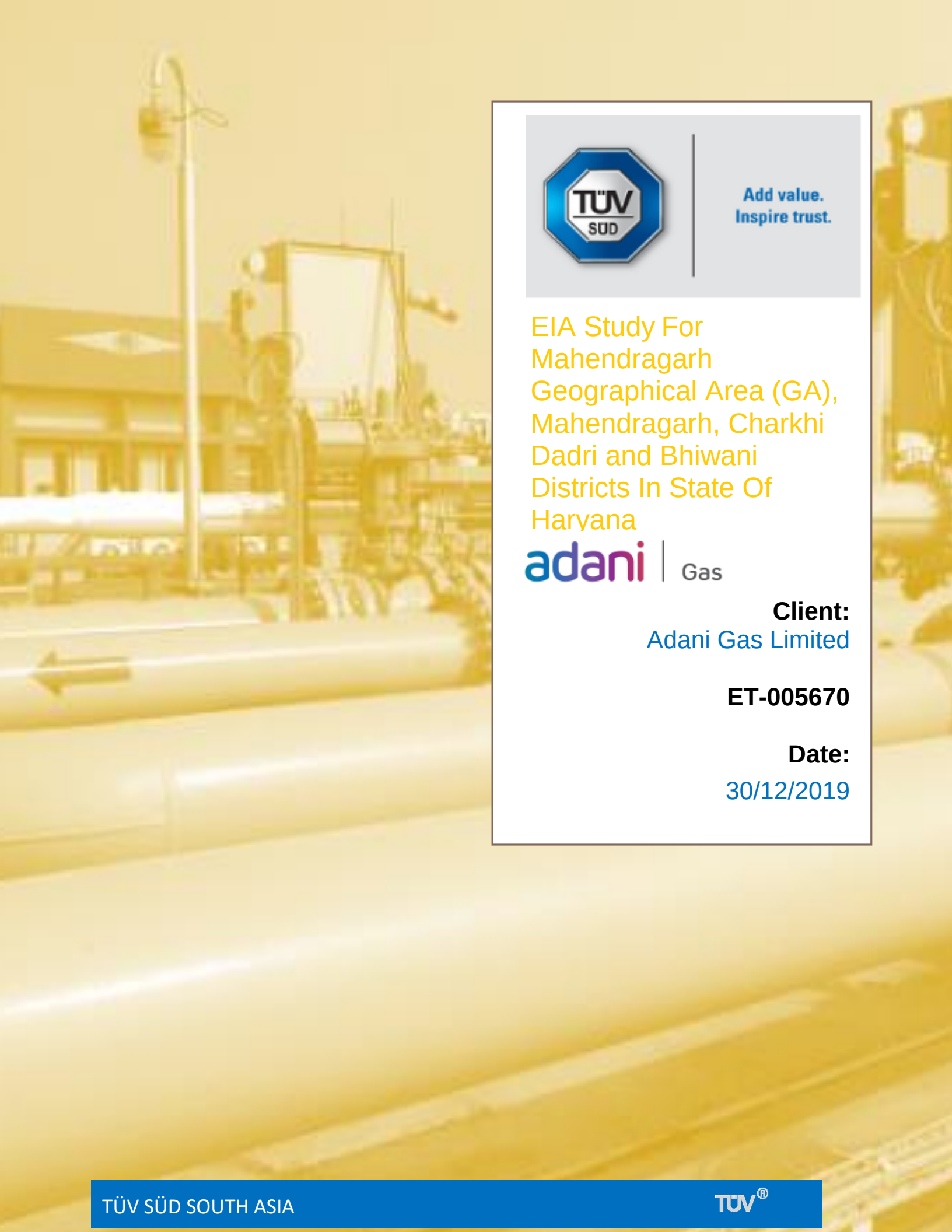

EIA Study For Mahendragarh Geographical Area (GA), Mahendragarh, Charkhi Dadri and Bhiwani Districts In State Of Haryana

adani | Gas

Client:
Adani Gas Limited

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CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

Adani Gas Limited (AGL) is developing and operating City Gas Distribution (CGD) networks to supply Piped Natural Gas (PNG) to industrial, commercial and domestic (residential) customers and Compressed Natural Gas (CNG) to the transport sector. Natural Gas is a convenient, reliable and environment friendly fuel that allows consumers to enjoy a high level of safety, convenience and economic efficiency. Headquartered in Ahmedabad, India, the company has already set up city gas distribution networks in Ahmedabad and Vadodara in Gujarat, Faridabad in Haryana and Khurja in Uttar Pradesh.

With the Government of India planning to offer additional geographical areas for gas distribution in the Xth round involving 50 GAs comprising of 123 districts coupled with rapid urbanization, AGL is on track to become one of the largest private sector CGD companies of the world. AGL is committed to achieve approximately 23 lakh domestic piped natural gas connections and install approximately 500 CNG stations in these 13 new GAs.

List of 14 GAs (state-wise) for which Adani Gas Limited has been granted authorization to lay City Gas Infrastructure and supply natural gas in the IXth round of CGD bidding is as under:

1. Surendranagar District (Except areas already authorized) -Gujarat
2. Kheda (except areas already authorized), Morbi (Except areas already authorized) & Mahisagar Districts- Gujarat
3. Porbandar District-Gujarat
4. Barwala & Ranpur Talukas-Gujarat
5. Navsari (Except areas already authorized), Surat (Except areas already authorized), Tapi (Except areas already authorized) & The Dangs Districts-Gujarat
6. Nuh & Palwal Districts (Project Area) - Haryana
7. **Bhiwani, Charkhi Dadri & Mahendragarh Districts- Haryana**
8. Jhansi, Lalitpur, Jalaun, Dati anad Bhind districts in Uttar Pradesh and Madhya Prdaesh
9. Udupi District- Karnataka
10. Cuddalore, Nagapattinam & Tiruvarur Districts- Tamil Nadu
11. Tiruppur District- Tamil Nadu
12. Bhilwara & Bundi Districts- Rajasthan
13. Chittorgarh (Other than Rawatbhata Taluka) & Udaipur Districts- Rajasthan
14. Balasore, Bhadrak & Mayurbhanj Districts- Odisha

AGL group has been grant authorization for laying, building, operating or expanding the CGD Network in Mahendragarh, Charkhi Dadri and Bhiwani districts in the state of Haryana. The grant has been authorized subject to the petroleum and natural gas regulatory board (authorizing entities to lay, build, operate or expand city or local natural gas distribution networks) regulations, 2008. Under this, the CGD network will be covering 6677 square kilometers of area. The activities of laying, building and operating or expansion of the CGD network had to commence immediately after signing and issuance of authority dated, 13th September, 2018. Also the activities have to be completed as per the mentioned schedule in a tenure of 8 contract years.

1.2 PROJECT BRIEF

Adani group has been grant authorization for laying, building, operating or expanding the CGD Network in Mahendragarh, Charkhi Dadri and Bhiwani districts in the state of Haryana. The authorized area for laying, building, operating, or expanding the proposed network shall cover an area of 6677 square kilometers.

Table 1-1: Description of Work

S.No	Description of Work	Numbers
1	Number of CNG stations (Online and daughter booster stations) to be installed within 8 contract years from the date of authorization	60
2	Number of domestic piped natural gas connections to be achieved within 8 years from 13th September, 2018	150464
3	Inch-km of steel pipeline to be laid within 8 years from 13th September, 2018	1010

Source: Adani Gas Limited

Adani group is responsible for designing and installation of optimal size of the infrastructure in terms of pipeline of various types including steel belting of the authorized area, online compressors of adequate capacity for compressing of natural gas into CNG, allied equipment and facilities in the CGD network depending upon the potential demand for natural gas. The infrastructure in the CGD network will be adequate to maintain uninterrupted flow of natural gas in the pipelines and will also be able to maintain supplies at adequate pressure to online CNG stations.

Adani has planned to lay 8” & 4” dia steel pipeline, approx. 155 kms for the gas distribution throughout Bhiwani, Charkhi Dadri and Mahendragarh districts. The pipeline stretch is divided into two parts: Narnaul to Mahendragarh and Charkhi Dadri to Bhiwani.The pipeline has two Tap-Off Points; GAIL Tap-Off Point at Neemrana on Delhi-Jaipur Expressway (National Highway-8)

and GSPL Tap Off Point at Bhiwani near Bhiwani-Hansi Road (SH-17 stretch near Nizampur Narnaul - Bhiwani-Munak)

The pipeline stretch from Neemrana CGS to Narnaul is falling within 10 km from Aravalli hills and since the project stretch lies in the notified protected forest as well as the Aravalli hills area (Ecologically sensitive region as well as Natural Conservation zone by town and country planning department) as per the published Haryana government gazette, legislative supplement 1981 and the notification of MoEF dated May, 1992. All the project roads are covered under this notification, and are covered under notified protected area.

NOC and clearance has to be obtained from Haryana forest department and MoEFCC, as the pipeline would be buried in the Protected area along Neemrana to Narnaul stretch and falls in the Arravalli ranges which is an ecological sensitive area.

1.3 PROJECT IMPLEMENTATION SCHEDULE

A grant of authorization was signed on 13th September, 2018 by PNGRB vide a letter of authorization to AGL group, which was accepted by them on 18th September, 2018. The letter schedule D of the letter stated the year wise work program within the 8 contract year period. The details on which are given in table below:

Table 1-2: Project Implementation Schedule

Tenure	Implementation Schedule		
	Approximate PNG Connections (Cumulative)	Approximate CNG Stations (Cumulative)	Approximate Inch-km of steel pipeline (Cumulative)
September, 2019	Nil	Nil	40
September, 2020	18,102	9	161
September, 2021	36,204	18	321
September, 2022	54,306	27	482
September, 2023	72,408	36	562
September, 2024	1,08,611	45	642

September, 2025	144815	54	723
September, 2026	181019	60	803

Source: Adani Gas Limited

1.4 NEED & SCOPE OF EIA

The purpose of this EIA is to assess the potential environmental impacts due to the proposed project in a study area of 10 km radius around and 500 m on both sides of the pipeline. The assessment covers both construction and operation phases of the project. The EIA forecasts changes (positive and negative) that may occur as a result of key project activities to the baseline environmental conditions in the study area. Early identification of impacts and their mitigation reduces the risk of long-term adverse environmental effects.

Scope of EIA:

- Assessment of the present status of environmental components such as air, water, noise, soil, topography and drainage, traffic and socio- economic conditions based on field data/ secondary data.
- Identification of the potential impacts of various activities proposed to be undertaken during construction and operation phases of the project.
- Prediction and evaluation of the impact of activities.
- Identifying the mitigation measures, management plan and monitoring schedule, if any

1.5 REGULATORY FRAMEWORK

The Ministry of Environment, Forest and Climate Change (MoEF&CC) has notified the Environmental Impact Assessment (EIA) Notification, 2006 under the provisions of the Environment (Protection) Act, 1986, which regulates development and their expansion/modernization of 39 sectors/activities listed in the Schedule to the EIA Notification, 2006. There are two Categories of the projects in the notification namely Category ‘A’ and Category ‘B' projects. Category ‘A’ projects are appraised at the level of MoEF&CC and Category 'B' projects are appraised by the respective State Environment Impact Assessment Authority (SEIAA) following the procedure prescribed under the EIA Notification, 2006.

The project lies in the notified protected forest area as per the published Haryana government gazette, legislative supplement 1981. As per the gazette, the governor of Haryana declares the strips of government forests land or waste lands whether under tree growth or not on the metaled surface of the roads, under the control of PWD (Building and roads) as on either side of the flowing

water course of all canals, branches, distributaries, major-minor channels etc., under the control of irrigation department, the land along the railway track and station yards under the control of northern railways, escape abandoned canals, bunds and other land and transferred to the department for management, mentioned in the schedule to be protected forests and to be provisions of chapter IV of the said Act, to be applicable to them.

