667	0	2041	1097	944
			Khelma Pt I	Rural	433	2002	1072	930	325	173	152	836	0	1486	840	646
			Khelma Pt II	Rural	365	1607	837	770	330	163	167	987	14	929	513	416
			Khelma Pt III	Rural	405	1812	970	842	357	196	161	1521	28	1106	650	456
			Khelma Pt IV	Rural	120	634	334	300	125	68	57	564	11	336	196	140
			Khelma Pt V	Rural	243	1160	579	581	240	114	126	213	7	527	281	246
			Bhairabpur Pt I	Rural	255	1116	570	546	186	90	96	350	0	821	430	391
			Bhairabpur Pt II	Rural	735	3301	1624	1677	663	324	339	309	12	1803	956	847
			Bhairabpur Pt III	Rural	113	459	236	223	92	47	45	404	3	239	144	95
			Digabar Grant	Rural	385	1412	744	668	220	113	107	117	0	653	413	240

			Lakhipur Pt II	Rural	320	1572	788	784	207	105	102	55	0	1181	628	553
			Lakhipur Pt III	Rural	118	528	262	266	79	42	37	17	0	350	186	164
			Rajagarh Khasia Punjee	Rural	13	57	31	26	13	8	5	0	0	17	10	7
			Sewti Pt I (Santi Pt I)	Rural	522	2742	1384	1358	488	236	252	663	0	1914	1022	892
			Sewti Pt II	Rural	285	1188	594	594	132	68	64	75	0	967	502	465
			Burunga Pt I	Rural	568	2766	1459	1307	451	239	212	92	3	1847	1044	803
			Burunga Pt II	Rural	340	1422	747	675	179	107	72	65	0	1132	605	527
			Burunga Pt III	Rural	240	1299	682	617	295	159	136	0	0	835	466	369
			Tarapur	Rural	622	3027	1561	1466	578	309	269	232	0	1857	1008	849
			Talkar Grant	Rural	1720	8068	4196	3872	1533	793	740	1763	24	4280	2441	1839
			Karaballe Grant	Rural	49	218	111	107	32	15	17	0	0	86	58	28
			Biswambarpur	Rural	360	1703	889	814	289	163	126	1157	0	1172	633	539
			Gumra Grant	Rural	125	686	323	363	139	61	78	130	0	330	177	153
			Manipu	Rural	112	442	227	215	55	28	27	30	0	313	176	137

			r Pt II													
Cachar	Silchar	Silchar	Berenga Pt II	Rural	894	4353	2229	2124	664	354	310	138	0	2941	1570	1371
			Berenga Pt III	Rural	808	4125	2145	1980	616	307	309	114	0	2949	1632	1317
			Berenga Pt V	Rural	458	2289	1178	1111	330	168	162	0	1	1809	968	841
			Berenga Pt I	Rural	476	2372	1229	1143	292	159	133	97	0	1920	1020	900
			Ambicapur Pt XI	Rural	642	2778	1399	1379	280	142	138	540	14	2364	1222	1142
			Ambicapur Pt VIII (CT)	Urban	2336	11691	5866	5825	1610	804	806	6115	148	7549	4052	3497
			Ambicapur Pt VI (CT)	Urban	1641	7971	4070	3901	1168	577	591	887	1	5760	3132	2628
			Uttar Krishnapur Pt. I (CT)	Urban	1485	6960	3549	3411	892	447	445	352	9	5229	2800	2429
			Tarapur VII (CT)	Urban	1651	6977	3506	3471	609	301	308	839	46	6101	3112	2989
Cachar	Silchar	Udarbond	Larsingpar Grant	Rural	819	3726	1879	1847	546	281	265	49	0	1539	950	589
			Jhapirbond Pt II	Rural	237	1184	611	573	242	123	119	0	0	604	328	276

			Rangpur Pt III	Rural	257	1254	632	622	114	59	55	0	0	1069	550	519
			Kachipur Pt II	Rural	716	3383	1764	1619	440	249	191	315	0	2610	1422	1188
			Kachipur Pt I	Rural	320	1550	793	757	230	126	104	209	0	1072	574	498
			Ratanpur	Rural	48	245	129	116	52	29	23	0	162	146	76	70
			Paticharа T.E.(Puthicharagrant	Rural	216	876	446	430	121	55	66	14	0	421	244	177
			Nayagram	Rural	186	748	402	346	55	28	27	1	92	467	263	204
			Arcuttepur Grant	Rural	906	4037	2053	1984	631	313	318	2334	0	2077	1215	862
			Durga Nagar Pt. V (CT)	Urban	1972	9051	4522	4529	868	444	424	811	6	7589	3832	3757
			Nutan Dayapur	Rural	450	2204	1122	1082	355	173	182	48	0	1464	823	641
			Taligram	Rural	280	1208	618	590	138	67	71	75	18	853	464	389
			Salganga Par	Rural	824	3785	2159	1626	451	230	221	98	14	3067	1814	1253
			Kaspur Bagerkona	Rural	387	1795	891	904	280	146	134	0	104	1246	654	592
			Chandi	Rural	300	1348	685	663	174	84	90	49	1	772	445	327

			Ghat Pt III												
			Pangram Pt III	Rural	767	3636	1892	1744	575	299	276	134	4	2576	1396	1180
			Doyapore Grant	Rural	932	4202	2324	1878	586	331	255	182	7	1974	1326	648
			Latigram (Lathigram)	Rural	488	2513	1316	1197	463	238	225	0	1	1615	885	730
			Gossaipur Pt V	Rural	383	1410	725	685	182	93	89	41	0	898	468	430
Cachar	Silchar	Sonai	Uttar Krishnapur Pt II	Rural	917	4546	2383	2163	694	380	314	192	0	3195	1769	1426
			Sabashpur (Sabujpur)	Rural	142	770	385	385	107	56	51	114	0	566	299	267
			Bariknagar Pt II	Rural	847	4041	2117	1924	686	372	314	88	0	2770	1560	1210
			Bariknagar Pt I	Rural	254	1209	591	618	197	94	103	0	0	787	423	364
			Sildubi	Rural	150	813	444	369	140	73	67	142	0	441	274	167
			Menipur Pt I	Rural	273	1207	630	577	182	99	83	332	0	804	443	361
			Sildubi Grant	Rural	925	4452	2283	2169	655	342	313	882	0	2970	1639	1331

			Saidpur Pt I	Rural	387	1877	950	927	272	134	138	0	0	1284	706	578
			Saidpur Pt II	Rural	849	3807	1946	1861	602	307	295	1101	0	2721	1431	1290
			Sonabarighat Pt I	Rural	594	2908	1460	1448	450	242	208	0	0	2099	1090	1009
			Saidpur Pt III	Rural	381	1888	1002	886	234	130	104	85	0	1373	765	608
			Saidpur Pt IV	Rural	702	3347	1685	1662	553	266	287	0	0	2329	1265	1064
			Saidpur Pt V	Rural	386	1856	915	941	357	168	189	0	0	1081	558	523
			Dhanehari Pt II	Rural	943	4322	2213	2109	761	390	371	0	0	2807	1544	1263
			Nutan Ramnagar Pt IV	Rural	550	2784	1439	1345	442	232	210	99	0	1844	1031	813
			Nutan Ramnagar Pt V	Rural	440	2112	1059	1053	454	217	237	0	0	1282	739	543
			Dakshin Mohanpur Pt IV	Rural	58	286	146	140	53	29	24	0	0	157	87	70
			Dakshin Mohanpur Pt	Rural	269	1207	605	602	257	126	131	0	0	498	274	224

			VIII												
			Dakshin Mohanpur Pt VII	Rural	1122	5149	2559	2590	889	434	455	0	0	3399	1827	1572
			Dakshin Mohanpur Pt III	Rural	258	1018	526	492	146	86	60	274	0	729	391	338
			Bhaurikandi Pt I (Bhanri)	Rural	628	2720	1338	1382	635	295	340	0	1	1457	816	641
			Dakshin Mohanpur Pt V	Rural	673	3040	1532	1508	559	309	250	0	0	1980	1074	906
			Dakshin Mohanpur Pt VI	Rural	317	1297	664	633	227	112	115	25	0	876	489	387
			Kachudaram Pt I	Rural	723	3086	1590	1496	515	262	253	1126	0	2027	1119	908
			Bhaurikandi Pt II	Rural	313	1418	712	706	286	152	134	0	0	872	482	390
			Kachu	Rural	720	3138	1515	1623	576	266	310	0	0	2160	1135	1025

			daram Pt IV												
			Kachudaram Pt III	Rural	285	1340	704	636	183	99	84	513	0	1097	586	511
			Sundari Pt III	Rural	248	1032	503	529	92	50	42	0	0	877	439	438
			Dakshin Mohanpur Pt I	Rural	515	2421	1237	1184	367	183	184	43	0	1688	929	759
			Kachudaram Pt II	Rural	555	2583	1281	1302	502	233	269	440	0	1754	948	806
			Uttar Krishnapur Pt III (CT)	Urban	1060	5187	2657	2530	652	344	308	817	17	3925	2110	1815
			Dhanehari Pt I	Rural	679	3079	1584	1495	439	224	215	14	0	2362	1292	1070
			Dhanehari Pt III	Rural	371	1697	883	814	305	158	147	159	0	1211	653	558
Cachar	Silchar	Barjalenga	Niz Chatla Howar	Rural	299	1400	737	663	215	113	102	270	0	974	552	422
			Borakhai Grant	Rural	2857	12970	6673	6297	1782	925	857	1074	95	9033	5004	4029
			Barjalenga Pt I	Rural	296	1357	707	650	177	92	85	40	0	980	548	432

			Bar Jalenga Pt II	Rural	251	1017	530	487	130	64	66	81	0	645	362	283
Cachar	Silchar	Narsingpur	Paloipunji T.E.	Rural	550	2231	1142	1089	256	125	131	454	10	1452	828	624
			Barjalenga Pt IX (Pt XI)	Rural	511	2335	1203	1132	377	196	181	45	0	1483	820	663
			Barjalenga Pt III	Rural	158	687	347	340	128	62	66	1	0	349	220	129
			Barjalenga Pt IV	Rural	140	567	281	286	42	19	23	3	0	201	109	92
			Nagdirgram Pt IV	Rural	374	1917	964	953	298	150	148	291	0	1453	769	684
			Narsingpur Pt V	Rural	502	2060	1004	1056	211	104	107	205	0	1716	859	857
			Narsingpur Pt VI	Rural	325	1411	739	672	110	59	51	5	0	1217	654	563
			Nagdirgram Pt I	Rural	628	2863	1446	1417	427	223	204	2	0	2206	1164	1042
			Gajalghat	Rural	217	963	458	505	121	63	58	744	47	771	367	404
			Jibangram	Rural	328	1431	697	734	207	106	101	1011	275	1081	534	547
			Islamabad	Rural	727	3739	1890	1849	695	361	334	7	0	2371	1287	1084

			Saraspur	Rural	63	386	244	142	43	19	24	11	0	309	216	93
			Dhalaikhal F.V.	Rural	68	355	184	171	77	47	30	0	0	159	92	67
			Rampr asadpur	Rural	33	140	64	76	19	8	11	54	0	92	47	45
			Bhubandhar	Rural	133	623	325	298	96	56	40	603	0	483	251	232
			Dulalgram	Rural	478	1893	981	912	215	124	91	656	0	1610	834	776
			Nagdirgram Pt III	Rural	756	3531	1778	1753	533	288	245	135	0	2659	1411	1248
			Narsingpur Pt III	Rural	441	1885	941	944	199	102	97	101	0	1559	798	761
			Debipur	Rural	510	2148	1089	1059	287	160	127	1807	171	1760	892	868
			Sadagram (Sapagram)	Rural	1022	4238	2122	2116	395	199	196	726	310	3612	1846	1766
			Dhanipur	Rural	629	3131	1580	1551	561	284	277	0	0	2230	1186	1044
			Kajidahar Pt III	Rural	829	3706	1883	1823	491	247	244	58	0	2791	1490	1301
			Dhanipur	Rural	110	521	269	252	80	44	36	0	516	403	215	188
Cachar	Silchar	Palonghat	Didarkosh Pt II	Rural	287	1406	719	687	265	133	132	41	1	876	486	390