As per project/ Activity 6 (a) of Schedule of EIA Notification 2006, Oil and Gas transportation pipelines which pass through national parks, sanctuaries, coral reefs or ecologically sensitive areas sites require Environmental Clearance (EC). The existing MDP facilities and the proposed facilities pass through such areas. Therefore, Environmental Clearance (EC) under project / Activity 6 (a) is applicable for Mahendragarh GA site, as it lies in the Aravalli hills area, which is an ecologically sensitive zone. AGL needs to submit an application to HSPCB to obtain further clarification and recommendations from HSPCB. This project requires prior clearance and NOC before commencement of activities.

All the project roads are covered under this notification, and are covered under notified protected area. The pipeline would be buried in the Protected area along the Neemrana CGS-Narnaul stretch faling within 10 km in Aravalli range. The approval for the forest land from the State/Central Govt. under Forest (Conservation) Act, 1980 however is not required as the project is exempted under MoEF Notification vide letter no. F.No.11-09/98-FC date 7th November 2014 wherein the laying of underground CNG/PNG pipelines along the roads within existing Right of Way not falling in National Parks and Wildlife Sanctuaries without felling of trees, wherein maximum size of trench is not more than 2 m depth and 1 m width is exempted to obtain general approval under Section-2 of Forest Conservation Act, 1980

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Table 1-3: Applicability of all Act, Laws & Rules to the project

S.No	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable Yes/No
1	Environmental (Protection) Act & Rules, 1986	To protect and improve overall environment	As all environmental notifications, rules and schedules are issued under this act	MoEF&CC GoI, Forest, Ecology & Environment Department, CPCB, HSPCB	Yes
2.	Environmental Impact Assessment (EIA) Notification, 2006	To provide environmental clearance to new development activities following environmental impact assessment	As per project/ activity 6 (a) of Schedule of EIA Notification 2006, oil and gas transportation pipelines which pass through national parks, sanctuaries, coral reefs or ecologically sensitive areas sites require Environmental Clearance (EC). The project lies in Category A of the notification.	MoEFCC	Yes
3.	Forest (Conservation) Act, 1980	To check deforestation by restricting conversion of forested areas into non-forested areas	The project lies along and in the protected forest area. The protected forest area lies along the roads from which the pipeline will pass through	Forest Department, MoEFCC	No
4.	National Forest Policy(Revised) , 1988	To maintain ecological stability through preservation and restoration of biological diversity	As eco sensitive zone exists along the project corridor, from which the pipeline passes through	Forest Department	Yes
5.	Wild Life Protection Act, 1972	To Protect wild life sanctuaries and National Park	No wildlife sanctuary falls within 10 km of the project road.	NBWL, SBWL & Chief Wild Life Warden, MoEFCC	No

S.No	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable Yes/No
6.	Water (Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling emission & Water pollutants as per the prescribed standards	This act will be applicable during construction, for establishments of hot mix plant, construction camp, workers' camp, etc	HSPCB	Yes
7.	Air (Prevention and Control of Pollution) Act as amended in 1987	To control air pollution by controlling emission and air pollutants according to prescribed standards	This act will be applicable during construction; for obtaining NOC for establishment of hot mix plant, workers' camp, stone crusher, construction camp, & other heavy machinery.	HSPCB	Yes
8.	Noise Pollution (Regulation and Control) rules, 2000	Noise pollution regulation and controls	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	HSPCB	Yes
9.	The Explosives Act (& Rules), 1884	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosives	For transporting and storing diesel, bitumen etc.	HSPCB	Yes
10.	Public Liability Insurance Act, 1991	Insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc. safely in designated locations within the construction camp	HSPCB	Yes

S.No	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable Yes/No
11.	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	Storage, handling, transportation and disposal of hazardous waste	Storage and handling of hazardous waste during construction	HSPCB	Yes
12.	Solid Waste Management Rules, 2016	Management and handling of solid waste	For disposal of solid waste generated during construction	HSPCB	Yes
13.	Construction and Demolition Waste Management Rules	Management of construction and demolition waste	For disposal of solid waste generated due to construction and demolition	HSPCB	Yes
14.	Batteries (Management & Handling) Amendment Rules, 2016	Management and handling of used lead acid batteries	Safe disposal of used lead batteries through authorized e waste recyclers	HSPCB	Yes
15.	E-Waste (Management) Rules, 2016	Effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes	Handling of e-waste	HSPCB	Yes
16.	Central Motor Vehicles Act , 1988	To control vehicular air and noise pollution	This rule will be applicable to road users and construction machinery	Motor Vehicle Department	Yes

S.No	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable Yes/No
17.	The Petroleum Act 1934, as amended in August 1976 The Petroleum Rules 1976, as amended in March 2002.	Operation, Storage and transportation of Petroleum products	The rule is applicable for as the transportation and distribution of compressed natural gas will take place	Ministry of Petroleum & Natural Gas	Yes
19.	Petroleum and Natural Gas Rules, 1959, amended 2009	As states own the blocks found within their territory and are therefore, responsible for awarding the licenses for onshore blocks,	The rule is applicable for as the transportation and distribution of compressed natural gas will take place through the state of haryana	Ministry of Petroleum & Natural Gas & Harayana State Govt	Yes
20.	The Petroleum and minerals pipeline (acquisition of right of user in land) act, 1962	Acquisition of right of user in land [for laying pipelines for the transport of petroleum and minerals] and Provision of compensation in case of any damage, loss or injury is sustained by any person interested in the land under which the pipeline is proposed to be, or is being, or has been laid	The pipeline passes through residential and commercial areas, It may even passes from or near to private property.	Ministry of Petroleum & Natural Gas	Yes

S.No	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable Yes/No
21.	Petroleum and Natural Gas Regulatory Board Act, 2006	Regulation of refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil and natural gas so as to protect the interests of consumers and entities engaged in specified activities	The project is proposed under this act and is bid out by PNGRB for uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country	PNGRB	Yes
22.	The Irrigation Laws (Amendment) Act, 1964	To maintain the uninterrupted flow of natural water ways and canals	For using land under the Right of Way basis for laying the CNG PNG pipeline across a either side of the flowing water course of all canals, branches, distributaries, major-minor channels etc.	Water Resources Department, Govt. of Haryana (PWD)	Yes Application needs to be made

The Environmental issues during pipeline laying & construction stage generally involve equity, safety and public health issues. The construction agencies require complying with laws mentioned below as well:

- **Workmen's Compensation Act 1923** (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- **Payment of Gratuity Act, 1972** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- **Employees PF and Miscellaneous Provision Act 1952** (the Act provides for monthly contributions by the employer plus workers);
- **Maternity Benefit Act, 1951** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- **Contact Labor (Regulation and Abolition) Act, 1970** (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- **Minimum Wages Act, 1948** (the employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions);
- **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers);
- **Equal Remuneration Act, 1979** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- **Payment of Bonus Act, 1965** (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- **Industrial Disputes Act, 1947** (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- **Industrial Employment (Standing Orders) Act; 1946** (the Act provides for laying down rules governing the conditions of employment);
- **Trade Unions Act, 1926** (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- **The Child Labour (Prohibition and Regulation) Amendment Act, 2016** An Act further to amend the Child Labour (Prohibition and Regulation) Act, 1986. (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);

- **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, arerequired to be provided certain facilities such as housing, medical aid, traveling expenses fromhome to the establishment and back, etc.);
- **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996** and the Cess Act of 1996 (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- **The Factories Act, 1948** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities).

1.6 CONTENTS OF THE EIA REPORT

The report has been divided in to the following chapters

Chapter 1: Introduction

This chapter provides background information of the existing pipeline, brief description and objectives of the project, scope of the study.

Chapter-2: Project Description

This chapter presents the details of the proposed project with description of the resources required and emissions, waste and wastewater anticipated to be generated.

Chapter-3: Description of Environment

This chapter describes the existing baseline status of environment components collected in a pre-defined study area based on primary and secondary data collection.

Chapter 4: Anticipated environment impacts and mitigation measures

This chapter describes the potential impacts of the proposed project and evaluates their significance based on parameters such as Intensity, Spatial extension, Temporal duration and Environmental Vulnerability. Impact avoidance and mitigation measures are delineated.

Chapter 5: Additional Studies

This chapter assesses the potential risks involved in the construction and operation of proposed facilities and presents a Disaster Management Plan (DMP).

Chapter 6: Analysis of Alternatives

The chapter entails the alternative options for the project.

Chapter 7: Project Benefits

This chapter presents the details of direct and indirect benefits due to proposed project.

Chapter 8: Environment Monitoring & Management Plan

This chapter describes the details of the monitoring schedule to be implemented for checking the effectiveness of mitigation measures. It covers the parameters, frequency and location of monitoring. If existing monitoring schedule is sufficient to cover the proposed development, the same has been clearly mentioned.

The chapter also describes the organizational structure and resources planned for implementing the mitigation measures and monitoring schedule.

Chapter 9: Summary & Conclusions

This chapter summarizes the potential positive and negative environmental impacts of the project.

2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF THE CITY GAS DISTRIBUTION PIPELINE

Adani has planned to lay 8" & 4" dia steel pipeline, approx. 155 kms for the gas distribution throughout Bhiwani, Charkhi Dadri and Mahendragarh districts. The pipeline stretch is divided into two parts: Narnaul to Mahendragarh and Charkhi Dadri to Bhiwani.The pipeline has two Tap-Off Points; GAIL Tap-Off Point at Neemrana on Delhi-Jaipur Expressway (National Highway-8) and GSPL Tap Off Point at Bhiwani near Bhiwani-Hansi Road (SH-17 stretch near Nizampur Narnaul - Bhiwani-Munak).

The proposed project will be completed in approximately 36 months from the date of approval environmental & other statutory clearances.

2.2 PIPELINE ROUTE & ACCESSIBILITY

The pipeline runs parallel along the various roads, accessibility is not an issue. Project pipeline runs along Delhi-Ajmer Expressway which further emerges on SH-148B on Behror Taluka. The route covers 50 villages in 6 talukas and 2 districts in State of Haryana. Only a minor stretch falls in Alwar district in Rajasthan.

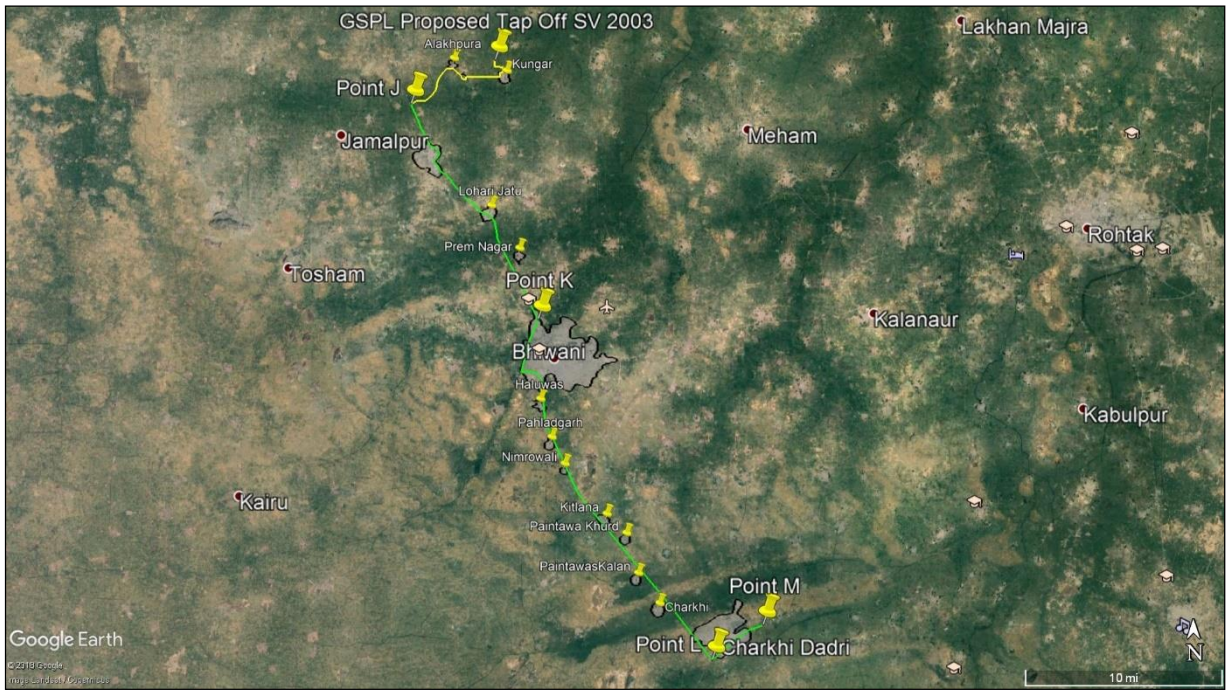
Table 2-1: List of villages, cities, talukas and districts of Haryana falling in the project area

S.No	City/ Village		Taluka	District	State
1	1. Janaksinghpura 2. Kalipahari 3. Madhosingpura 4. Mohalariyan	5. Dooghera 6. Patel Nagar 7. Jharoda	Nimrana	Bhiwani	Harayana
2	8. Nasarpur 9. Sagli 10. Nibhor 11. Jakhrana Khurd	12. Jakhrana 13. Bhagwar Kalan 14.	Bhehror		
3	15. Anantpura		Chomu	Alwar (just a minor stretch falling in Rajasthan)	
4	16. Mandhana 17. Bhiwani Jonpal 18. Lohari Jatu 19. Bhiwani Khera	20. Nimriwali 21. Haluwas 22. Alakhpura 23. Kungar	Bhiwani	Mahendragarh	
5	24. Seka 25. Kadeepura	36. Lehroda 37. Faizabad	Narnaul		

	26. Neerpur 27. Bargaon 28. Jamalpur ka Johar 29. Narnaul 30. Nasibpur 31. Sainipura 32. Mohalla Kathikan 33. Buchakpur 34. Lutapur 35. NuniAwal	38. Hudina 39. Gulawal 40. Kuksi 41. Nangal Sirohi 42. Janjariwas 43. Jonawas 44. Paiga 45. Rewasa 46. Marja Khurd			
6	47. Charkhi 48. Sarabha Nagar	49. Paintawas Kalan 50. Kitlana	Charkhi dadri	Charkhi dadri	

Source: Primary Survey, TUV SUD

Figure 2-1: Route Map for the pipeline



Source: Adani Gas Limited

2.3 PIPELINE DESIGN & CODE

As stated in PNGRB Notification 2008, the design, materials and equipment, welding, fabrication, installation, testing, operation and maintenance and corrosion control of CGD network shall be in

accordance with requirements of ASME B31.8 except insofar as such requirements are specifically cancelled, replaced or modified by the requirements specified in these regulations.

The CNG Station, CNG Mother Station, CNG On-Line Station and CNG Daughter Station shall be designed, operated and maintained in line with the requirements of the Chief Controller of Explosives as detailed in the Gas Cylinder Rules, 2004 as modified or amended from time to time. This includes compression, handling and transportation activities of compressed natural gas.

It is intended to apply these regulations to all new and such aspects of already existing networks as design, fabrication, installation, testing at the time of construction and commissioning. However, if an Adani has laid, built, constructed or expanded the CGD infrastructure based on some other standard or is not meeting the standards specified in these regulations, then it needs to carry out a detailed technical audit of its infrastructure through a Board authorized or approved third party agency by the Board. Adani thereafter shall submit the recommendations made by the third party along-with its time-based mitigation plan and implementation schedule to the Board for authorization within six months from the date of notification of these regulations.

Technical standards and specifications mentioned in PNGRB notification, 2008 including safety standards (hereinafter referred to as standards) for city or local natural gas distribution networks are as specified in Schedule–I which cover material and equipment (Schedule–1A), welding (Schedule–1B), piping system components and fabrication (Schedule– 1C), design, installation and testing (Schedule–1D), operating and maintenance procedures (Schedule–1E), corrosion control (Schedule–1F) and miscellaneous (Schedule–1G).

Table 2-2: Applicable Standards & Codes

S.No	Standards & Schedule	Applicability
1	ASME B 16.25	Butt welding Ends
2	ASME B 31.8	Gas Transmission and Distribution Piping Systems
3	ASME B 16.11	Forged Fittings, Socket Welding and Threaded
4	ASME B 31.3	Process Piping
5	ASME B 31.4	Pipeline Transportation System for Liquid Hydrocarbons and Others
6	ASME B 16.5	Pipe line flanges and flanged fittings
7	ASME B 16.9	Factory made- Wrought Steel Butt welding Fittings
8	ASME PTC 10	Performance Test Code on Compressors and Exhausters
9	PNGRB T4S	Pipeline Design & Material Selection
10	PNGRB Regulation, 2008-Schedule–I A	material and equipment

11	PNGRB Regulation, 2008-Schedule–1B	welding
12	PNGRB Regulation, 2008-Schedule–I C	piping system components and fabrication
13	PNGRB Regulation, 2008-Schedule–I D	design, installation and testing
14	PNGRB Regulation, 2008-Schedule–I E	operating and maintenance procedures
15	PNGRB Regulation, 2008-Schedule–I F	corrosion control
16	PNGRB Regulation, 2008-Schedule–I E	miscellaneous

Source: Secondary Data Survey, TUV SUD

Table 2-3: Technical details for the proposed pipeline

S.No	Description	Piping Details
1	Pipeline internal Diameter (Inches)	8” & 4”
2	Normal operating pressure	19-40 kg/cm^2
3	Maximum allowable operating pressure	40 kg/cm^2
4	External Coating type & specification	
5	Design Throughput (MMSCMD)	0.3 MMSCMD
6	Pipeline Design Life	25 years
7	Design Temperature (C)	0-60 degree centigrate
8	Rating of Piping Components	Schedule 40 (API 5L *42)
9	Mainline Valve Stations	Will be installed at every 3 kms for the complete length of the pipeline

Source: Adani Gas Limited

2.4 ASSOCIATED FACILITIES

2.4.1 SCADA, TELECOMMUNICATION & LEAK DETECTION

The Master Control Station shall be equipped with Supervisory Control and Data Acquisition (SCADA) software running under multi-programming, multitasking real time operating system environment. The SCADA software shall incorporate control & monitoring of all locations including Block valves. Leak Detection system shall be provided and the Leak Detection Software shall run in a separate machine at Master Control Station. This package will enable the operator to take optimal control actions and thus ensure the safety and security of the pipeline network.

The CGD system should have leak detection system in position and should be operative. For pipeline network it shall be odorisation based and for enclosures such as CGS, above ground

DPRS, it shall be gas leak detection based. Gas detectors shall be installed at strategic locations covering to detect any gas leakage.

2.4.2 FIRE ALARM & FIRE FIGHTING SYSTEMS

As per the Petroleum and natural gas regulatory board notification 2008, Schedule 1 D, after construction activities relevant warning signs shall be displayed in the area. A proper Emergency Response Plan shall be in place and emergency contact numbers of relevant agencies should be visible. Firefighting equipment's should be available during commissioning.

As per the PNGRB notification, 2008 AGL operating CGD Networks shall provide for an Emergency Control Room, manned round the clock and equipped with effective communication system and emergency vehicles fitted with communication facilities, first aid equipment, fire extinguishers, gas detectors, repair kits and tools, maps, plans, material safety data sheets etc. at its disposal. The CGD entity shall put in place an Emergency Response Plan, a Disaster Management Plan and a Pandemic Plan. While preparing these plans the entity shall take into confidence the various local authorities (i.e. The Fire authorities, Police authorities, Health authorities, local administration, Disaster Management authorities, Mutual aid, Factory inspectorate etc) and clearly elaborate on their role in case of an incident.

2.4.3 CORROSION PROTECTION

Underground carbon steel section beyond transition fitting is below ground, it shall be protected against corrosion by minimum 400 micron thick 2 pack high build epoxy coating. Above ground service piping shall be Galvanized Iron or copper or carbon steel protected by anti-corrosive coating.

2.5 LAYING OF PIPELINE

The pipeline construction is proposed to be carried out through deployment of 4 to 5 spreads. The sequence and methodology of construction of new pipeline is given below:

- Clearing and grading - A 30 m wide Right of Use (RoU) area will be cleared off vegetation and other obstacles such as boulders. Tree felling will not take place.
- Stringing–Pipes are transported to the site on trucks will be offloaded using side booms. Pipes are then strung adjacent to the trench. Trailers and cranes will be used for maneuvering of pipes. This activity may be done before or after trenching.
- Trenching - Trenchers and backhoe type excavators will be used to dig the trench for laying the pipeline. The topsoil in agricultural areas will be removed and stockpiled for restoration. The excavated sub-soil will be stockpiled separately for backfill.

- Bending – Pipes will be bent using a bending machine to the appropriate angle to match the vertical and horizontal alignment of the trench.
- Welding - Welding will be done using conventional manual/ semi-automatic welding involving a crew of welders and fitters. Once the pipe is strung a line-up crew will position the pipe using side booms in preparation for welding. Pipe strings to be welded will be effectively earthed. During welding, atleast one end of the pipe string will be closed to prevent a forced draught effect.
- Non-Destructive Inspection - Mechanized Ultrasonic Testing (MUT) is the specified method to be applied for the execution of NDT. Each field weld will be 100% radiographed to test for soundness of the weld in compliance with specifications. NDT and its evaluation shall be performed in accordance with API Standard 1104.
- Coating: After welding at each weld joint, coating of field joints of bare pipes and the repair of coating shall be done by.
- Burial - General burial depth of the pipeline along the route will be with a minimum 1.0 m cover. Burial cover will be compacted to avoid future erosion by all weathers.
- Backfilling - The excavated sub-soil will be returned to the trench. The topsoil, which has been preserved on the side of the ROU, will be spread over the filled up trench. A crown of soil will be kept on top of the trenched portion to allow for future settlement. Backfilling will be managed so that damage from sizable rocks is not used or any other materials that may damage the pipeline.
- Crossings - The method used for the crossing of waterways and other infrastructure facilities will vary from place to place depending on the environmental setting and the geo-technical features of the area. The detail method of various types of crossings is specified below.

Table 2-4: Type of crossings required for various type of infrastructure

S.No	Type of Crossing	Method of Crossing
1	National Highway	Conventional Trenching/ HDD
2	State Highway	Conventional Trenching/ HDD
3	Other Roads	Conventional Trenching/ HDD
4	Railway Crossing	HDD
5	Major Lined Canal	HDD
6	Unlined Canal	HDD

Source: PNRGB Notification, 2008

- Restoration - Restoration of the ROU will be conducted progressively following the completion of construction work. This will involve removal of foreign materials such as construction debris and wastes. The ROU will be returned to its original condition by spreading the topsoil over

the areas from where it was stripped, so that agricultural activities will be restored. Special focus will be given to restoration of side slopes and beds of natural water body crossings.