			Didarkosh Pt I	Rural	686	3068	1535	1533	541	249	292	677	0	2098	1165	933
			Ganganagar Pt V	Rural	121	505	258	247	80	42	38	18	0	367	200	167
			Rammaniayapur	Rural	415	1743	915	828	291	156	135	718	10	1197	669	528
			Nayagram	Rural	36	141	76	65	29	16	13	0	0	44	27	17
			Bhubannagar Pt I	Rural	60	246	118	128	38	17	21	0	0	156	84	72
			Bhubannagar Pt II	Rural	62	323	168	155	60	32	28	0	0	133	79	54
			Punirmukh	Rural	481	2004	1016	988	354	185	169	784	2	1467	769	698
			Malugram	Rural	322	1275	642	633	120	64	56	178	0	1079	554	525
			Bharampur	Rural	8	25	12	13	8	4	4	11	0	8	5	3
			Tupidahar Pt II	Rural	57	218	110	108	30	15	15	211	0	130	69	61
			Rukni Pt IV	Rural	584	2345	1168	1177	282	145	137	1736	49	1919	969	950
			Katanpur Grant	Rural	233	963	507	456	158	81	77	217	0	515	300	215
			Anandakhal	Rural	216	1077	556	521	198	89	109	124	0	576	378	198

Cachar	Lakhipur	Banskandi	Gangapur	Rural	530	2312	1166	1146	353	158	195	1090	28	1548	910	638
			Badripar Pt IV	Rural	351	1460	652	808	180	87	93	296	0	1027	499	528
			Badripar Pt III	Rural	265	1097	566	531	155	79	76	293	0	715	416	299
			Badripar Pt I	Rural	327	1409	728	681	239	126	113	233	0	683	395	288
			Badripar Pt II	Rural	43	189	83	106	18	5	13	0	0	170	78	92
			Gobindapur Pt III	Rural	606	3242	1637	1605	460	214	246	1	0	2510	1359	1151
			Niz-Banskandi Pt II	Rural	658	3283	1649	1634	439	199	240	14	0	2477	1351	1126
			Ratanpur	Rural	24	137	72	65	41	23	18	0	0	31	20	11
			Badripar	Rural	136	533	295	238	98	54	44	124	7	304	196	108
			Monipur Pt I	Rural	300	1483	709	774	187	83	104	0	0	1095	580	515
			Monipur Pt II	Rural	409	2046	1046	1000	295	157	138	0	0	1333	738	595
			Uzan Tarapur	Rural	515	2539	1298	1241	424	236	188	0	1	1614	894	720
Cachar	Lakhipur	Binnakandi	Singerbond Pt I	Rural	124	458	206	252	50	17	33	0	0	345	179	166
			Singerbond	Rural	458	2251	1152	1099	425	221	204	2	0	1352	748	604

			Pt II												
			Singer bond Pt III	Rural	421	2097	1052	1045	366	194	172	0	0	1448	780	668
			Boaligrant	Rural	609	2876	1484	1392	612	324	288	194	0	1244	771	473
			Chengsur Grant	Rural	381	1846	957	889	325	167	158	143	0	904	560	344
Cachar	Silchar	Rajabazar	Salamatpur Pt I	Rural	32	144	72	72	19	13	6	12	0	84	46	38
			Lalang Grant	Rural	1511	7181	3661	3520	951	504	447	666	10	4128	2446	1682
			Kanakpur Pt II	Rural	134	633	304	329	79	40	39	13	2	512	254	258
			Harinagar Khasia Punji	Rural	64	342	195	147	66	45	21	0	1	154	90	64
			Mahalthal	Rural	72	402	221	181	60	29	31	0	0	262	158	104
			Lalangkitta Labocpar Pt I	Rural	630	3085	1529	1556	399	218	181	62	1	2353	1193	1160
			Laboc Grant	Rural	1341	6432	3471	2961	823	434	389	334	45	4190	2524	1666
			Salamatpur Pt I	Rural	32	144	72	72	19	13	6	12	0	84	46	38
			Lalang	Rural	1511	7181	3661	3520	951	504	447	666	10	4128	2446	1682

			Grant												
			U.S. Molong	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Harinagar	Rural	156	820	428	392	94	42	52	3	5	580	336	244
			Chatridoyal (Charatdagal)	Rural	283	1587	820	767	277	149	128	0	0	911	521	390
			Pahelpur	Rural	48	266	134	132	35	13	22	0	133	168	94	74
			Purba Dakhin Mutrachara	Rural	64	308	167	141	44	26	18	91	138	260	137	123
			Narainpur Grant Pt II	Rural	297	1337	719	618	171	101	70	11	73	749	466	283
			Kanakpur Pt II	Rural	134	633	304	329	79	40	39	13	2	512	254	258
			Dikcha Grant	Rural	99	389	208	181	44	23	21	56	0	300	174	126
			Budhan Nagar	Rural	43	188	92	96	21	11	10	0	0	19	14	5
Cachar	Lakhipur	Lakhipur	Lalang Pt III	Rural	383	1815	910	905	223	109	114	0	0	1387	762	625
			Lalang Pt IV	Rural	225	1154	571	583	190	90	100	0	0	687	375	312
			Lalang Pt II	Rural	550	2673	1313	1360	347	176	171	5	0	1965	1024	941

			Lalang Pt I	Rural	571	2761	1396	1365	351	178	173	1	0	2015	1118	897
			Chirirpar Pt II	Rural	491	2428	1178	1250	368	189	179	0	0	1684	878	806
			Niz-Lakhipur Pt III	Rural	330	1674	775	899	220	104	116	0	0	1259	635	624
			Niz-Lakhipur Pt II	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Nayagram	Rural	476	2145	1020	1125	211	110	101	0	0	1780	890	890
			Digor Fulertol Pt I	Rural	243	1223	610	613	138	67	71	52	8	956	504	452
			Roujabad	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Lalang Kitta Labocpar Pt V	Rural	156	755	375	380	108	65	43	97	0	517	249	268
			Lalang Kitta Labocpar Pt IV	Rural	302	1360	693	667	183	105	78	0	0	984	532	452
			Chalitartol	Rural	66	343	179	164	100	54	46	0	0	163	97	66
			U.S.Labongkhal Pt IV	Rural	128	691	366	325	110	61	49	0	576	482	254	228
			Uttar Lalpani	Rural	286	1530	764	766	325	159	166	13	1	920	516	404
			Howkip	Rural	50	274	133	141	32	16	16	0	137	234	117	117

			Punji												
			Khairabad Fv(Old Khairabad Fv)	Rural	75	396	267	129	48	38	10	0	0	256	178	78
			Sibpur Pt I	Rural	300	1318	638	680	111	61	50	4	0	1083	556	527
			Chiriripar Pt I	Rural	244	1225	610	615	180	105	75	0	0	848	442	406
			Chalitartol	Rural	66	343	179	164	100	54	46	0	0	163	97	66
Total (A)					102143	473627	242471	231156	71673	36802	34871	66060	3580	323858	177173	146685
Karimganj	Karimganj	North Karimganj	Chandsrikuna Chak	Rural	380	1854	955	899	247	135	112	257	0	1320	733	587
			Tajpur Pt I	Rural	101	480	233	247	68	33	35	93	0	363	185	178
			Surigram Pt I	Rural	80	458	239	219	62	39	23	0	0	372	195	177
			Dharakuna	Rural	167	846	429	417	138	72	66	9	0	611	323	288
			Karnamadhu Pt II	Rural	854	4452	2264	2188	800	405	395	36	2	2766	1505	1261
			Ayalabari T.E.	Rural	244	1038	530	508	165	91	74	23	4	339	215	124
			Ramanikrishna T.E.	Rural	110	400	207	193	42	21	21	0	0	227	141	86
			Madanpur T.E.	Rural	101	471	247	224	66	29	37	0	0	224	146	78

			Hizimangura Pt I	Rural	53	202	113	89	25	15	10	0	0	65	48	17
			Chandkhani	Rural	62	361	176	185	53	25	28	0	0	284	142	142
			Brahmanshasan Chak	Rural	459	2794	1429	1365	607	295	312	0	0	1435	772	663
			Meda Pt II	Rural	121	615	324	291	102	50	52	494	0	418	236	182
			Dasgram Pt II	Rural	319	1762	902	860	379	179	200	0	0	1016	559	457
			Nandibari	Rural	37	198	107	91	31	11	20	0	0	165	96	69
			Chandkhani Chak	Rural	155	615	313	302	101	55	46	522	1	217	129	88
			Hizim	Rural	430	2282	1150	1132	414	196	218	51	0	1678	896	782
			Promodnagar T.E.	Rural	199	852	431	421	123	72	51	445	0	312	195	117
			Bargool	Rural	43	172	82	90	46	18	28	0	0	47	29	18
			Nayagram Pt II	Rural	92	437	218	219	98	43	55	0	0	222	137	85
Karimganj	Karimganj	South Karimganj	Mubarakpur	Rural	375	1945	993	952	254	132	122	115	0	1256	692	564
			Ambarkhana	Rural	231	1204	593	611	156	83	73	69	7	921	459	462
			Kaibarthakapan	Rural	54	250	123	127	48	24	24	0	0	122	65	57
			Nagkapan Pt I	Rural	258	1439	735	704	307	161	146	5	0	846	471	375
			Pancha	Rural	40	167	71	96	26	12	14	29	0	106	45	61

			s												
			Kulcherra Pt I	Rural	118	732	360	372	168	83	85	0	0	373	205	168
			Jalalnagar T.E.	Rural	116	492	249	243	66	36	30	0	0	129	78	51
			Ranibari	Rural	184	927	468	459	149	75	74	0	0	638	332	306
			Umarpur Pt I	Rural	124	589	293	296	70	34	36	466	0	464	237	227
			Kamalpur	Rural	321	1423	698	725	292	144	148	144	2	831	440	391
			Angura	Rural	350	1712	859	853	242	120	122	150	6	1207	639	568
			Ghugrakona Pt II	Rural	121	609	301	308	90	41	49	13	0	455	230	225
			Dalgram	Rural	517	3108	1543	1565	628	276	352	44	0	1828	1013	815
			Duliakhal	Rural	207	1022	536	486	139	73	66	0	0	781	428	353
			Farampasha Pt I	Rural	732	3437	1754	1683	542	288	254	59	0	2444	1314	1130
			Kaysthagram Pt I	Rural	43	214	105	109	41	13	28	0	0	126	71	55
			Duliakhal Karaibari	Rural	226	1184	608	576	208	109	99	252	0	781	432	349
			Nayagram	Rural	171	908	474	434	151	83	68	180	0	682	367	315
			Singaria Pt II	Rural	307	1717	892	825	284	155	129	10	0	1163	645	518
			Kamarg	Rural	317	1642	817	825	338	165	173	0	0	1084	564	520

			ram												
			Maizba gargool Pt I	Rural	227	1089	540	549	190	97	93	449	3	729	364	365
			Maizba gargool Pt II	Rural	64	308	151	157	60	30	30	13	0	202	105	97
			Maizba gargool Pt III	Rural	64	270	148	122	38	24	14	16	0	207	116	91
			Saidpur	Rural	245	1335	676	659	251	125	126	22	0	954	517	437
			Krishna nagar Pt II	Rural	7	34	18	16	9	6	3	0	0	25	12	13
			Kulcherra Pt II	Rural	248	1410	702	708	327	150	177	0	0	906	501	405
			Ghugra kona Pt I	Rural	221	1379	715	664	305	164	141	0	0	740	395	345
			Ghugra kona Pt IV	Rural	17	103	60	43	18	12	6	0	0	69	40	29
Karimganj	Karimganj	Patharkandi	Baraituk	Rural	219	1135	557	578	228	116	112	453	1	695	355	340
			Hafania Kitte Badejama	Rural	390	1895	964	931	383	190	193	11	0	1238	672	566
			Teghari a Kitte Tehurbeel	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Madanduri	Rural	157	882	444	438	185	90	95	98	0	570	318	252