- Pipeline warning markers–In the final stages of construction, warning marker posts will be erected indicating the location of the pipeline and the crossing of other pipelines, cables and features. A marker tape will be placed in the trench 500 mm above the pipeline to indicate to future excavators that a pipeline is below and that they are nearing

The major construction activity involved during laying of pipeline are as follows:

- Transport of pipes from the place of availability to stock/lining yard.
- Transporting of pipes from the stock / lining yard to suitable places along the route of the pipeline.
- Application of lining and coating.
- Fabrication of fittings and special lining and coating of the same.
- Excavation and preparation of trenches for the pipes. Topsoil to be kept separately.
- Lowering the pipes into the trench.
- Jointing of pipes inside the trench.
- Welding of pipes.
- Rectification of defects and re-testing
- Finishing the coating and lining at weld joints.
- Back-filling of the trench with top soil layer.
- Construction of valve chambers and erection of valve.
- Construction of necessary pipe supports, anchor blocks.
- Providing line markers

2.5.1 SITE PREPARATION & LAYING METHODOLOGY

The project is for laying of a Gas pipeline with open trenching. However, for the Portion passing through, train tracks, Canals, ponds bridges will be done by Horizontal Directional Drilling Method (HDD) to reduce the environmental impacts to minimum.

The usual approach to pipeline installation is to dig an open trench, place the pipeline and then bury it. Proposed pipeline is passing through commercial, industrial residential, agricultural areas, water bodies, public spaces etc shall be laid by:

1. Horizontal Directional Drilling (HDD) method for pipeline.
2. Open cut method for remaining portion of pipeline.

Horizontal Directional Drilling (HDD) is a Trench-less methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut method.

- In a sensitive wetland environment such as a river/creek crossing, wildlife habitats would be destroyed and extensive mitigation efforts would be required while pipe laying by open cut method. As a result, trenchless or "no-dig" technology has been used extensively worldwide.
- HDD can be implemented with very little disruption to surface activities, requires less working space, and may be performed more quickly than open-cut methods.
- 8” Nominal bore, & 4” Nominal bore pipelines Steel Pipelines laid together by HDD methodology and remaining length of CRZ portion by Open Cut Method.

Open Cut Method is a usual approach to pipeline installation is to dig an open trench, place the pipeline and then bury it.

- Pressure shall be between 16-40 Bar, 3 layer PE coated steel pipes for the transportation of gas to its delivery centers.

2.5.2 PIPELINE BURIAL

As per the Petroleum and natural gas regulatory board notification 2008, all types of pipes (plastic and steel) and fittings shall be laid underground and shall not be exposed. The buried service lines are provided with a minimum cover of 1.0- 1.5 m. Where it is impractical to provide 1.0 m cover due to physical constraints, additional protective measures such as concrete slabs or high impact resistance plastic sheets shall be installed at least 300 mm above the service line. In no case the depth of cover shall be less than 600mm. For transition from plastic pipe to GI pipe, transition fittings shall be used. Plastic part of transition fitting protruding above ground shall be protected by encasing it with concrete guard.

In case carbon steel section beyond transition fitting is below ground, it shall be protected against corrosion by minimum 400 micron thick 2 pack high build epoxy coating. Above ground service piping shall be Galvanized Iron or copper or carbon steel protected by anti-corrosive coating.

In cases where HDD is used for pipeline burial, plastic or carbon steel, adequate depth of 2-2.5m shall be maintained under if the pipeline is going below from any of the listed features, i.e river/ canal beds, highways, roads, houses and industries.

Table 2-5: Minimum depth of cover for buried steel pipeline

S.No	Location	Minimum Cover (m)
1	Normal/ Rocky Terrain	1.0
2	Minor River/ unlined canal/ nala crossing/ tidal areas/ other water courses	1.5
3	Major River Crossings	2.5
4	Rivers with rocky bed	1.5

5	Lined canals/ drains/ nalahs	1.5
6	Drainage ditches at roadways and railways	1.0
7	Rocky Areas	1.0
8	Cased/ uncased road crossing	1.2
9	Cased railroad crossing	1.7

Source: PNGRB Notification, 2008

2.6 PROJECT REQUIREMENT

2.6.1 LAND

The land required for the project is only for CNG Stations and Tap off points. 60 CNG stations have to be setup for this project and two tap off point. The land for the Tap off point has been bought near to the GAIL Tap off point at Neemrana and GSPL Tap-Off point near Bhiwani, as the LPG/CNG will be bought from Gail and converted to CNG and transported further. Vacant land has already been bought. Rest all the required land will be bought in the near future.

2.6.2 MANPOWER RESOURCES

During the construction phase, local skilled and unskilled labour will get temporary employment based on required skill sets. However, as the development will be phase wise, the total number of locals employed at any one time may not be more than 500- 600. Adani, has contracted out the construction work and management of labour to shanti contractors, local skilled and unskilled workers and service providers are preferred in order to boost local employment generation. As far as operation phase is considered, guards will be employed to patrol the pipeline areas, which will be around 20-30 people for this stretch. Skilled workers will be employed for the operation and maintenance. All these will also be contracted out to the subcontractors.

2.6.3 POWER REQUIREMENT

Power requirement will be bet from DG Sets during construction phase of the project.

2.6.4 WATER REQUIREMENT

Water requirement will be minimal for the project associated only with domestic use by the workers during construction and office staff during constructions and operations period at the distribution centers. The water requirement for construction phase will be contracted out to private tankers. During the operation phase, water requirement will only be at the CNG stations.

2.6.5 EMISSION AND DISCHARGES

Fugitive dust shall be the main air pollutant, from the small diesel engines used for the construction works & movement of vehicles for which dust suppression system will be used as relevant points. No effluent will be generated during operation of the proposed project.

3 ENVIRONMENTAL DESCRIPTION

3.1 STUDY AREA

This chapter summarizes the available baseline data on physical and biological resources within the principal area of interest i.e. the project area that would comprise of project components and associates facilities. Key existing sources of information used for this section comprises of government departments, analysis of available research papers and secondary data review from established sources such as Indian Meteorological Department, etc. Reconnaissance visits and physical, social and biological field surveys were carried out to supplement the existing baseline data.

The scope of environmental assessment, existing features of the project and proposed improvement, methodology and regulations applicable to environmental assessment is highlighted in the previous sections. In this chapter, an attempt has been made to prepare a baseline environmental setting to meet out the applicability of Government of India (GoI) regulatory requirements. Considering the existing environmental scenario, potential impacts of road improvement will be identified and accordingly management plan will be proposed in forthcoming sections. The baseline environmental conditions will help in comparing and to monitor the predicted negative and positive impacts resulting from the project during construction and operation phases.

The area falling within 10 km radius from the project boundary has been considered as “Study Area” for the purpose of conducting EIA Study. The baseline data generation includes site visits, ecological surveys, social surveys and interviews, and secondary data review from established sources such as Indian Meteorological Department, Census of India.

The details pertaining to both the project taluka and district, from authentic government sources, have been presented where project area / project site specific information was not available in public domain.

3.2 TOPOGRAPHY

The area of Mahendergarh district is dry due to its sandy and mountainous areas. Mahendragarh is located at an average elevation of 262 m amsl, Charkhi Dadri is located at an average elevation of 324 m amsl and Bhiwani is located at an average elevation of 222 m amsl.

The entire proposed pipeline stretch is along highway and comprises of nearly flat and even topography.

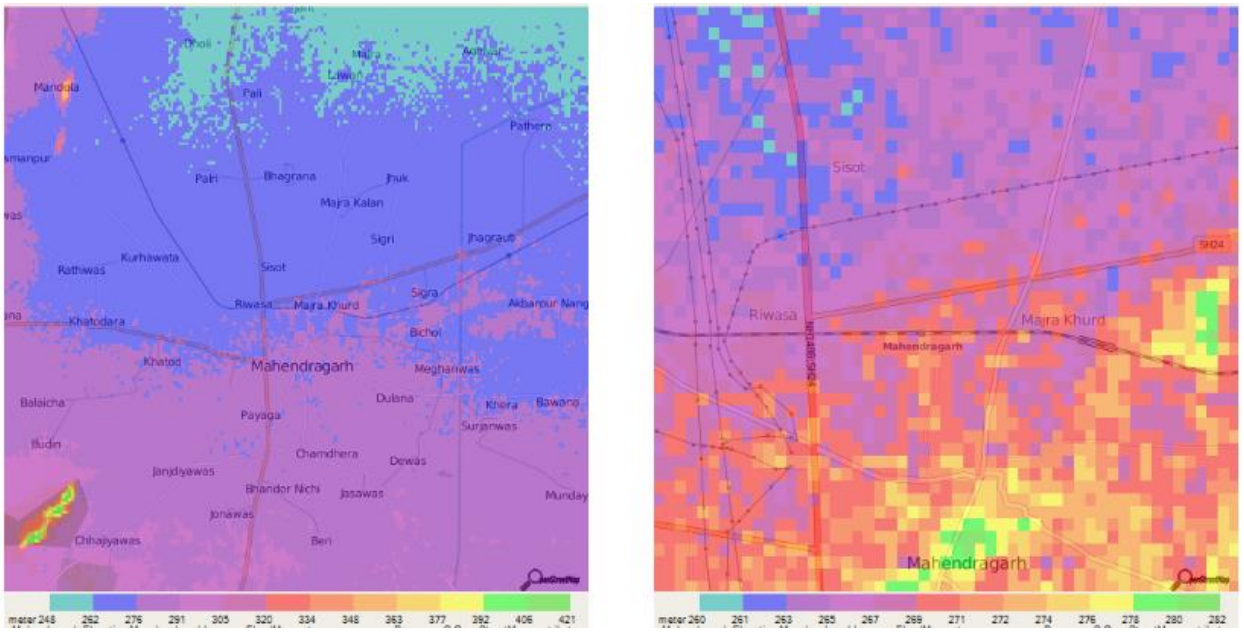


Figure 3-1 : Topographical Map of Mahendragarh district

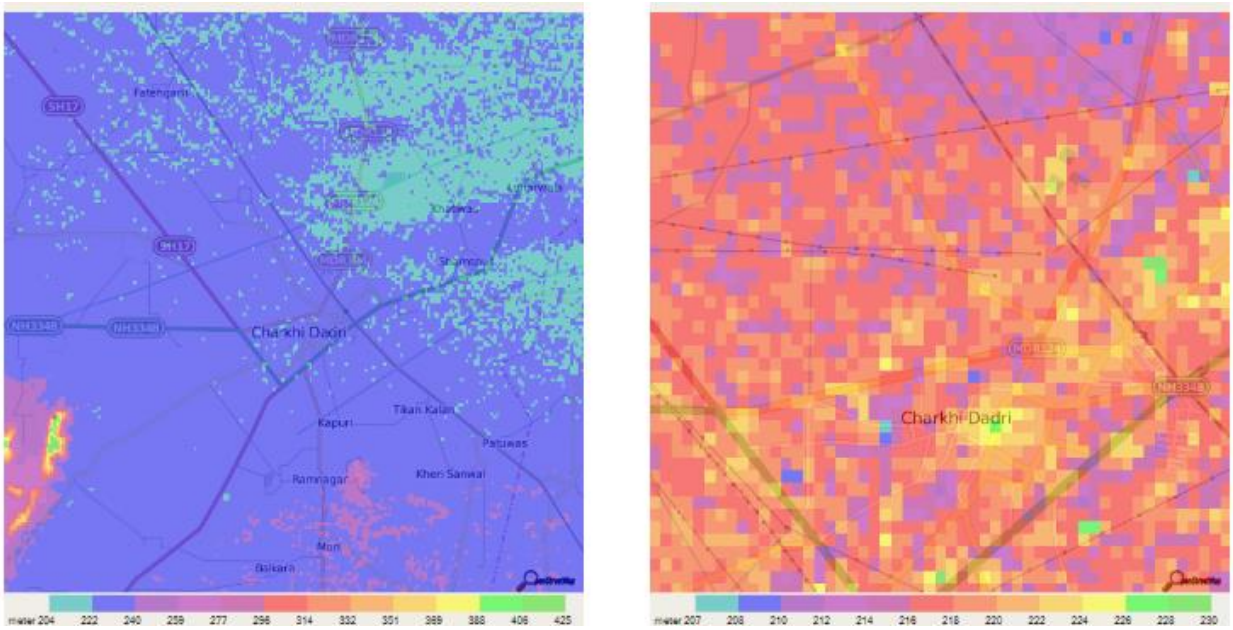


Figure 3-2 : Topographical Map of Charkhi Dadri district

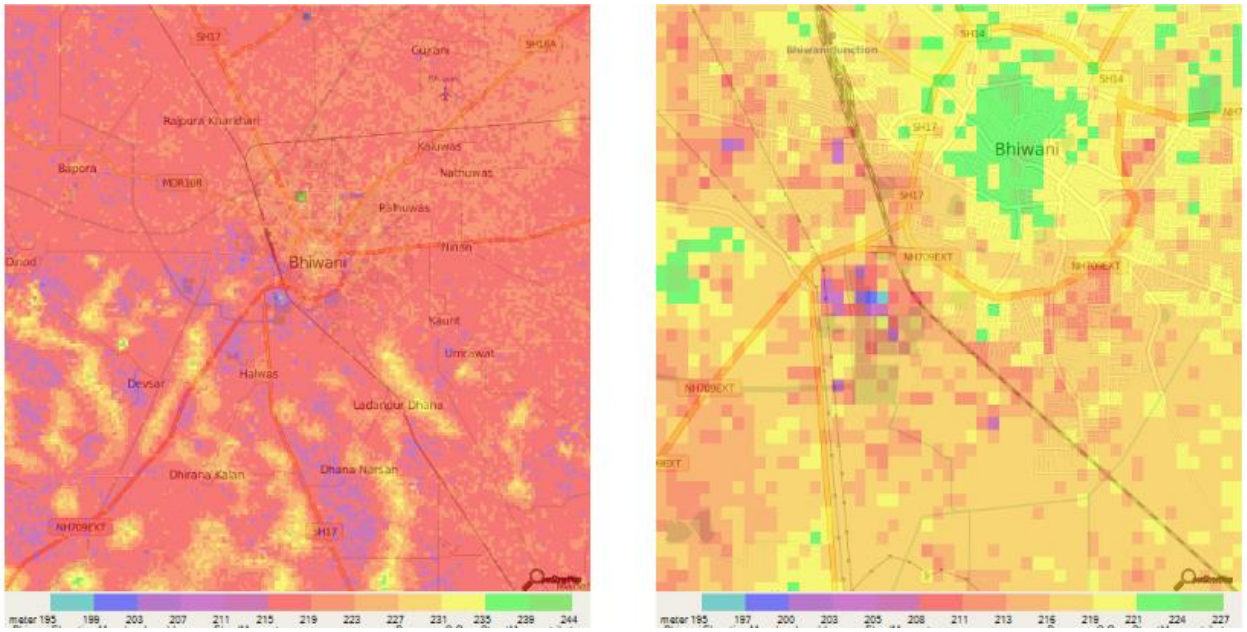


Figure 3-3 : Topographical Map of Bhiwani district

3.3 GEOMORPHOLOGY

The Site falls in Mahendragarh, Bhiwani and Charkhi Dadri districts. The geomorphological formations in study area comprises of Aeolian Plain, Alluvial Plain and Dunes

Mahendragarh

The area forms the part of Indo - Gangetic plains and has vast alluvial and sandy tracts. It is interspersed with strike ridges which are occasionally covered by blown sands. South western part of the district is occupied by blown sand and alluvium. The sand dunes attain heights unto 30m but on an average they attain height of about 7m with respect to surrounding. The hill ranges are marked features of the district and are part of great Aravali chain. The Dhosi hill touches the height of 7090 m amsl. The master slope of the area is north ward. The main streams of the district are Dohan & Krishnawati which flow from south to north. These streams are known to carry copious supply of water to inundate large part of the district during monsoon and remain dry for major part of the year.

Bhiwani (including Charkhi Dadri)

The district consists of flat and level plain interrupted from place to place by clusters of sand dunes, isolated hillocks and rocky ridges. A few isolated rocky ridges elevated sharply from the

plain occur in the south central portion or the district. Dohan river is the only ephemeral stream in the area and flows in direct response to precipitation. Only the tail of this ephemeral stream falls in the south-central corner of the district and ultimately dies out in sands around village.

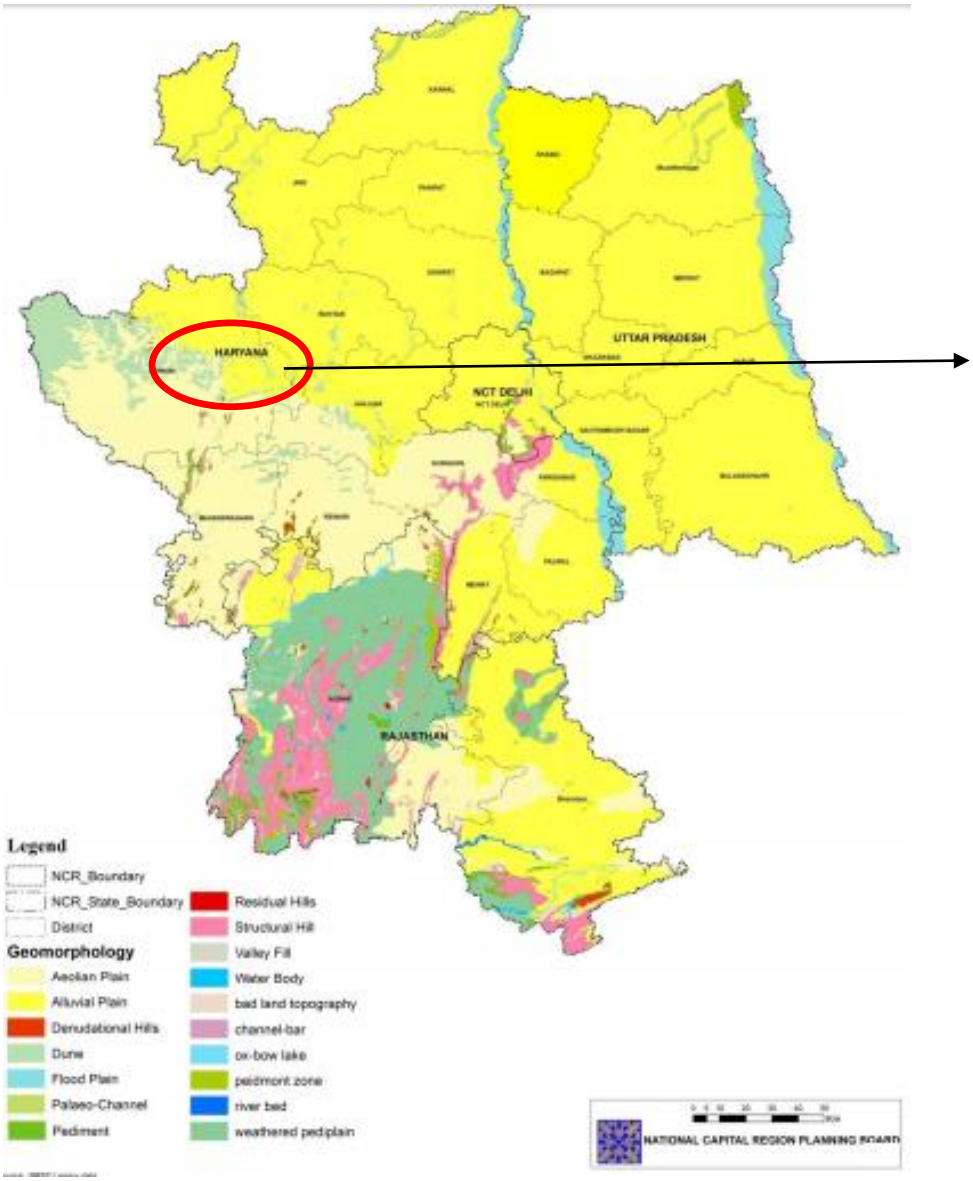


Figure 3-4 : Geomorphology Map showing Pipeline stretch

3.4 HYDROGEOLOGY

Mahendragarh district is underlain by alluvium and blown sand of Recent to sub Recent age which are overlying the rocks of post Delhi and Delhi system. The alluvium in the area belongs to older alluvium stage comprising of sand, silt, clay and calcareous nodules. The alluvium is the fresh water deposit of Indo- Gangetic river system. In alluvium the granular zones exist down to entire thickness, which is negligible near the out crop of Delhi system to about 150m in the northern part of district. The average thickness of the alluvium in the district is more than 50m. In alluvial formations the successful exploratory tube well tapped aquifer zones down to the depth of 170m & 235 m yielding 220 lpm to 1200 lpm for 6 to 23m drawdown. The transmisivity value ranges from 150 to 810 m 2 /day in alluvial formations and between 370 and 1685 m 2 /day in hard rocks. The lateral hydraulic conductivity ranges from 1.5 to 20 m/ day. In hard rock area the depth of bore holes ranges between 50 to 135 m and the water bearing zones in weathered fractured quartzite and limestone were tapped. The discharge of tube wells varies between 100 to 1325 lpm with 3 to 15m draw down in lime stone aquifers. The discharge of tube wells constructed in quartzite formation ranges between 22 and 820 lpm for reasonable drawdowns.

The geological formation met within the Bhiwani and Charkhi Dadri districts are ferruginous chiastolite schist associated argillaceous rocks of Aravalli group, Alwar quartzite of Delhi system, Malani suite of volcanics of lower Vindhyan age, Older alluvial deposits of Quarternary age and Aeolian sands of recent age the out crops are, however, limited to small parts of the district, Older alluvium occurs extensively in the area consisting of inter bedded , lenticular, interfingering deposits of gravel sand ,silt, clay and Kanker mixed in various proportions. The youngest formations are aeolian deposits, which are unconsolidated surface sands covering large area in the western part of the district, these deposits occur as sand dunes at the surface and consist of sands. Ground water occurs in alluvium and aeolian sands and underlying jointed and fractured hard rocks formations also form the aquifers, in alluvium, sands, silt, kankar and gravel form the water bearing zones. In-shallow aquifers zones, ground water occurs under water table conditions where as in the deeper zones, confined/semiconfined condition exist, hard rocks comprising of Aravalli group of rocks, Malani suite of volcanics and Alwar Quartzites of Delhi system are water bearing but have yet not been explored thoroughly. Drilling was conducted at 21 locations in the district, with the depth

3.5 DEPTH TO WATER LEVELS

As per Central Ground Water Board, North-western region, the depth of water level in Mahendragarh is 50 -135 m bgl (Hard rock) 170 -235 m bgl (Alluvial).

Further, the depth to water levels during Pre-Monsoon season in Bhiwani (including Charkhi Dadri) is 1.87-65.97 m bgl and 0.84- 64.19 m bgl (during Post-Monsoon season. The long term water level trend in 10 yrs in 0.03m-1.38m/yr m/yr fall.

3.6 WATER RESOURCES

3.6.1 SURFACE WATER

The main streams of the Mahendragarh district are Dohan & Krishnawati which flow from south to north. These streams are known to carry copious supply of water to inundate large part of the district during monsoon and remain dry for major part of the year.

Dohan river is the only ephemeral stream in the Charkhi Dadri and Bhiwani area and flows in direct response to precipitation. Only the tail of this ephemeral stream falls in the south-central corner of the district and ultimately dies out in sands around village.

3.6.2 GROUND WATER

Ground water resources have been estimated jointly by Central Ground Water Board and State Ground Water Department as per the norms recommended by GEC' 97 for the Mahendragarh, Charkhi Dadri and Bhiwani districts.

The stage of ground water development in the Mahendragarh district ranges between 49% (block –Narnaul) to178% (block –Kanina). The total repleneshable ground water resource in the district is 21435Ham. The net ground water draft is 22778 Ha.m., thus over exploiting 1343 Ha.m of ground water. The stage of ground water development in the district is 104%. Ground water resource and development potential of Mahendragarh district is given as under Table 3-1.