			Serpur Kitte Chotobeel	Rural	25	131	69	62	22	13	9	0	0	91	50	41
			Hafania	Rural	118	671	332	339	131	58	73	0	0	384	208	176
			Serpur Pt II	Rural	204	948	488	460	145	81	64	0	0	612	341	271
			Dhalcharra Kitte Hatirgool	Rural	369	2056	1052	1004	371	188	183	30	0	1377	761	616
			Hatirgool	Rural	555	3111	1598	1513	640	331	309	30	0	1780	996	784
			Chandpur	Rural	429	2444	1220	1224	483	238	245	0	0	1435	793	642
			Chipacharra	Rural	32	153	80	73	30	11	19	1	0	63	47	16
			Bazarghat F.V.	Rural	171	998	488	510	252	123	129	0	0	546	303	243
			Gangpar	Rural	174	870	451	419	146	81	65	201	0	652	353	299
Karimganj	Karimganj	Lowairpoa	Kurtacharra	Rural	76	291	159	132	60	37	23	0	0	125	67	58
			Adamtilla T.E.	Rural	586	2619	1325	1294	416	202	214	66	1	1190	703	487
			Longai T.E.	Rural	574	2394	1214	1180	393	200	193	130	0	1052	663	389
			Dalua Charra	Rural	120	473	237	236	104	47	57	0	0	199	120	79
			Paschim Lalkhira Sonakhi	Rural	172	695	370	325	130	59	71	28	0	330	211	119

			ra												
			Purbo Piplagool	Rural	154	655	338	317	94	47	47	145	3	275	176	99
			Dakshin Sonakhira	Rural	0	0	0	0	0	0	0	0	0	0	0	0
			Shephinjuri T.E.	Rural	271	1386	674	712	254	128	126	0	0	288	198	90
			Indurali Punjee	Rural	42	192	99	93	32	21	11	0	0	118	69	49
			Baithakhal Basti	Rural	370	1821	920	901	289	140	149	605	0	1267	681	586
			Ankapai Punjee	Rural	255	1210	624	586	219	113	106	785	0	781	409	372
			Salgoi T.E.	Rural	387	1615	835	780	261	127	134	558	0	817	526	291
			Paschim Salgoi	Rural	501	2131	1153	978	311	171	140	586	0	979	644	335
			Dhengarbond	Rural	308	1625	833	792	316	174	142	51	0	988	536	452
			Pecharghat	Rural	79	325	169	156	38	18	20	3	0	245	139	106
			Uttor Hatikhira	Rural	142	611	319	292	87	44	43	26	0	308	207	101
			Purbo Indurali	Rural	46	240	122	118	31	18	13	2	102	148	82	66
			Hatikhira T.E.	Rural	750	3437	1739	1698	514	249	265	824	1	2036	1195	841
			Dakshin	Rural	420	1792	920	872	243	126	117	268	2	993	614	379

			Hatikhira												
			Kalacharra	Rural	839	3803	1916	1887	518	264	254	477	0	2929	1554	1375
			Isabeel	Rural	1551	6790	3467	3323	1000	488	512	1051	0	4041	2376	1665
			Uttor Isarpar Kitte Chandpur	Rural	101	599	281	318	156	76	80	9	0	232	124	108
			Isarpar	Rural	445	2377	1208	1169	527	262	265	128	0	1217	720	497
			Radha madhab pur Kitte Rashidpur	Rural	374	2169	1110	1059	507	256	251	14	10	852	477	375
			Kalanpur	Rural	374	2168	1119	1049	475	251	224	0	0	1141	643	498
			Longai Forest	Rural	74	321	157	164	47	15	32	18	0	180	96	84
			Kanikhai F.V.	Rural	858	4260	2201	2059	732	353	379	1304	6	2452	1409	1043
			Old Solamona F.V.	Rural	413	2467	1254	1213	517	262	255	0	0	1138	681	457
			Zahanpur F.V.	Rural	84	450	214	236	113	58	55	0	0	204	120	84
			North Maguna F.V.	Rural	93	473	258	215	82	41	41	434	0	348	195	153
			Maguna Punjee F.V.	Rural	133	884	439	445	139	72	67	15	4	497	255	242

			Proper Magura F.V.	Rural	44	239	120	119	39	20	19	142	0	163	86	77
			Shambu Nagar F.V.	Rural	141	854	435	419	196	109	87	0	0	433	248	185
			Manik Bond Mahi F.V.	Rural	287	1538	780	758	305	160	145	414	0	859	497	362
			South Magura F.V.	Rural	152	664	335	329	109	51	58	459	0	472	247	225
			Piplapu njee F.V.	Rural	166	949	493	456	137	72	65	2	13	698	396	302
Total (B)					24137	120749	61411	59338	21371	10750	10621	13334	168	71588	40020	31568
Total (A+B)					126280	594376	303882	290494	93044	47552	45492	79394	3748	395446	217193	178253

Source: District Census Handbook; Cachar and Karimganj District (2011)

ANNEXURE 2: EMPLOYMENT PATTERN IN THE BLOCK AREA

District	Sub-Division	CD Block	Village	Area Type	Total Population	Main Workers			Marginal Workers			Non Workers		
						Total	Male	Female	Total	Male	Female	Total	Male	Female
Cachar	Silchar	Katigora	Niz Leverpute Pt II	Rural	2014	468	434	34	62	47	15	1484	518	966
			Saidpur Pt I	Rural	950	261	243	18	24	21	3	665	228	437
			Saidpur Pt II	Rural	1125	319	294	25	18	10	8	788	268	520
			Saidpur Pt III	Rural	654	80	75	5	114	108	6	460	148	312
			Chandi Nagar Pt II	Rural	2453	530	508	22	44	43	1	1879	681	1198
			Hari Nagar Pt I	Rural	1517	291	277	14	192	177	15	1034	380	654
			Hari Nagar Pt II	Rural	1363	362	264	98	75	67	8	926	372	554
			Hari Nagar Pt III	Rural	724	246	192	54	118	29	89	360	150	210
			Niz Hari Tikar Pt II	Rural	2192	541	496	45	52	47	5	1599	584	1015
			Karai Kandi Pt I	Rural	663	117	114	3	250	71	179	296	153	143
			Nazat Pur	Rural	2036	460	443	17	87	68	19	1489	534	955
			Lathimara (Latimara)	Rural	3250	797	768	29	77	72	5	2376	849	1527
			Siddeswar Pt I	Rural	292	62	53	9	53	42	11	177	59	118
			Gobindapur Pt III	Rural	3392	626	583	43	613	470	143	2153	732	1421
			Kalinagar	Rural	1285	310	297	13	52	45	7	923	303	620
			Sripur Pt I	Rural	1617	383	358	25	25	18	7	1209	468	741
			Chandranath Pur	Rural	2781	828	603	225	326	180	146	1627	619	1008
			Mulidahar Grant	Rural	1157	314	249	65	287	86	201	556	274	282
			Leburbond	Rural	849	66	56	10	227	196	31	556	166	390
			Borodudhpatil Grant	Rural	3657	1077	871	206	304	134	170	2276	878	1398
			Dudhpatil Pt V (CT)	Urban	4121	1047	965	82	251	142	109	2823	985	1838
			Niz Katigorah Pt II	Rural	2437	581	550	31	179	145	34	1677	587	1090
			Siddeswar Pt II	Rural	2415	655	598	57	78	45	33	1682	579	1103
			Sidhipur	Rural	1763	481	458	23	49	35	14	1233	414	819
Cachar	Silchar	Salchapra	Bhangerpar Pt IV	Rural	3201	657	622	35	417	174	243	2127	849	1278
			Chandpur Pt IV	Rural	1780	418	399	19	103	71	32	1259	462	797

			Pratapi Para	Rural	400	11	9	2	58	51	7	331	153	178
			Ujan Gram	Rural	1996	436	391	45	45	33	12	1515	589	926
			Bhairab Nagar	Rural	2703	706	621	85	281	105	176	1716	669	1047
			Nischintapur	Rural	1392	359	338	21	14	14	0	1019	360	659
Cachar	Silchar	Borkhola	Sunapur Pt I	Rural	4775	1268	1186	82	118	70	48	3389	1143	2246
			Sunapur Pt II	Rural	943	239	235	4	1	1	0	703	260	443
			Sunapur Pt III	Rural	1001	93	84	9	192	188	4	716	239	477
			Rangar Pt I	Rural	1499	342	309	33	78	33	45	1079	420	659
			Rangar Pt III(Rangghar Pt III)	Rural	420	98	95	3	45	38	7	277	98	179
			Heirbond Pt II	Rural	746	25	23	2	231	143	88	490	209	281
			Chutra Sangan	Rural	330	94	87	7	3	3	0	233	75	158
			Masimpur Grant	Rural	1771	872	859	13	166	67	99	733	267	466
			Dudhpatil Pt V (CT)	Urban	4121	1047	965	82	251	142	109	2823	985	1838
			Masimpur Pt II	Rural	2364	1000	955	45	142	81	61	1222	414	808
			Ardvallik	Rural	789	215	207	8	19	19	0	555	195	360
			Dudhpatil Pt III	Rural	527	126	121	5	17	15	2	384	123	261
Cachar	Silchar	Kalain	Digor Mahadevpur	Rural	284	67	61	6	69	28	41	148	67	81
			Kushierkul	Rural	618	192	167	25	61	44	17	365	112	253
			Ratha Cherre Khasia Punjee	Rural	0	0	0	0	0	0	0	0	0	0
			Suna Cherra Mikir Punjee	Rural	0	0	0	0	0	0	0	0	0	0
			Mahadevpur Pt I	Rural	1185	311	289	22	67	59	8	807	287	520
			Mahadevpur Pt II	Rural	771	256	241	15	7	4	3	508	174	334
			Mahadevpur Pt III	Rural	759	196	175	21	29	25	4	534	185	349
			Mahadevpur Pt IV	Rural	832	93	85	8	80	78	2	659	253	406
			Saraspur	Rural	1508	429	399	30	14	12	2	1065	359	706
			Talkar Beel	Rural	56	19	18	1	0	0	0	37	14	23
			Rajyeswarpur Pt II(Rajeswarpur	Rural	1592	419	359	60	92	77	15	1081	370	711

			Rajyeswarpur Pt I	Rural	886	266	215	51	40	30	10	580	199	381
			Chandipur	Rural	1441	407	384	23	7	6	1	1027	362	665
			Paikan	Rural	2848	696	657	39	70	53	17	2082	745	1337
			Khelma Pt VIII	Rural	2269	550	509	41	47	43	4	1672	585	1087
			Khelma Pt VII	Rural	2565	600	582	18	51	30	21	1914	711	1203
			Khelma Pt VI	Rural	2737	634	606	28	167	132	35	1936	683	1253
			Khelma Pt I	Rural	2002	530	507	23	7	6	1	1465	559	906
			Khelma Pt II	Rural	1607	421	418	3	1	1	0	1185	418	767
			Khelma Pt III	Rural	1812	459	439	20	88	35	53	1265	496	769
			Khelma Pt IV	Rural	634	139	139	0	5	4	1	490	191	299
			Khelma Pt V	Rural	1160	297	289	8	64	30	34	799	260	539
			Bhairabpur Pt I	Rural	1116	157	152	5	194	190	4	765	228	537
			Bhairabpur Pt II	Rural	3301	566	553	13	450	359	91	2285	712	1573
			Bhairabpur Pt III	Rural	459	119	112	7	18	18	0	322	106	216
			Digabar Grant	Rural	1412	518	369	149	69	43	26	825	332	493
			Lakhipur Pt II	Rural	1572	415	383	32	34	33	1	1123	372	751
			Lakhipur Pt III	Rural	528	118	105	13	22	8	14	388	149	239
			Rajagarh Khasia Punjee	Rural	57	32	18	14	0	0	0	25	13	12
			Sewti Pt I (Santi Pt I)	Rural	2742	372	338	34	433	354	79	1937	692	1245
			Sewti Pt II	Rural	1188	150	137	13	208	153	55	830	304	526
			Burunga Pt I	Rural	2766	475	397	78	278	229	49	2013	833	1180
			Burunga Pt II	Rural	1422	418	381	37	8	8	0	996	358	638
			Burunga Pt III	Rural	1299	314	304	10	33	31	2	952	347	605
			Tarapur	Rural	3027	809	693	116	121	76	45	2097	792	1305
			Talkar Grant	Rural	8068	2442	1972	470	502	308	194	5124	1916	3208
			Karaballe Grant	Rural	218	110	62	48	2	2	0	106	47	59
			Biswambarpur	Rural	1703	490	423	67	102	59	43	1111	407	704
			Gumra Grant	Rural	686	167	152	15	17	15	2	502	156	346
			Manipur Pt II	Rural	442	30	27	3	166	113	53	246	87	159
Cachar	Silchar	Silchar	Berenga Pt II	Rural	4353	813	692	121	429	337	92	3111	1200	1911
			Berenga Pt III	Rural	4125	1014	910	104	378	265	113	2733	970	1763