Table 3-1: Ground Water Potential of Mahendragarh District

Block	Net annual groundwater availability (ham)	Existing gross ground water draft for irrigation (ham)	Provision for domestic & industrial water requirement supply	Existing gross groundwater draft for all uses (ham)	Allocation for domestic and industrial supply for next 25 years	Allocation for future irrigation development (ham)	Stage of GW development
Ateli	3881	3422	70	3492	90	369	90
Narnaul	3726	1694	116	1715	108	1924	49
Kanina	4673	8266	44	8310	44	-3636	178

Mahendragarh	5004	5140	82	5222	82	-219	104
Nangal Chowdhary	4151	3931	108	4039	791	-571	97
TOTAL	21435	22453	420	22778	1115	-2133	104

Source: Groundwater Information Booklet, Mahendragarh District, Haryana, 2013

The water supply to the Bhiwani and Charkhi Dadri districts is mainly based on groundwater through tubewells. The urban population is covered under drinking water supply scheme. The water supply to the villages is met out with the installation of hand pumps by the villagers as spot and convenient source of water. The shallow tubewells in the district range from 20 to 90m. deep, tapping the aquifer from 15m to 90 m. with a discharge of 400 to 900 Ipm. Most of the shallow tube wells are either run by diesel engines or electric motors. There are 32790 motors working in the district. The major part of the district is being irrigated through ground water.

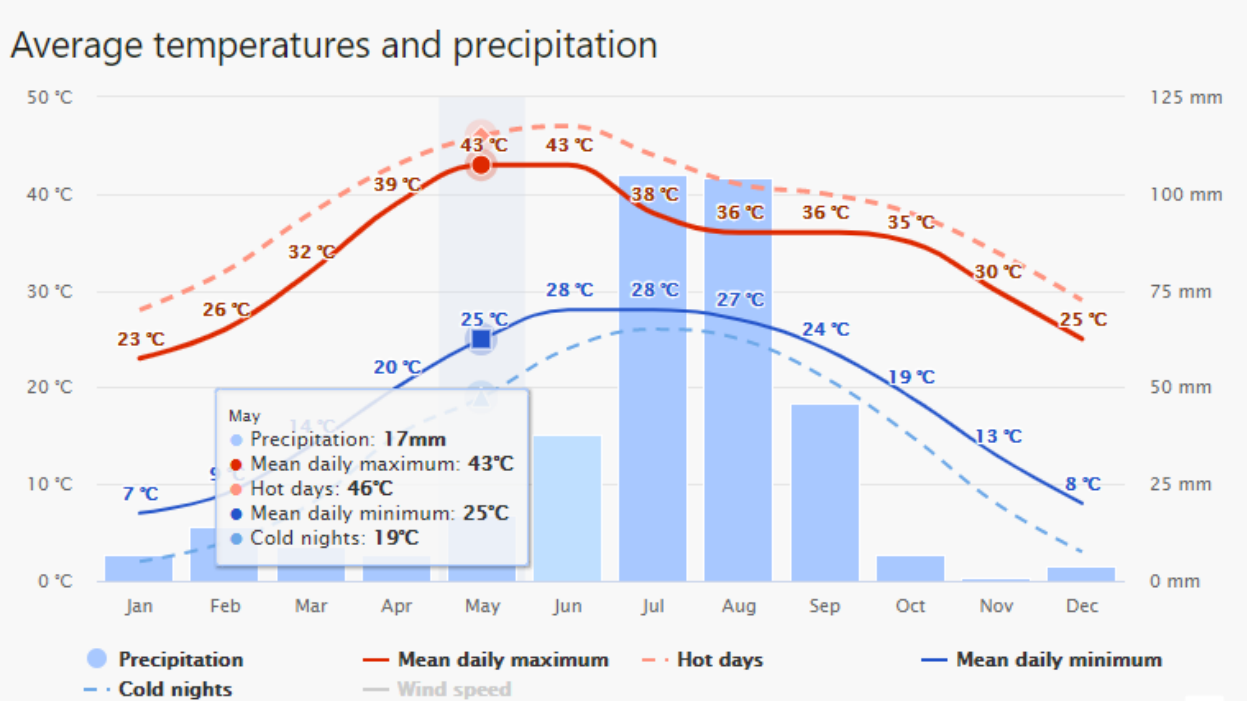
3.7 CLIMATE

The climate can be classified as tropical steppe, semi-arid and hot which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrates into the district. There are four seasons in a year. The hot weather season starts from mid-March to last week of the June followed by the south- west monsoon which lasts up to September. The transition period from September to October forms the post-monsoon season. The winter season starts late in November and remains up to first week of March.

3.7.1 TEMPERATURE

The maximum and minimum temperature recorded is 41^{o}C and 7^{o}C. The district experiences the highest temperature during the month of May whereas the lowest temperature during the month of January.

Figure 3-5: Temperature variation in Mahendragarh district



3.7.2 RAINFALL

The normal annual rainfall of the district is 420 mm which is unevenly distributed over the area 22 days. The south west monsoon, sets in from last week of June and withdraws in end of September, contributed about 85% of annual rainfall. July and August are the wettest months. Rest 15% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally, rainfall in the district increases from southwest to northeast.

3.7.3 WIND

The wind blows from North-west and South-east towards North-east direction. The wind-rose diagram for Mahendragarh District is given in Figure 3-6. The Wind Hazard Map of India shows that the area lies in High Damage Risk Zone with a wind velocity of V<47 m/s. The Wind Hazard Map is shown in Figure 3-7.

Table 3-2: Wind Speed (IMD Gurgaon)

Month	Wind Speed (m/s)	Month	Wind Speed (m/s)
January	2.8	July	4.1
February	3.4	August	2.1

March	4.1	September	2.6
April	4.3	October	1.9
May	4.6	November	1.6
June	5.5	December	2.0

Source: Climatological Normals (1981-2010)

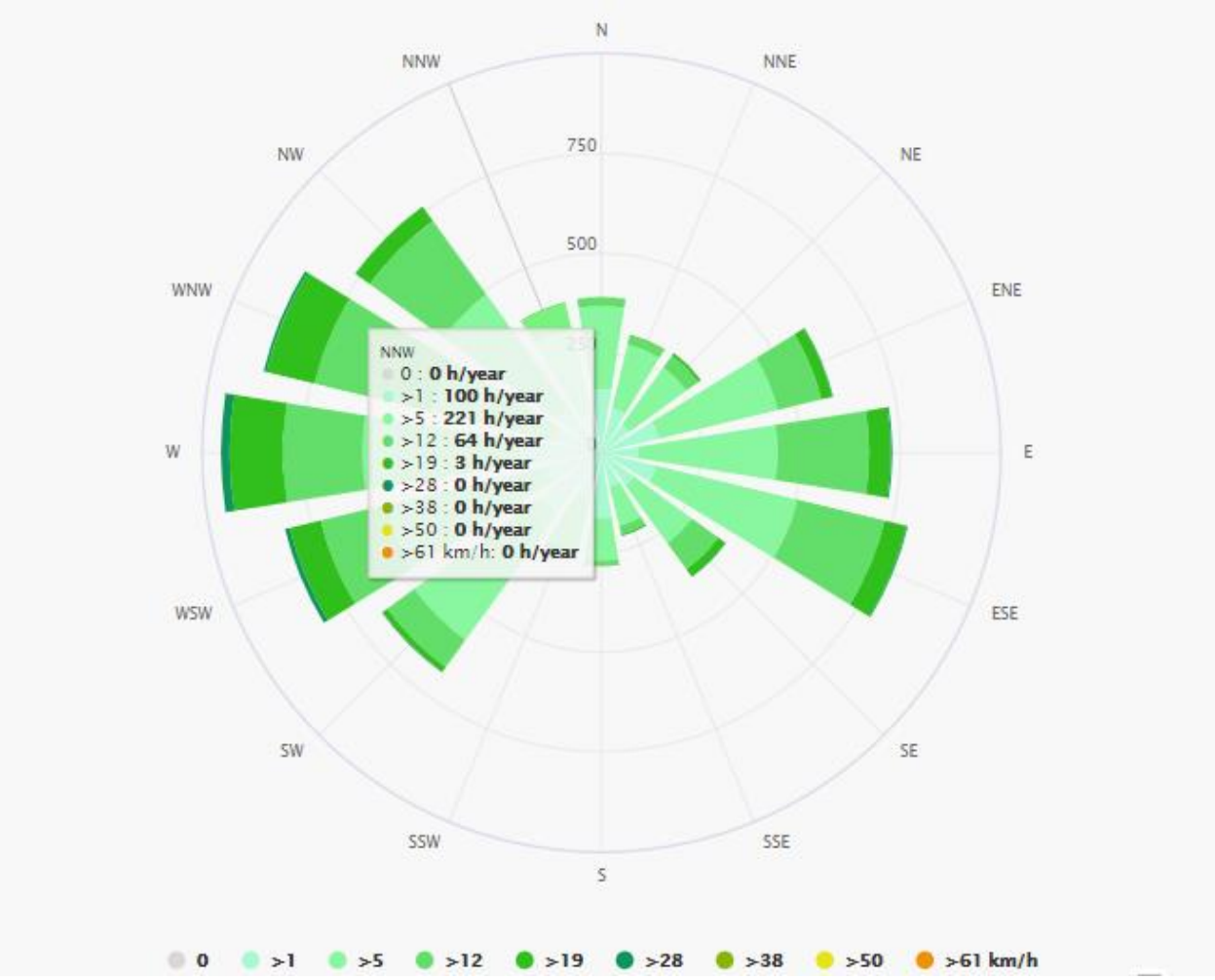
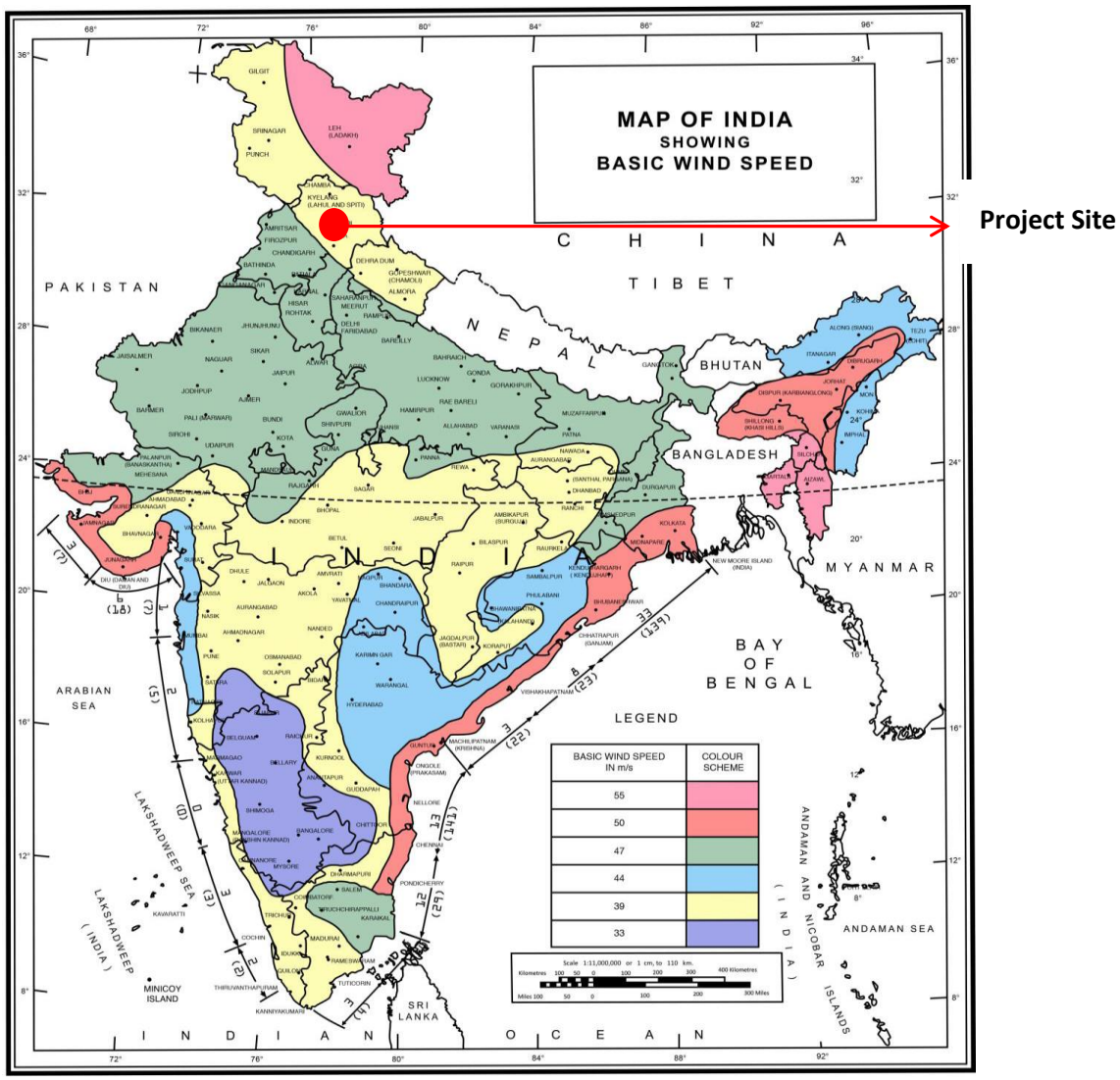