			Berenga Pt V	Rural	2289	559	530	29	76	69	7	1654	579	1075
			Berenga Pt I	Rural	2372	533	494	39	59	40	19	1780	695	1085
			Ambicapur Pt XI	Rural	2778	896	705	191	70	36	34	1812	658	1154
			Ambicapur Pt VIII (CT)	Urban	11691	3578	2997	581	294	186	108	7819	2683	5136
			Ambicapur Pt VI (CT)	Urban	7971	2125	1939	186	229	196	33	5617	1935	3682
			Uttar Krishnapur Pt. I (CT)	Urban	6960	1867	1601	266	378	270	108	4715	1678	3037
			Tarapur VII (CT)	Urban	6977	2199	1876	323	111	54	57	4667	1576	3091
Cachar	Silchar	Udarbond	Larsingpar Grant	Rural	3726	1364	761	603	517	280	237	1845	838	1007
			Jhapirbond Pt II	Rural	1184	179	161	18	158	132	26	847	318	529
			Rangpur Pt III	Rural	1254	350	331	19	18	14	4	886	287	599
			Kachipur Pt II	Rural	3383	762	713	49	404	194	210	2217	857	1360
			Kachipur Pt I	Rural	1550	374	336	38	14	9	5	1162	448	714
			Ratanpur	Rural	245	20	18	2	50	46	4	175	65	110
			Patichara T.E.(Puthicharagrant	Rural	876	457	260	197	16	10	6	403	176	227
			Nayagram	Rural	748	220	162	58	80	44	36	448	196	252
			Arcuttepur Grant	Rural	4037	1090	790	300	300	235	65	2647	1028	1619
			Durga Nagar Pt. V (CT)	Urban	9051	2558	2203	355	527	390	137	5966	1929	4037
			Nutan Dayapur	Rural	2204	599	540	59	152	56	96	1453	526	927
			Taligram	Rural	1208	306	219	87	261	156	105	641	243	398
			Salganga Par	Rural	3785	1623	1413	210	116	48	68	2046	698	1348
			Kaspur Bagerkona	Rural	1795	437	369	68	64	50	14	1294	472	822
			Chandi Ghat Pt III	Rural	1348	419	294	125	81	46	35	848	345	503
			Pangram Pt III	Rural	3636	842	774	68	506	236	270	2288	882	1406
			Doyapore Grant	Rural	4202	1477	1113	364	506	251	255	2219	960	1259
			Latigram (Lathigram)	Rural	2513	559	527	32	91	35	56	1863	754	1109

			Gossaipur Pt V	Rural	1410	429	392	37	51	37	14	930	296	634
Cachar	Silchar	Sonai	Uttar Krishnapur Pt II	Rural	4546	991	880	111	280	207	73	3275	1296	1979
			Sabashpur (Sabujpur)	Rural	770	215	201	14	3	2	1	552	182	370
			Bariknagar Pt II	Rural	4041	984	912	72	462	211	251	2595	994	1601
			Bariknagar Pt I	Rural	1209	336	237	99	58	35	23	815	319	496
			Sildubi	Rural	813	344	255	89	35	9	26	434	180	254
			Menipur Pt I	Rural	1207	424	330	94	80	16	64	703	284	419
			Sildubi Grant	Rural	4452	1091	1010	81	343	241	102	3018	1032	1986
			Saidpur Pt I	Rural	1877	404	383	21	107	58	49	1366	509	857
			Saidpur Pt II	Rural	3807	680	556	124	309	262	47	2818	1128	1690
			Sonabarighat Pt I	Rural	2908	743	681	62	51	43	8	2114	736	1378
			Saidpur Pt III	Rural	1888	383	365	18	178	162	16	1327	475	852
			Saidpur Pt IV	Rural	3347	561	536	25	374	312	62	2412	837	1575
			Saidpur Pt V	Rural	1856	414	386	28	86	80	6	1356	449	907
			Dhanehari Pt II	Rural	4322	676	649	27	525	478	47	3121	1086	2035
			Nutan Ramnagar Pt IV	Rural	2784	677	637	40	135	68	67	1972	734	1238
			Nutan Ramnagar Pt V	Rural	2112	508	480	28	85	62	23	1519	517	1002
			Dakshin Mohanpur Pt IV	Rural	286	62	56	6	19	17	2	205	73	132
			Dakshin Mohanpur Pt VIII	Rural	1207	273	265	8	36	16	20	898	324	574
			Dakshin Mohanpur Pt VII	Rural	5149	1164	1053	111	333	254	79	3652	1252	2400
			Dakshin Mohanpur Pt III	Rural	1018	240	206	34	192	79	113	586	241	345
			Bhaurikandi Pt I (Bhanri)	Rural	2720	566	531	35	211	150	61	1943	657	1286
			Dakshin Mohanpur	Rural	3040	695	644	51	139	113	26	2206	775	1431

			Pt V										
			Dakshin Mohanpur Pt VI	Rural	1297	276	265	11	263	86	177	758	313	445
			Kachudaram Pt I	Rural	3086	656	615	41	288	237	51	2142	738	1404
			Bhaurikandi Pt II	Rural	1418	360	332	28	7	3	4	1051	377	674
			Kachudaram Pt IV	Rural	3138	746	693	53	110	85	25	2282	737	1545
			Kachudaram Pt III	Rural	1340	330	310	20	12	10	2	998	384	614
			Sundari Pt III	Rural	1032	235	213	22	55	34	21	742	256	486
			Dakshin Mohanpur Pt I	Rural	2421	601	509	92	214	138	76	1606	590	1016
			Kachudaram Pt II	Rural	2583	688	651	37	41	33	8	1854	597	1257
			Uttar Krishnapur Pt III (CT)	Urban	5187	1345	1162	183	238	187	51	3604	1308	2296
			Dhanehari Pt I	Rural	3079	797	766	31	166	98	68	2116	720	1396
			Dhanehari Pt III	Rural	1697	328	298	30	348	164	184	1021	421	600
Cachar	Silchar	Barjalenga	Niz Chatla Howar	Rural	1400	218	199	19	201	179	22	981	359	622
			Borakhai Grant	Rural	12970	3636	2939	697	1257	576	681	8077	3158	4919
			Barjalenga Pt I	Rural	1357	401	352	49	69	33	36	887	322	565
			Bar Jalenga Pt II	Rural	1017	293	260	33	54	24	30	670	246	424
Cachar	Silchar	Narsingpur	Paloipunji T.E.	Rural	2231	761	602	159	467	182	285	1003	358	645
			Barjalenga Pt IX (Pt XI)	Rural	2335	608	533	75	136	82	54	1591	588	1003
			Barjalenga Pt III	Rural	687	266	168	98	73	38	35	348	141	207
			Barjalenga Pt IV	Rural	567	303	154	149	37	19	18	227	108	119
			Nagdirgram Pt IV	Rural	1917	491	469	22	48	15	33	1378	480	898
			Narsingpur Pt V	Rural	2060	458	358	100	337	187	150	1265	459	806
			Narsingpur Pt VI	Rural	1411	418	370	48	171	69	102	822	300	522
			Nagdirgram Pt I	Rural	2863	757	693	64	300	109	191	1806	644	1162
			Gajalghat	Rural	963	259	229	30	10	6	4	694	223	471
			Jibangram	Rural	1431	398	350	48	18	9	9	1015	338	677
			Islamabad	Rural	3739	942	869	73	142	61	81	2655	960	1695
			Saraspur	Rural	386	187	180	7	7	4	3	192	60	132

			Dhalaikhal F.V.	Rural	355	98	88	10	3	2	1	254	94	160
			Ramprasadpur	Rural	140	48	43	5	48	5	43	44	16	28
			Bhubandhar	Rural	623	202	177	25	3	1	2	418	147	271
			Dulalgram	Rural	1893	503	445	58	88	69	19	1302	467	835
			Nagdirgram Pt III	Rural	3531	852	777	75	329	126	203	2350	875	1475
			Narsingpur Pt III	Rural	1885	466	391	75	86	58	28	1333	492	841
			Debipur	Rural	2148	324	288	36	312	283	29	1512	518	994
			Sadagram (Sapagram)	Rural	4238	1247	1086	161	198	142	56	2793	894	1899
			Dhanipur	Rural	3131	776	735	41	69	60	9	2286	785	1501
			Kajidahar Pt III	Rural	3706	1134	890	244	261	178	83	2311	815	1496
			Dhanipur	Rural	521	169	163	6	2	0	2	350	106	244
Cachar	Silchar	Palon ghat	Didarkosh Pt II	Rural	1406	256	245	11	103	84	19	1047	390	657
			Didarkosh Pt I	Rural	3068	648	572	76	269	173	96	2151	790	1361
			Ganganagar Pt V	Rural	505	123	111	12	19	17	2	363	130	233
			Rammaniayapur	Rural	1743	444	410	34	155	92	63	1144	413	731
			Nayagram	Rural	141	65	48	17	7	2	5	69	26	43
			Bhubannagar Pt I	Rural	246	69	54	15	26	4	22	151	60	91
			Bhubannagar Pt II	Rural	323	87	64	23	84	37	47	152	67	85
			Punirmukh	Rural	2004	492	438	54	217	120	97	1295	458	837
			Malugram	Rural	1275	307	289	18	28	17	11	940	336	604
			Bharampur	Rural	25	6	5	1	1	1	0	18	6	12
			Tupidahar Pt II	Rural	218	64	61	3	29	7	22	125	42	83
			Rukni Pt IV	Rural	2345	611	538	73	258	159	99	1476	471	1005
			Katanpur Grant	Rural	963	257	228	29	108	43	65	598	236	362
			Anandakhal	Rural	1077	250	225	25	139	79	60	688	252	436
Cachar	Lakhipur	Banskandi	Gangapur	Rural	2312	670	614	56	48	27	21	1594	525	1069
			Badripar Pt IV	Rural	1460	303	241	62	53	32	21	1104	379	725
			Badripar Pt III	Rural	1097	332	307	25	26	15	11	739	244	495
			Badripar Pt I	Rural	1409	453	341	112	84	29	55	872	358	514
			Badripar Pt II	Rural	189	54	47	7	27	7	20	108	29	79
			Gobindapur Pt III	Rural	3242	718	639	79	589	207	382	1935	791	1144