Figure 3-6: Windrose Map of Mahendragarh district

Figure 3-7: Wind Hazard Map showing Project Site



Source: Climatological Normals (1981-2010)

3.7.4 NATURAL HAZARDS

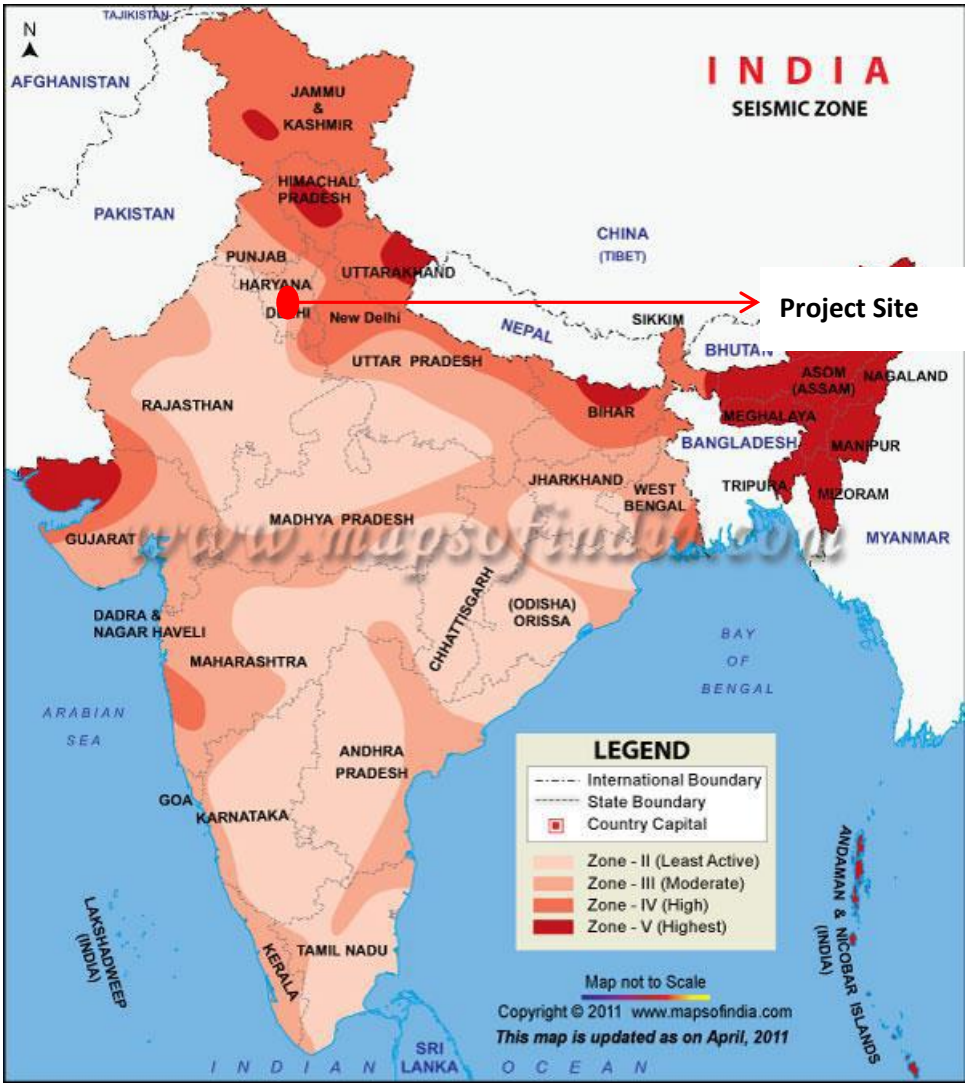
Natural hazards are naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical (earthquakes, landslides, tsunamis and volcanic activity), hydrological (floods), climatological (droughts, etc.), meteorological (cyclones and storms/wave surges) or biological (disease epidemics and insect/animal plagues). Natural hazards can have

impacts on the developments; hence assessment of the natural hazards in the area is important for any development.

Seismicity

As per the seismic zoning map of India (given in the earthquake resistant design code of India [IS:1893, Part 1, 2002], the project site area falls in seismic Zone III, i.e the moderate active seismic zone. The IS code assigns zone factor of 0.16 for Zone III. The project under the Mahendragarh, Charkhi Dadri and Bhiwani Districts of Haryana hence lies in seismic zone III (Moderate Damage Risk Zone (MSK VII) as shown in Figure 3-8 below.

Figure 3-8: Geological Map of India with Seismic Zonation showing Project Site



Source: Map of India, Secondary Research, TUV SUD

3.8 BIOLOGICAL ENVIRONMENT

The proposed pipeline passes through Mahendragarh, Haryana and just a minor stretch passes through Alwar, Rajasthan. The total length of the pipeline is 154260 mts. The details of pipeline routing are given below in Table 3-3.

Table 3-3: Details of Pipeline Stretch

Sr. No.	Pipeline Name	Pipeline Length (m)	Districts	State
1	Main Grid Line Mahendragarh GA-"Mahaveer Chowk to GA entry"	10978	Mahendragarh	Haryana
2	Main Grid Line Mahendragarh GA-"Mahaveer Chowk to Bhumika Public school"	30475	Mahendragarh	
3	GSPL Tap off to Main Grid Line	11707	Bhiwani	
4	Main Grid Line Mahendragarh GA-"BHIWANI CHARKHI DADRI"	60322	Bhiwani, Charkhi Dadri	
5	CGS to GA entry	35231	Alwar	Rajasthan
6	GAIL Tap off Neemrana To CGS	808	Alwar	
7	Main Grid Line Mahendragarh GA-"Mahaveer Chowk to HP Salasar Petro Pump"	4739	Mahendragarh	Haryana
	Total	154260		

3.8.1 FOREST AREA/ RESERVED FOREST/ NATIONAL PARKS & SANCTAURIES

There are no forests or wildlife sanctuaries or biosphere reserves or nesting or breeding grounds for any of the rare species or other protected areas within the project area. There are no mangroves or mangrove forests in the project area. There are no national parks or wildlife sanctuaries or biosphere reserves or nesting sites of Marine turtles either in the study area.

The nearest boundary of Khaparwas Wildlife Sanctuary is at a distance of 19 km from point M of proposed pipeline. The pipeline route on Map of Forest and Wildlife Map of Haryana is shown in Figure 3-9.

Haryana

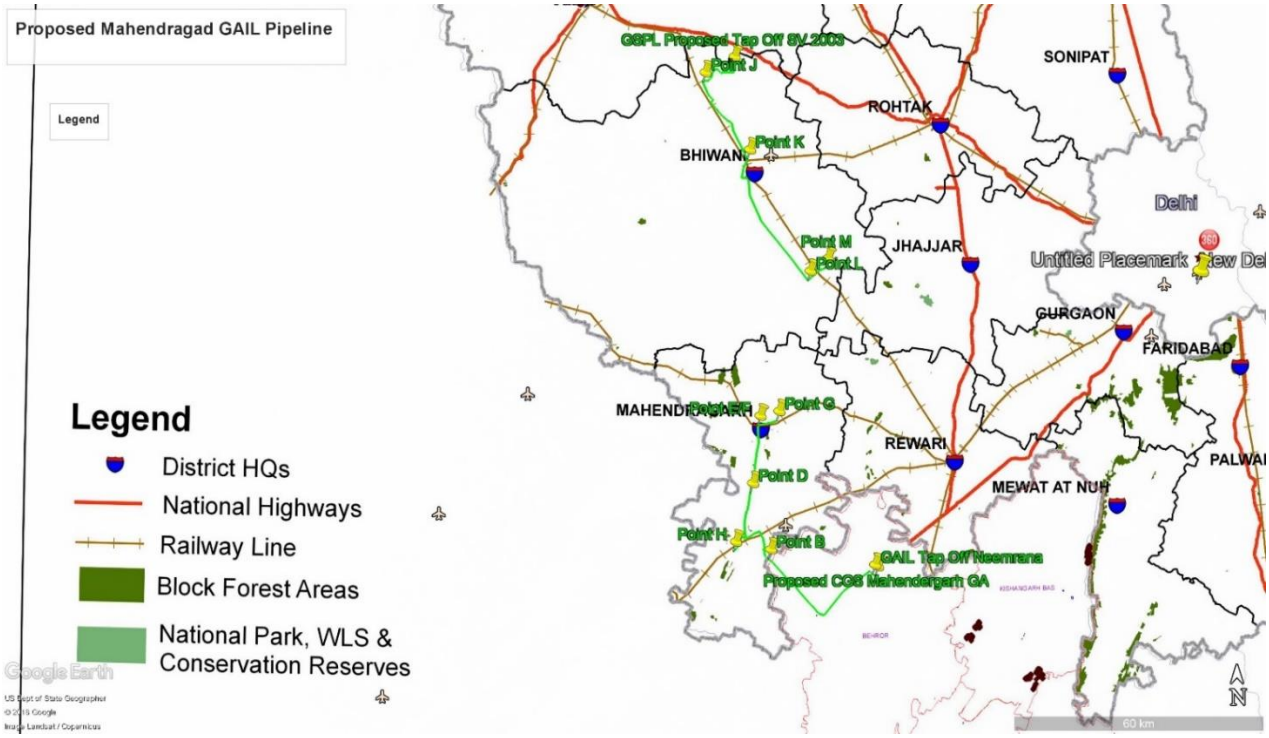


Figure 3-9: Proposed pipeline

Proposed Pipeline is not crossing through any protected area as such but passing very near to forest block area at few places.

Details:

1. Nahar wild life sanctuary : around 26 km away on N-E side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. from point G of study area.
2. Forest block area : around 2 km away on E side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point E/F and Point D, of study area, near Mahendragrh (*Figure 3-10*).