			Niz-Banskandi Pt II	Rural	3283	852	779	73	168	68	100	2263	802	1461
			Ratanpur	Rural	137	26	24	2	7	7	0	104	41	63
			Badripar	Rural	533	133	118	15	12	11	1	388	166	222
			Monipur Pt I	Rural	1483	439	377	62	118	16	102	926	316	610
			Monipur Pt II	Rural	2046	495	471	24	63	26	37	1488	549	939
			Uzan Tarapur	Rural	2539	448	398	50	498	214	284	1593	686	907
Cachar	Lakhipur	Binnakandi	Singerbond Pt I	Rural	458	51	45	6	148	47	101	259	114	145
			Singerbond Pt II	Rural	2251	581	566	15	20	16	4	1650	570	1080
			Singerbond Pt III	Rural	2097	426	408	18	129	97	32	1542	547	995
			Boaligrant	Rural	2876	762	606	156	113	92	21	2001	786	1215
			Chengsur Grant	Rural	1846	704	486	218	15	14	1	1127	457	670
Cachar	Silchar	Rajabazar	Salamatpur Pt I	Rural	144	16	11	5	41	23	18	87	38	49
			Lalang Grant	Rural	7181	2167	1511	656	441	223	218	4573	1927	2646
			Kanakpur Pt II	Rural	633	192	145	47	38	20	18	403	139	264
			Harinagar Khasia Punji	Rural	342	84	82	2	104	31	73	154	82	72
			Mahalthal	Rural	402	86	85	1	18	15	3	298	121	177
			Lalangkitta Labocpar Pt I	Rural	3085	829	727	102	109	74	35	2147	728	1419
			Laboc Grant	Rural	6432	1563	1206	357	477	363	114	4392	1902	2490
			Salamatpur Pt I	Rural	144	16	11	5	41	23	18	87	38	49
			Lalang Grant	Rural	7181	2167	1511	656	441	223	218	4573	1927	2646
			U.S. Molong	Rural	0	0	0	0	0	0	0	0	0	0
			Harinagar	Rural	820	261	242	19	245	57	188	314	129	185
			Chatridoyal (Charatdagal)	Rural	1587	380	330	50	312	99	213	895	391	504
			Pahelpur	Rural	266	76	67	9	20	9	11	170	58	112
			Purba Dakhin Mutrachara	Rural	308	155	101	54	98	34	64	55	32	23
			Narainpur Grant Pt II	Rural	1337	369	315	54	269	96	173	699	308	391
			Kanakpur Pt II	Rural	633	192	145	47	38	20	18	403	139	264
			Dikcha Grant	Rural	389	126	106	20	2	2	0	261	100	161

			Budhan Nagar	Rural	188	69	55	14	42	4	38	77	33	44
Cachar	Lakhipur	Lakhipur	Lalang Pt III	Rural	1815	522	389	133	283	124	159	1010	397	613
			Lalang Pt IV	Rural	1154	345	227	118	356	147	209	453	197	256
			Lalang Pt II	Rural	2673	743	577	166	281	136	145	1649	600	1049
			Lalang Pt I	Rural	2761	712	604	108	487	159	328	1562	633	929
			Chirirpar Pt II	Rural	2428	599	448	151	321	104	217	1508	626	882
			Niz-Lakhipur Pt III	Rural	1674	329	294	35	184	72	112	1161	409	752
			Niz-Lakhipur Pt II	Rural	0	0	0	0	0	0	0	0	0	0
			Nayagram	Rural	2145	594	471	123	235	84	151	1316	465	851
			Digor Fulertol Pt I	Rural	1223	304	264	40	138	70	68	781	276	505
			Roujabad	Rural	0	0	0	0	0	0	0	0	0	0
			Lalang Kitta Labocpar Pt V	Rural	755	166	153	13	133	39	94	456	183	273
			Lalang Kitta Labocpar Pt IV	Rural	1360	314	281	33	220	124	96	826	288	538
			Chalitartol	Rural	343	68	64	4	6	4	2	269	111	158
			U.S.Labongkhal Pt IV	Rural	691	181	156	25	204	71	133	306	139	167
			Uttar Lalpani	Rural	1530	404	339	65	79	66	13	1047	359	688
			Howkip Punji	Rural	274	54	37	17	24	15	9	196	81	115
			Khairabad Fv(Old Khairabad Fv)	Rural	396	16	10	6	144	91	53	236	166	70
			Sibpur Pt I	Rural	1318	321	250	71	139	35	104	858	353	505
			Chirirpar Pt I	Rural	1225	181	127	54	450	185	265	594	298	296
			Chalitartol	Rural	343	68	64	4	6	4	2	269	111	158
Total (A)					473627	122043	105527	16516	35793	21037	14756	315791	115907	199884
Karimganj	Karimganj	North Karimganj	Chandsrikuna Chak	Rural	1854	406	358	48	277	172	105	1171	425	746
			Tajpur Pt I	Rural	480	94	84	10	20	17	3	366	132	234
			Surigram Pt I	Rural	458	107	100	7	1	1	0	350	138	212
			Dharakuna	Rural	846	239	226	13	14	8	6	593	195	398

			Karnamadhu Pt II	Rural	4452	825	761	64	575	352	223	3052	1151	1901
			Ayalabari T.E.	Rural	1038	558	289	269	50	23	27	430	218	212
			Ramanikrishna T.E.	Rural	400	173	101	72	6	3	3	221	103	118
			Madanpur T.E.	Rural	471	205	133	72	1	1	0	265	113	152
			Hizimangura Pt I	Rural	202	154	80	74	13	8	5	35	25	10
			Chandkhani	Rural	361	82	73	9	12	10	2	267	93	174
			Brahmanshasan Chak	Rural	2794	652	611	41	359	144	215	1783	674	1109
			Meda Pt II	Rural	615	101	97	4	170	95	75	344	132	212
			Dasgram Pt II	Rural	1762	385	371	14	92	84	8	1285	447	838
			Nandibari	Rural	198	65	62	3	1	1	0	132	44	88
			Chandkhani Chak	Rural	615	381	197	184	5	2	3	229	114	115
			Hizim	Rural	2282	493	469	24	200	150	50	1589	531	1058
			Promodnagar T.E.	Rural	852	370	201	169	66	36	30	416	194	222
			Bargool	Rural	172	107	54	53	0	0	0	65	28	37
			Nayagram Pt II	Rural	437	120	102	18	17	8	9	300	108	192
Karimganj	Karimganj	South Karimganj	Mubarakpur	Rural	1945	365	337	28	107	90	17	1473	566	907
			Ambarkhana	Rural	1204	254	222	32	108	85	23	842	286	556
			Kaibarthakapan	Rural	250	55	55	0	11	8	3	184	60	124
			Nagkapan Pt I	Rural	1439	312	303	9	31	28	3	1096	404	692
			Panchas	Rural	167	60	38	22	58	13	45	49	20	29
			Kulcherra Pt I	Rural	732	155	151	4	9	5	4	568	204	364
			Jalalnagar T.E.	Rural	492	288	159	129	45	21	24	159	69	90
			Ranibari	Rural	927	273	245	28	22	16	6	632	207	425
			Umarpur Pt I	Rural	589	141	139	2	2	2	0	446	152	294
			Kamalpur	Rural	1423	426	405	21	20	3	17	977	290	687
			Angura	Rural	1712	519	411	108	59	21	38	1134	427	707
			Ghugrakona Pt II	Rural	609	191	119	72	40	15	25	378	167	211
			Dalgram	Rural	3108	648	612	36	478	217	261	1982	714	1268
			Duliakhal	Rural	1022	279	268	11	35	26	9	708	242	466
			Farampasha Pt I	Rural	3437	827	751	76	250	135	115	2360	868	1492

			Kaysthagram Pt I	Rural	214	50	48	2	20	11	9	144	46	98
			Duliakhal Karaibari	Rural	1184	229	215	14	96	87	9	859	306	553
			Nayagram	Rural	908	313	205	108	72	45	27	523	224	299
			Singaria Pt II	Rural	1717	384	360	24	158	124	34	1175	408	767
			Kamargram	Rural	1642	435	402	33	173	50	123	1034	365	669
			Maizbagargool Pt I	Rural	1089	232	216	16	287	98	189	570	226	344
			Maizbagargool Pt II	Rural	308	69	61	8	37	30	7	202	60	142
			Maizbagargool Pt III	Rural	270	56	55	1	88	26	62	126	67	59
			Saidpur	Rural	1335	310	290	20	50	44	6	975	342	633
			Krishnanagar Pt II	Rural	34	7	7	0	0	0	0	27	11	16
			Kulcherra Pt II	Rural	1410	531	358	173	55	35	20	824	309	515
			Ghugrakona Pt I	Rural	1379	432	350	82	68	16	52	879	349	530
			Ghugrakona Pt IV	Rural	103	48	25	23	1	0	1	54	35	19
Karimganj	Karimganj	Patharkandi	Baraituk	Rural	1135	175	157	18	272	158	114	688	242	446
			Hafania Kitte Badejama	Rural	1895	357	341	16	134	123	11	1404	500	904
			Tegharia Kitte Tehurbeel	Rural	0	0	0	0	0	0	0	0	0	0
			Madanduri	Rural	882	171	164	7	39	30	9	672	250	422
			Serpur Kitte Chotobeel	Rural	131	28	27	1	3	3	0	100	39	61
			Hafania	Rural	671	135	130	5	51	49	2	485	153	332
			Serpur Pt II	Rural	948	207	180	27	99	40	59	642	268	374
			Dhalcharra Kitte Hatirgool	Rural	2056	441	418	23	172	88	84	1443	546	897
			Hatirgool	Rural	3111	577	555	22	260	204	56	2274	839	1435
			Chandpur	Rural	2444	401	387	14	186	178	8	1857	655	1202
			Chipacharra	Rural	153	15	14	1	38	30	8	100	36	64
			Bazarghat F.V.	Rural	998	243	226	17	6	6	0	749	256	493

			Gangpar	Rural	870	155	140	15	97	71	26	618	240	378
Karimganj	Karimganj	Lowairpoa	Kurtacharra	Rural	291	84	74	10	1	1	0	206	84	122
			Adamtilla T.E.	Rural	2619	723	532	191	207	146	61	1689	647	1042
			Longai T.E.	Rural	2394	739	507	232	156	124	32	1499	583	916
			Dalua Charra	Rural	473	113	77	36	43	39	4	317	121	196
			Paschim Lalkhira Sonakhira	Rural	695	157	100	57	159	121	38	379	149	230
			Purbo Piplagool	Rural	655	161	143	18	92	46	46	402	149	253
			Dakshin Sonakhira	Rural	0	0	0	0	0	0	0	0	0	0
			Shephinjuri T.E.	Rural	1386	350	177	173	433	218	215	603	279	324
			Indurali Punjee	Rural	192	67	38	29	37	14	23	88	47	41
			Baithakhal Basti	Rural	1821	398	297	101	233	191	42	1190	432	758
			Ankapai Punjee	Rural	1210	222	218	4	124	83	41	864	323	541
			Salgoi T.E.	Rural	1615	469	337	132	151	103	48	995	395	600
			Paschim Salgoi	Rural	2131	522	326	196	312	207	105	1297	620	677
			Dhengarbond	Rural	1625	214	204	10	192	177	15	1219	452	767
			Pecharghat	Rural	325	82	62	20	112	36	76	131	71	60
			Uttor Hatikhira	Rural	611	121	96	25	154	115	39	336	108	228
			Purbo Indurali	Rural	240	45	42	3	77	19	58	118	61	57
			Hatikhira T.E.	Rural	3437	784	563	221	487	300	187	2166	876	1290
			Dakshin Hatikhira	Rural	1792	571	356	215	244	145	99	977	419	558
			Kalacharra	Rural	3803	1073	898	175	591	212	379	2139	806	1333
			Isabeel	Rural	6790	2086	1555	531	415	291	124	4289	1621	2668
			Uttor Isarpar Kitte Chandpur	Rural	599	136	123	13	4	3	1	459	155	304
			Isarpar	Rural	2377	523	465	58	263	92	171	1591	651	940
			Radhamadhabpur Kitte Rashidpur	Rural	2169	524	386	138	123	62	61	1522	662	860
			Kalanpur	Rural	2168	498	479	19	227	37	190	1443	603	840
			Longai Forest	Rural	321	147	98	49	11	9	2	163	50	113
			Kanikhai F.V.	Rural	4260	857	714	143	957	482	475	2446	1005	1441

			Old Solamona F.V.	Rural	2467	537	525	12	73	63	10	1857	666	1191
			Zahanpur F.V.	Rural	450	112	99	13	1	1	0	337	114	223
			North Maguna F.V.	Rural	473	130	123	7	29	25	4	314	110	204
			Maguna Punjee F.V.	Rural	884	215	168	47	75	48	27	594	223	371
			Proper Magura F.V.	Rural	239	74	64	10	0	0	0	165	56	109
			Shambu Nagar F.V.	Rural	854	187	150	37	109	28	81	558	257	301
			Manik Bond Mahi F.V.	Rural	1538	310	270	40	392	91	301	836	419	417
			South Magura F.V.	Rural	664	162	154	8	25	21	4	477	160	317
			Piplapunjee F.V.	Rural	949	173	155	18	36	32	4	740	306	434
Total (B)					120749	29877	24490	5387	12161	6928	5233	78711	29993	48718
Total (A+B)					594376	151920	130017	21903	47954	27965	19989	394502	145900	248602

Source: District Census Handbook; Cachar and Karimganj District (2011)

ANNEXURE 3: VILLAGE WISE DEMOGRAPHIC PROFILE OF THE STUDY AREA

District	Sub-Division	CD Block	Village	Area Type	No of Household	Population			Population(0-6yrs)			Population		Literates		
						Total	Male	Female	Total	Male	Female	SC	ST	Total	Male	Female
Cachar	Silchar	Katigora	Siddeswar Pt I	Rural	73	292	154	138	32	18	14	5	0	259	135	124
			Niz Katigorah Pt II	Rural	607	2437	1282	1155	329	175	154	694	0	1987	1068	919
			Siddeswar Pt II	Rural	514	2415	1222	1193	359	205	154	1105	0	1816	928	888
			Sidhipur	Rural	364	1763	907	856	258	119	139	934	0	1361	732	629
Cachar	Silchar	Borkhola	Masimpur Pt II	Rural	460	2364	1450	914	287	156	131	70	0	1893	1263	630
			Ardvallik	Rural	163	789	421	368	125	64	61	549	0	540	309	231
			Dudhpatil Pt III	Rural	119	527	259	268	88	39	49	435	0	400	214	186
Cachar	Silchar	Kalain	Digor Mahadevpur	Rural	64	284	156	128	53	30	23	159	0	138	84	54
			Kushierkul (Kushiyarkul)	Rural	144	618	323	295	67	33	34	207	0	500	266	234
			Talkar Beel	Rural	11	56	32	24	11	7	4	34	6	27	16	11
			Rajyeswarpur Pt II	Rural	335	1592	806	786	218	102	116	291	1	1045	578	467
			Rajyeswarpur Pt I	Rural	185	886	444	442	165	74	91	165	0	536	297	239
			Tarapur	Rural	622	3027	1561	1466	578	309	269	232	0	1857	1008	849
			Karaballe Grant	Rural	49	218	111	107	32	15	17	0	0	86	58	28
			Biswambarpur	Rural	360	1703	889	814	289	163	126	1157	0	1172	633	539
			Gumra Grant	Rural	125	686	323	363	139	61	78	130	0	330	177	153
Cachar	Silchar	Udarbond	Larsingpar Grant	Rural	819	3726	1879	1847	546	281	265	49	0	1539	950	589
			Jhapirbond Pt II	Rural	237	1184	611	573	242	123	119	0	0	604	328	276
Cachar	Silchar	Sonai	Dhanehari Pt I	Rural	679	3079	1584	1495	439	224	215	14	0	2362	1292	1070
			Dhanehari Pt III	Rural	371	1697	883	814	305	158	147	159	0	1211	653	558
Cachar	Silchar	Narsingpur	Barjalenga Pt IV	Rural	140	567	281	286	42	19	23	3	0	201	109	92
			Gajalghat	Rural	217	963	458	505	121	63	58	744	47	771	367	404
			Debipur	Rural	510	2148	1089	1059	287	160	127	1807	171	1760	892	868
			Dhanipur	Rural	629	3131	1580	1551	561	284	277	0	0	2230	1186	1044
			Kajidahar Pt III	Rural	829	3706	1883	1823	491	247	244	58	0	2791	1490	1301
Cachar	Silchar	Palonghat	Tupidahar Pt II	Rural	57	218	110	108	30	15	15	211	0	130	69	61
Cachar	Silchar	Rajabaza	Kanakpur Pt II	Rural	134	633	304	329	79	40	39	13	2	512	254	258

		r	Narainpur Grant Pt II	Rural	297	1337	719	618	171	101	70	11	73	749	466	283
			Dikcha Grant	Rural	99	389	208	181	44	23	21	56	0	300	174	126
			Budhan Nagar	Rural	43	188	92	96	21	11	10	0	0	19	14	5
Cachar	Lakhipur	Lakhipur	Chalitartol	Rural	66	343	179	164	100	54	46	0	0	163	97	66
Total (A)					9322	42966	22200	20766	6509	3373	3136	9292	300	29289	16107	13182
Karimganj	Karimganj	North Karimganj	Madanpur T.E.	Rural	101	471	247	224	66	29	37	0	0	224	146	78
			Hizimangura Pt I	Rural	53	202	113	89	25	15	10	0	0	65	48	17
			Chandkhani	Rural	62	361	176	185	53	25	28	0	0	284	142	142
			Nandibari	Rural	37	198	107	91	31	11	20	0	0	165	96	69
			Chandkhani Chak	Rural	155	615	313	302	101	55	46	522	1	217	129	88
			Promodnagar T.E.	Rural	199	852	431	421	123	72	51	445	0	312	195	117
			Bargool	Rural	43	172	82	90	46	18	28	0	0	47	29	18
			Nayagram Pt II	Rural	92	437	218	219	98	43	55	0	0	222	137	85
Karimganj	Karimganj	South Karimganj	Panchas	Rural	40	167	71	96	26	12	14	29	0	106	45	61
			Kulcherra Pt I	Rural	118	732	360	372	168	83	85	0	0	373	205	168
			Ranibari	Rural	184	927	468	459	149	75	74	0	0	638	332	306
			Ghugrakona Pt II	Rural	121	609	301	308	90	41	49	13	0	455	230	225
			Maizbagargool Pt III	Rural	64	270	148	122	38	24	14	16	0	207	116	91
			Saidpur	Rural	245	1335	676	659	251	125	126	22	0	954	517	437
			Krishnanagar Pt II	Rural	7	34	18	16	9	6	3	0	0	25	12	13
			Kulcherra Pt II	Rural	248	1410	702	708	327	150	177	0	0	906	501	405
			Ghugrakona Pt I	Rural	221	1379	715	664	305	164	141	0	0	740	395	345
			Ghugrakona Pt IV	Rural	17	103	60	43	18	12	6	0	0	69	40	29
Karimganj	Karimganj	Patharkandi	Baraituk	Rural	219	1135	557	578	228	116	112	453	1	695	355	340
			Chandpur	Rural	429	2444	1220	1224	483	238	245	0	0	1435	793	642
			Gangpar	Rural	174	870	451	419	146	81	65	201	0	652	353	299
Karimganj	Karimganj	Lowairpoa	Baithakhal Basti	Rural	370	1821	920	901	289	140	149	605	0	1267	681	586
			Ankapai Punjee	Rural	255	1210	624	586	219	113	106	785	0	781	409	372
			Paschim Salgoi	Rural	501	2131	1153	978	311	171	140	586	0	979	644	335
			North Maguna F.V.	Rural	93	473	258	215	82	41	41	434	0	348	195	153
			Hatikhira T.E.	Rural	750	3437	1739	1698	514	249	265	824	1	2036	1195	841
Total (B)					4798	23795	12128	11667	4196	2109	2087	4935	3	14202	7940	6262
Total (A+B)					14120	66761	34328	32433	10705	5482	5223	14227	303	43491	24047	19444

Source: District Census Handbook; Cachar and Karimganj District (2011)

ANNEXURE 4: VILLAGE WISE INFRASTRUCTURE RESOURCE BASE IN THE STUDY AREA

Village	Education Facilities								
	Primary School	Middle School	Secondary School	Senior Secondary School	College (Arts, Science and Commerce)	Engineering College	Medical College	Polytechnic College	Vocational training Centre/ITI
Cachar District									
Niz Katigorah Pt II	3	2	1	b	b	c	c	c	c
Siddeswar Pt I (Sidheswar-I)	1	1	1	a	b	c	c	c	c
Siddeswar Pt II	1	a	a	a	b	c	c	c	c
Sidhipur	3	a	a	a	a	c	a	c	c
Masimpur Pt II	2	2	a	a	c	c	c	c	c
Ardvallik	1	1	b	c	c	c	c	c	c
Dudhpatil Pt II	1	a	a	a	c	c	c	c	
Karaballe Grant	1	a	a	a	a	c	c	c	c
Biswambarpur	3	c	c	c	c	c	c	c	c
Gumra Grant	1	1	1	1	c	c	c	c	c
Tarapur	3	a	a	a	c	c	c	c	c
Digor Mahadevpur	a	b	b	b	b	c	c	c	c
Kushierkul (Kushiyarkul)	1	1	1	1	c	c	c	c	c
Talkar Beel	a	a	a	b		c	c		
Rajyeswarpur Pt II	2	a	a	b	b	c	c	c	c
Rajyeswarpur Pt I	2	1	a	b	b	c	c	c	c
Larsingpar Grant	1	b	b	b	c	c	c	c	c
Jhapirbond Pt II	1	a	b	b	c	c	c	c	
Dhanehari Pt I	3	3	1	a	b	c	c	c	c
Dhanehari Pt III	2	a	b	b	c	c	c	c	c
Barjalenga Pt IV	1	a	a	a	b	c	c	c	c
Kajidahar Pt III	4	3	1	1	b	c	c	c	c

Village	Education Facilities								
	Primary School	Middle School	Secondary School	Senior Secondary School	College (Arts, Science and Commerce)	Engineering College	Medical College	Polytechnic College	Vocational training Centre/ITI
Debipur	2	2	1	a	c	c	c	c	c
Gajalghat	2	1	b	b	b	c	c	c	c
Dhanipur	1	1	1	a	c	c	c	c	c
Tupidahar Pt II	1	1	b	b	c	c	c	c	c
Narainpur Grant Pt II	3	2	c	c	c	c	c	c	c
Kanakpur Pt II	7	3	a	a	a	c	c	c	c
Dikcha Grant	1	a	a	b	b	c	c	c	c
Budhan Nagar	1	a	b	b	b	c	c	c	c
Chalitartol	1	c	c	c	c	c	c	c	c
Karimganj District									
Nayagram Pt II	1	1	a	a	c	c	c	c	c
Madanpur T.E.	1	a	a	c	c	c	c	c	c
Hizimangura Pt I	1	a	a	c	c	c	c	c	c
Chandkhani	1	a	a	c	c	c	c	c	c
Nandibari	1	a	b	b	b	c	c	c	c
Chandkhani Chak	1	1	b	b	b	c	c	c	c
Promodnagar T.E.	1	1	b	b	b	c	c	c	c
Ghugrakona Pt I	2	2	b	b	b	c	c	c	c
Ghugrakona Pt II	1	1	b	b	b	c	c	c	c
Ghugrakona Pt IV	1	a	b	b	b	c	c	c	c
Maizbagargool Pt III	1	1	a	b	c	c	c	c	c
Gangpar	1	a	a	b	b	c	c	c	c
Saidpur	1	a	b	a	b	c	c	c	c
Baraituk	1	2	a	a	b	c	c	c	c
Kulcherra Pt I	1	b	c	c	c	c	c	c	c
Kulcherra Pt II	1	2	c	c	c	c	c	c	c

Village	Education Facilities								
	Primary School	Middle School	Secondary School	Senior Secondary School	College (Arts, Science and Commerce)	Engineering College	Medical College	Polytechnic College	Vocational training Centre/ITI
Ranibari	1	a	b	b	b	c	c	c	b
Krishnanagar Pt II	a	a	b	b	b	c	c	c	b
Bargool	a	a	b	b	b	c	c	c	b
Chandpur	1	a	a	b	b	c	c	c	b
Panchas	1	a	b	b	b	c	c	c	b
Baithakhal Basti	1	a	a	a	c	c	c	c	c
Ankapai Punjee	1	2	a	a	c	c	c	c	c
Hatikhira T.E.	3	3	a	a	c	c	c	c	c
North Maguna F.V.	1	a	c	c	c	c	c	c	c
Paschim Salgoi	1	a	b	b	c	c	c	c	c

Cont.....

Village	Medical Facilities								
	Community Health Centre	Primary Health Centre	Primary Health Sub-centre	Maternity and Child Welfare Centrs	Hospital-allopathic (HA)	Dispensary	Family welfare Centre	Traditional practitioner and faith healer	Medical shop
Cachar District									
Niz Katigorah Pt II	b	b	b	c	c	c	c	0	1
Siddeswar Pt I	b	a	a	c	c	a	c	0	1
Siddeswar Pt II	b	a	a	a	c	c	c	0	1
Sidhipur	b	a	a	a	c	a	c	0	1
Masimpur Pt II	b	b	b	b	c	c	b	0	1
Ardvallik	c	c	c	c	c	c	b	0	0
Dudhpatil Pt II	b	b	b	a	b	b	b	0	0
Karaballe Grant	c	a	b		a	c	b	1	1

Village	Medical Facilities								
	Community Health Centre	Primary Health Centre	Primary Health Sub-centre	Maternity and Child Welfare Centrs	Hospital-allopathic (HA)	Dispensary	Family welfare Centre	Traditional practitioner and faith healer	Medical shop
Biswambarpur	c	a	a	b	a	b	b	1	1
Gumra Grant	c	c	c	c	c	c	c	0	0
Tarapur	c	1	a	b			b	1	1
Digor Mahadevpur	c	a	a	a	c	c	c	0	0
Kushierkul (Kushiyarkul)	c	a	a	b	a	b	b	1	1
Talkar Beel	b							0	0
Rajyeswarpur Pt II(Rajeswarpur	b	a	a	b	a	a	a	0	1
Rajyeswarpur Pt I	b	b	a	b	b	b	a	0	0
Larsingpar Grant	b	b	b	b	c	c	c	0	1
Jhapirbond Pt II		b	a	c	c	b	c	0	1
Dhanehari Pt I	b	a	a	b	b	b	a	0	1
Dhanehari Pt III	c	b	a	c	c	c	b	0	1
Barjalenga Pt IV	c	b	b	b	b	b		0	0
Kajidahar Pt III	c	a	c	c	c	c	c	0	1
Debipur	c	a	b	a	c	c	a	0	1
Gajalghat	b	b	b	c	b	b	b	0	1
Dhanipur	c	a	b	a	c	c	a	0	1
Tupidahar Pt II	c	c	c	c	c	c	c	0	0
Narainpur Grant Pt II	b	b	b	c	b	b	b	0	1
Kanakpur Pt III	b	1	b	b	b	b	1	0	1
Dikcha Grant	b	a	a	a	b	a	a	0	0
Budhan Nagar	a	a	a	b	b	b	b	0	0
Chalitartol	c	c	b	b	c	c	c	0	0
Karimganj District									

Village	Medical Facilities								
	Community Health Centre	Primary Health Centre	Primary Health Sub-centre	Maternity and Child Welfare Centrs	Hospital-allopathic (HA)	Dispensary	Family welfare Centre	Traditional practitioner and faith healer	Medical shop
Nayagram Pt II	c	c		c	c	c	c	0	0
Madanpur T.E.	c	c	c	c	c	c	c	0	0
Hizimangura Pt I	c	c	c	c	c	c	c	0	0
Chandkhani	c	c	c	c	c	c	c	0	0
Nandibari	b	b	b	b	b	b	b	1	1
Chandkhani Chak	b	b	b	b	b	b	b	0	0
Promodnagar T.E.	b	b	b	b	b	b	b	0	1
Ghugrakona Pt I	b	b		c	b	c	c	0	1
Ghugrakona Pt II	b	b		c	b	a		1	1
Ghugrakona Pt IV	c	b	b	b	b	b	b	1	1
Maizbagargool Pt III	a	a		c	c	c	c	0	0
Gangpar		b			c	c		1	1
Saidpur		b			c	c		1	1
Baraituk	b	b	c	c	c	b		1	2
Kulcherra Pt I	c	c	c	c	c	c	c	0	0
Kulcherra Pt II	b							1	1
Ranibari	c	b		b	b	b	b	0	1
Krishnanagar Pt II	c	b	a	b	b	b	b	0	1
Bargool	c	b	b	b	b	b	b	2	2
Chandpur	c	b	1	b	b	b	b	1	1
Panchas	c	b	a	b	b	b	b	1	1
Baithakhal Basti	c	b	a	c	c	b	a	0	1
Ankapai Punjee	b	b	b	c	c	c	a	0	1
Hatikhira T.E.	1	c	a	c	c	c	1	0	1
North Maguna F.V.	c	c	c	c	c	c		0	0
Paschim Salgoi	a	c	a	c	c	c	a	2	1

Cont.....

Village	Drinking Water and Communication Facilities							
	Tap Water	Well Water	Hand Pump	Tube Well/ Bore Well	Post office	Post & Telegraph office	Telephones (Landline)	Mobile phone coverage
Cachar District								
Niz Katigorah Pt II	Yes	Yes	No	Yes	a	a	Yes	Yes
Siddeswar Pt I (Sidheswar-I)	Yes	Yes	No	No	a	a	a	c
Siddeswar Pt II	Yes	Yes	Yes	No	a	a	Yes	Yes
Sidhipur	Yes	Yes	No	No	Yes	a	Yes	Yes
Masimpur Pt II	Yes	Yes	No	No	c	c	b	Yes
Ardvallik	No	Yes	No	No	a	a	a	Yes
Dudhpatil Pt II	No	No	No	No	b	b	b	Yes
Karaballe Grant	Yes	Yes	No	No	a	a	a	Yes
Biswambarpur	Yes	Yes	No	No	a	a	c	Yes
Gumra Grant	No	Yes	No	No	a	a	Yes	Yes
Tarapur	Yes	Yes	Yes	Yes	a	a	Yes	Yes
Digor Mahadevpur	Yes	Yes	No	No	a	a	a	Yes
Kushierkul (Kushiyarkul)	Yes	Yes	No	No	c		Yes	Yes
Talkar Beel	No	Yes	No	No			a	a
Rajyeswarpur Pt II(Rajeswarpur	Yes	Yes	Yes	No	a	c	a	Yes
Rajyeswarpur Pt I	No	Yes	No	No	a	c	a	Yes
Larsingpar Grant	Yes	Yes	Yes	No	b	b	b	Yes
Jhapirbond Pt II	Yes	Yes	No	Yes	b	b	Yes	Yes
Dhanehari Pt I	Yes	No	Yes	Yes		b	Yes	Yes
Dhanehari Pt III	Yes	Yes	No	Yes	c	c	Yes	Yes
Barjalenga Pt IV	Yes	Yes	No	No	a	a	a	c
Kajidahar Pt III	Yes	Yes	Yes	Yes	c	c	Yes	Yes
Debipur	Yes	Yes	Yes	No	Yes	a	Yes	Yes
Gajalghat	Yes	Yes	No	No	c	c	b	Yes

Village	Drinking Water and Communication Facilities							
	Tap Water	Well Water	Hand Pump	Tube Well/ Bore Well	Post office	Post & Telegraph office	Telephones (Landline)	Mobile phone coverage
Dhanipur	Yes	Yes	Yes	No	c	a	Yes	Yes
Tupidahar Pt II	No	Yes	No	No	c	c	a	Yes
Narainpur Grant Pt II	Yes	Yes	Yes	No	c	c	Yes	Yes
Kanakpur Pt III	Yes	Yes	Yes	Yes	c	a	Yes	Yes
Dikcha Grant	No	Yes	No	No	a	a	Yes	Yes
Budhan Nagar	No	No	No	No	b	b	a	b
Chalitartol	No	Yes	Yes	No	c	c	c	c
Karimganj district								
Nayagram Pt II	No	Yes	No	No	c	b	c	Yes
Madanpur T.E.	No	Yes	No	No	c	c	c	Yes
Hizimangura Pt I	No	Yes	No	No	c	c	c	a
Chandkhani	Yes	Yes	No	Yes	c	c	c	Yes
Nandibari	Yes	Yes	No	Yes	b	b	b	b
Chandkhani Chak	Yes	Yes	No	No	b	b	b	Yes
Promodnagar T.E.	Yes	Yes	No	Yes		b	Yes	Yes
Ghugrakona Pt I	Yes	Yes	Yes	Yes	a	b	b	c
Ghugrakona Pt II	Yes	Yes	Yes	Yes		b	b	c
Ghugrakona Pt IV	No	Yes	Yes	No	b	b	b	Yes
Maizbagargool Pt III	No	Yes	Yes	Yes	a	c	Yes	c
Gangpar	Yes	Yes	Yes	Yes	b		Yes	Yes
Saidpur	No	Yes	Yes	Yes	b		Yes	Yes
Baraituk	Yes	Yes	No	Yes	a	c	c	c
Kulcherra Pt I	No	Yes	No	No	c	c	c	Yes
Kulcherra Pt II	Yes	Yes	No	Yes	c	c	c	Yes
Ranibari	Yes	Yes	No	Yes		b	b	Yes
Krishnanagar Pt II	Yes	Yes	No	No	b	b	b	Yes
Bargool	No	Yes	No	Yes	b	b	b	Yes
Chandpur	No	No	No	Yes	b	b	a	Yes

Village	Drinking Water and Communication Facilities							
	Tap Water	Well Water	Hand Pump	Tube Well/ Bore Well	Post office	Post & Telegraph office	Telephones (Landline)	Mobile phone coverage
Panchas	No	Yes	No	No	b	b	b	a
Baithakhal Basti	Yes	Yes	Yes	Yes	c	c	Yes	Yes
Ankapai Punjee	Yes	Yes	No	Yes	c	c	a	Yes
Hatikhira T.E.	Yes	Yes	Yes	Yes	c	c	Yes	a
North Maguna F.V.	No	No	No	No	c	b	Yes	Yes
Paschim Salgoi	Yes	Yes	Yes	Yes	c	c	Yes	a

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Village	Transportation, Marker and Power Supply Facilities										
	Bus Service	Railway Station	Pucca Road	Kutchcha Road	Commercial & Co-operative Banks	Public Distribution System	Weekly Hatt	Sports Club / Recreation Centre	Power Supply for Domestic Use	Power Supply for Agriculture Use	Nearest Town
Cachar District											
Niz Katigorah Pt II	a	Yes	a	Yes	c	b	b	a	Yes	No	BADARPUR
Siddeswar Pt I	a	Yes	a	Yes	c	b	b	a	Yes	No	BADARPUR
Siddeswar Pt II	Yes	a	Yes	Yes	c	c	b	a	Yes	Yes	BADARPUR
Sidhipur	Yes	a	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	BADARPUR
Masimpur Pt II	Yes	c	b	Yes	b	a	b	b	Yes	No	SILCHAR
Ardvallik	a	c	a	Yes	c	a	a	Yes	Yes	No	SILCHAR
Dudhpatil Pt II	b	b	b	Yes	b	Yes	Yes	a	Yes	No	SILCHAR
Karaballe Grant	a	c	b	Yes	c	a	a	a	Yes	No	BADARPUR
Biswambarpur	a	c	a	Yes	c	Yes	Yes	a	Yes	No	BADARPUR
Gumra Grant	Yes	Yes	b	Yes	c	a	a	c	Yes	No	KATIGORA
Tarapur	Yes	c	Yes	Yes	c	c	c	a	Yes	No	BADARPUR
Digor Mahadevpur	a	c	a	Yes	c	b	b	a	Yes	No	BADARPUR
Kushierkul	Yes	c	b	Yes	c	b	b	Yes	Yes	No	BADARPUR

Village	Transportation, Marker and Power Supply Facilities										
	Bus Service	Railway Station	Pucca Road	Kutchcha Road	Commercial & Co-operative Banks	Public Distribution System	Weekly Hatt	Sports Club / Recreation Centre	Power Supply for Domestic Use	Power Supply for Agriculture Use	Nearest Town
(Kushiyarkul)											
Talkar Beel	b		a	a	c	b	b	a	Yes	No	BADARPUR
Rajyeswarpur Pt II(Rajeswarpur	Yes	c	Yes	Yes	c	b	b	Yes	Yes	No	BADARPUR
Rajyeswarpur Pt I	Yes	c	a	Yes	c	b	b	a	Yes	No	BADARPUR
Larsingpar Grant	Yes	c	Yes	Yes	b	Yes	Yes	Yes	Yes	No	SILCHAR
Jhapirbond Pt II	Yes		b	Yes	c	Yes	Yes	b	Yes	No	SILCHAR
Dhanehari Pt I	Yes	b	Yes	Yes	a	Yes	Yes	b	Yes	No	SILCHAR
Dhanehari Pt III	Yes	c	a	Yes	c	Yes	Yes	c	Yes	No	SILCHAR
Barjalenga Pt IV	B	c	a	Yes	b	Yes	Yes	b	No	No	SILCHAR
Kajidahar Pt III	Yes	c	Yes	Yes	b	Yes	Yes	a	Yes	No	SILCHAR
Debipur	Yes	c	Yes	Yes	b	Yes	Yes	a	Yes	No	SILCHAR
Gajalghat	Yes	c	b	Yes	a	Yes	Yes	Yes	Yes	No	
Dhanipur	a	c	b	Yes	b	Yes	Yes	a	Yes	No	SILCHAR
Tupidahar Pt II	c	c	a	Yes	a	Yes	Yes	a	Yes	No	SILCHAR
Narainpur Grant Pt II	b	c	b	Yes	c	Yes	Yes	Yes	Yes	No	LAKHIPUR
Kanakpur Pt III	Yes	c	Yes	Yes	a	Yes	Yes	Yes	Yes	No	LAKHIPUR
Dikcha Grant	a	c	b	Yes	c	a	a	b	Yes	No	LAKHIPUR
Budhan Nagar	c	a	b	Yes	a	a	a	b	No	No	LAKHIPUR
Chalitartol	Yes	c	c	Yes	b	Yes	Yes	b	Yes	No	LAKHIPUR
Karimganj District											
Nayagram Pt II	Yes	b	c	Yes	b	a	a	b	Yes	No	
Madanpur T.E.	Yes	c	c	Yes	a	Yes	Yes	b	Yes	No	
Hizimangura Pt I	a	b	c	Yes	b	Yes	Yes	c	No	No	
Chandkhani	Yes	b	c	Yes	a	a	a	b	Yes	No	
Nandibari	b	b	b	Yes	b	a	a	c	No	No	

Village	Transportation, Marker and Power Supply Facilities										
	Bus Service	Railway Station	Pucca Road	Kutchcha Road	Commercial & Co-operative Banks	Public Distribution System	Weekly Hatt	Sports Club / Recreation Centre	Power Supply for Domestic Use	Power Supply for Agriculture Use	Nearest Town
Chandkhani Chak	Yes	b	b	Yes	a	Yes	Yes	c	Yes	No	
Promodnagar T.E.	Yes	b	a	Yes	b	a	a	c	Yes	No	
Ghugrakona Pt I	b	b	b	Yes	a	a	a	c	No	No	
Ghugrakona Pt II	Yes	b	b	Yes	b	Yes	Yes	c	Yes	No	
Ghugrakona Pt IV	b	b	b	Yes	c	Yes	Yes	c	Yes	No	
Maizbagargool Pt III	b		b	Yes	c	c	c	b	Yes	No	
Gangpar	Yes	b	b	Yes	c	Yes	Yes	b	Yes	No	
Saidpur	Yes	b	b	Yes	c	c	c	b	Yes	No	
Baraituk	b	b	b	Yes	c	Yes	Yes	b	Yes	No	
Kulcherra Pt I	Yes	c	b	Yes	c	a	a	c	Yes	No	KARIMGANJ
Kulcherra Pt II	Yes	a	b	Yes	a	Yes	Yes	c	Yes	No	KARIMGANJ
Ranibari	Yes		b	Yes	a	Yes	Yes	b	Yes	No	KARIMGANJ
Krishnanagar Pt II	Yes	b	b	Yes	c	Yes	Yes	b	Yes	No	KARIMGANJ
Bargool	a	b	a	Yes	b	b	a	b	Yes	No	KARIMGANJ
Chandpur	a	b	a	a	c	a	a	a	Yes	No	KARIMGANJ
Panchas	Yes		b	Yes	a	Yes	Yes	b	No	No	KARIMGANJ
Baithakhal Basti	Yes	b	Yes	Yes	c	a	c	b	Yes	No	KARIMGANJ
Ankapai Punjee	Yes	a	b	Yes	c	Yes	Yes	b	Yes	No	KARIMGANJ
Hatikhira T.E.	Yes	c	Yes	Yes	a	Yes	Yes	Yes	Yes	No	KARIMGANJ
North Maguna F.V.	b	c	b	Yes	a	Yes	Yes	c	Yes	No	KARIMGANJ
Paschim Salgoi	Yes	c	Yes	Yes	a	Yes	Yes	a	Yes	No	KARIMGANJ

Source: District Census Handbook; Cachar and Karimganj District (2011); (http://www.censusindia.gov.in/2011census/dchb/DCHB.html

Abbreviations: (a) - <5kms (b) – 5-10kms (c) – Above 10+

ANNEXURE 5: EMPLOYMENT PATTERN IN THE STUDY AREA

District	Sub-Division	CD Block	Village	Area Type	Total Population	Main Workers			Marginal Workers			Non Workers		
						Total	Male	Female	Total	Male	Female	Total	Male	Female
Cachar	Silchar	Katigora	Siddeswar Pt I (Sidheswar-I)	Rural	292	62	53	9	53	42	11	177	59	118
			Niz Katigorah Pt II	Rural	2437	581	550	31	179	145	34	1677	587	1090
			Siddeswar Pt II	Rural	2415	655	598	57	78	45	33	1682	579	1103
			Sidhipur	Rural	1763	481	458	23	49	35	14	1233	414	819
Cachar	Silchar	Borkhola	Masimpur Pt II	Rural	2364	1000	955	45	142	81	61	1222	414	808
			Ardvallik	Rural	789	215	207	8	19	19	0	555	195	360
			Dudhpatil Pt III	Rural	527	126	121	5	17	15	2	384	123	261
Cachar	Silchar	Kalain	Digor Mahadevpur	Rural	284	67	61	6	69	28	41	148	67	81
			Kushierkul (Kushiyarkul)	Rural	618	192	167	25	61	44	17	365	112	253
			Talkar Beel	Rural	56	19	18	1	0	0	0	37	14	23
			Rajyeswarpur Pt II	Rural	1592	419	359	60	92	77	15	1081	370	711
			Rajyeswarpur Pt I	Rural	886	266	215	51	40	30	10	580	199	381
			Tarapur	Rural	3027	809	693	116	121	76	45	2097	792	1305
			Karaballe Grant	Rural	218	110	62	48	2	2	0	106	47	59
			Biswambarpur	Rural	1703	490	423	67	102	59	43	1111	407	704
			Gumra Grant	Rural	686	167	152	15	17	15	2	502	156	346
Cachar	Silchar	Udarbond	Larsingpar Grant	Rural	3726	1364	761	603	517	280	237	1845	838	1007
			Jhapirbond Pt II	Rural	1184	179	161	18	158	132	26	847	318	529
Cachar	Silchar	Sonai	Dhanehari Pt I	Rural	3079	797	766	31	166	98	68	2116	720	1396
			Dhanehari Pt III	Rural	1697	328	298	30	348	164	184	1021	421	600
Cachar	Silchar	Narsingpur	Barjalenga Pt IV	Rural	567	303	154	149	37	19	18	227	108	119
			Gajalghat	Rural	963	259	229	30	10	6	4	694	223	471

			Debipur	Rural	2148	324	288	36	312	283	29	1512	518	994
			Dhanipur	Rural	3131	776	735	41	69	60	9	2286	785	1501
			Kajidahar Pt III	Rural	3706	1134	890	244	261	178	83	2311	815	1496
Cachar	Silchar	Palonghat	Tupidahar Pt II	Rural	218	64	61	3	29	7	22	125	42	83
Cachar	Silchar	Rajabazar	Kanakpur Pt II	Rural	633	192	145	47	38	20	18	403	139	264
			Narainpur Grant Pt II	Rural	1337	369	315	54	269	96	173	699	308	391
			Dikcha Grant	Rural	389	126	106	20	2	2	0	261	100	161
			Budhan Nagar	Rural	188	69	55	14	42	4	38	77	33	44
Cachar	Lakhipur	Lakhipur	Chalitartol	Rural	343	68	64	4	6	4	2	269	111	158
Total (A)					42966	12011	10120	1891	3305	2066	1239	27650	10014	17636
Karimganj	Karimganj	North Karimganj	Madanpur T.E.	Rural	471	205	133	72	1	1	0	265	113	152
			Hizimangura Pt I	Rural	202	154	80	74	13	8	5	35	25	10
			Chandkhani	Rural	361	82	73	9	12	10	2	267	93	174
			Nandibari	Rural	198	65	62	3	1	1	0	132	44	88
			Chandkhani Chak	Rural	615	381	197	184	5	2	3	229	114	115
			Promodnagar T.E.	Rural	852	370	201	169	66	36	30	416	194	222
			Bargool	Rural	172	107	54	53	0	0	0	65	28	37
			Nayagram Pt II	Rural	437	120	102	18	17	8	9	300	108	192
Karimganj	Karimganj	South Karimganj	Panchas	Rural	167	60	38	22	58	13	45	49	20	29
			Kulcherra Pt I	Rural	732	155	151	4	9	5	4	568	204	364
			Ranibari	Rural	927	273	245	28	22	16	6	632	207	425
			Ghugrakona Pt II	Rural	609	191	119	72	40	15	25	378	167	211

			Maizbagargool Pt III	Rural	270	56	55	1	88	26	62	126	67	59
			Saidpur	Rural	1335	310	290	20	50	44	6	975	342	633
			Krishnanagar Pt II	Rural	34	7	7	0	0	0	0	27	11	16
			Kulcherra Pt II	Rural	1410	531	358	173	55	35	20	824	309	515
			Ghugrakona Pt I	Rural	1379	432	350	82	68	16	52	879	349	530
			Ghugrakona Pt IV	Rural	103	48	25	23	1	0	1	54	35	19
Karimganj	Karimganj	Patharkandi	Baraituk	Rural	1135	175	157	18	272	158	114	688	242	446
			Chandpur	Rural	2444	401	387	14	186	178	8	1857	655	1202
			Gangpar	Rural	870	155	140	15	97	71	26	618	240	378
Karimganj	Karimganj	Lowairpoa	Baithakhal Basti	Rural	1821	398	297	101	233	191	42	1190	432	758
			Ankapai Punjee	Rural	1210	222	218	4	124	83	41	864	323	541
			Paschim Salgoi	Rural	2131	522	326	196	312	207	105	1297	620	677
			North Maguna F.V.	Rural	473	130	123	7	29	25	4	314	110	204
			Hatikhira T.E.	Rural	3437	784	563	221	487	300	187	2166	876	1290
Total (B)					23795	6334	4751	1583	2246	1449	797	15215	5928	9287
Total (A+B)					66761	18345	14871	3474	5551	3515	2036	42865	15942	26923

Source: District Census Handbook; Cachar and Karimganj District (2011);

ANNEXURE 4: DECLARATION REGARDING LITIGATION

D.No. 1135
AAFB 02.12.15

ओएनजीसी
ONGC

Oil and Natural Gas Corporation Limited
Assam & Assam Arakan Basin

Assam-Arakan Fold Belt
116, Luit Bhavan, ONGC, Cinnamara Complex
Jorhat, Assam - 785704
Phone: 0376-2707030 & FAX: 0376-2360616

SELF DECLARATION

This is to certify and declare that our company **M/s OIL & NATURAL GAS CORPORATION LIMITED** does not have any litigation pending with any court against the project or any direction / order passed by any Court of Law against the project and neither the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant sections of Air and Water Acts.

For **M/s OIL & NATURAL GAS CORPORATION LIMITED**

Somnath Bandyopadhyay 30/11/2015

DGM (G), Acreage Manager
Cachar Acreage
AAFB, ONGC, Jorhat

SOMNATH BANDYOPADHYAY
DGM(G), Acreage Manager-Cachar
Authorised Signatory

M/s OIL & NATURAL GAS CORPORATION LIMITED

Jorhat, Assam

Date: 30.11.2015

Place: Jorhat, Assam