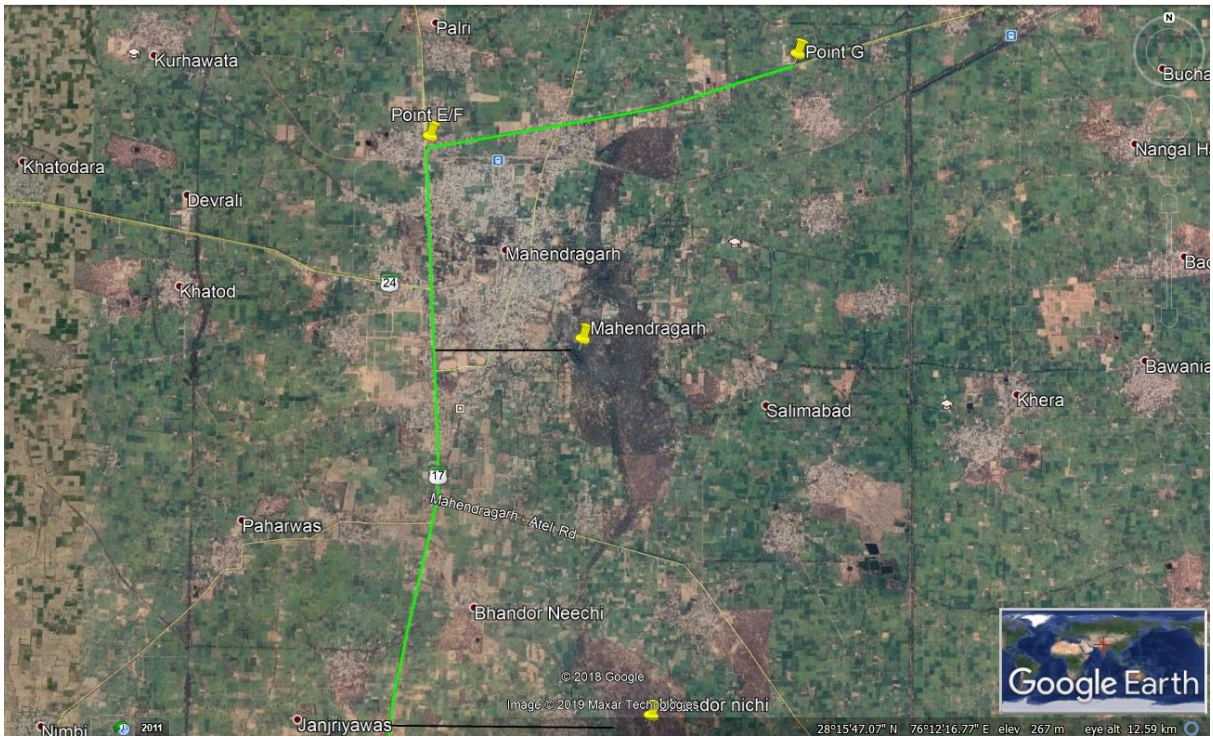


Figure 3-10: Proposed pipeline near Forest Block

3. Forest block area : around 2 km away on E side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point E/F and Point D of study area, near Bhandor Neechi (Figure 3-11).

Figure 3-11: Proposed pipeline near Bhandor Neechi

4. Forest block area : around 0.3 km away on W side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point E/F and Point D of study area, just before Nangal Sirohi.

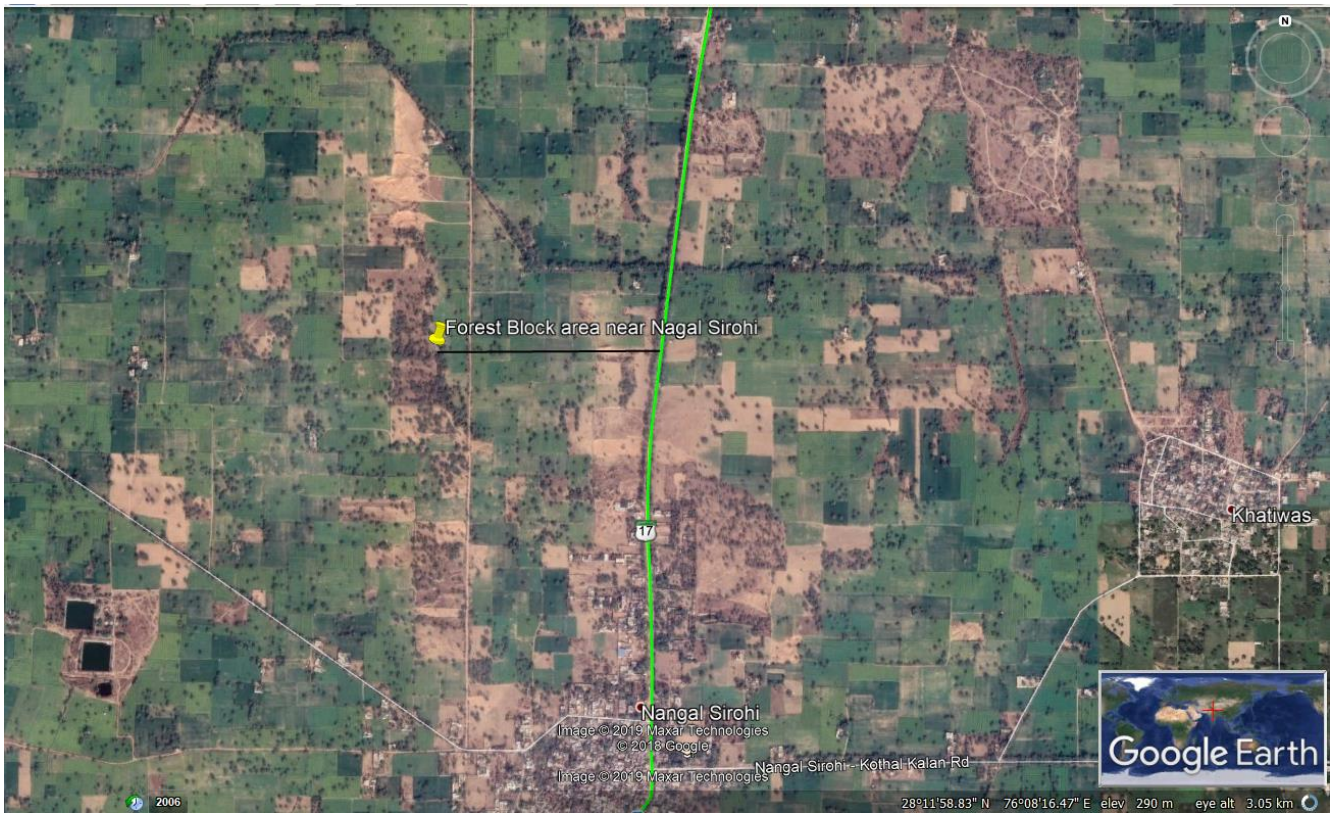


Figure 3-12: Proposed Pipeline route near Nangal Sirohi

5. Forest block area : around 1 km away on E side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point D and Point C of study area, near Narnaul (Figure 3-13)

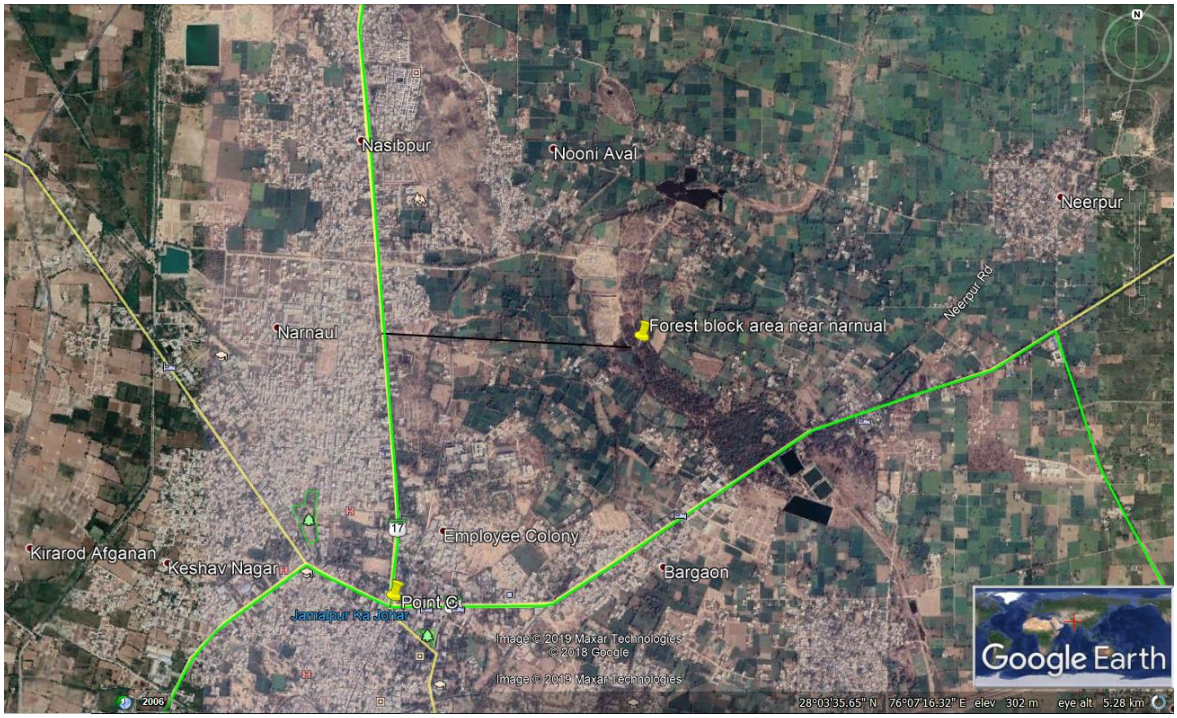


Figure 3-13: Forest Block near Main Grid Line-Mahendragarh

6. Forest block area : around 1 km away on W side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point D and Point C of study area, near Narnaul.
7. Forest block area : around 5 km away on W side from pipe line “Main Grid Line Mahendragarh GA- Mahavir Chowk To Bhumika Public School” i.e. between point E/F and Point D of study area, near Nimbi.

Rajasthan

1. Sariska tiger reserve and national park : around 28.5 km away on W-E side from pipeline “CGS to GA entry” near Behror.
2. Alwar forest protected area, jhakhrana block, legal status- protected : around 1.9km away on N-E side from pipeline “CGS to GA entry” near village jhakhrana khurd named as “ Jhakrana Kalan”
3. Alwar forest protected area, nibhor block, legal status- protected: around 0.1 km away on N-E side from pipeline “CGS to GA entry” after village jhakhrana Khurd.
4. Alwar forest protected area, nibhor A block, legal status- protected: around 0.5 km away on N-E side from pipeline “CGS to GA entry” near village Nibhor.

5. Alwar forest protected area, nibhor B block, legal status- protected: around 0.1 km away on W-S side from pipeline “CGS to GA entry” near village Nibhor.
6. Alwar forest protected area, golabas block, legal status- unclassed: around 0.1 km away on W-S side from pipeline “CGS to GA entry” near village Lukshiwas.
7. Alwar forest protected area, humzapur block, legal status- protected: around 0.5 km away on W-E side from pipeline “CGS to GA entry” near village Humjapur.
8. Alwar forest protected area, neemrana block, legal status- unclassed: around 0.1 km away on N-W side from pipeline “CGS to GA entry” near village Neemrana.

References :

1. ENVIS Centre on Wildlife & Protected Areas: Map of forest protected area. Haryana http://wiienvis.nic.in/Database/Maps_PAs_1267.aspx
2. Haryana forest department: Map of protected forest. Haryana http://haryanaforest.gov.in/en-us/Map
3. Rajasthan forest department: Map of Forest blocks on google earth http://forest.rajasthan.gov.in/content/raj/forest/en/forest-department/departmental-wings/forest-devlopment/districtwise-forest-blocks-google-earth.html

The Aravalli Range

The Aravalli Range is a mountain range located in northwestern India. The range has a length of 430 miles, and stretches from the northern parts of India, near Delhi, passing through Haryana, and ending in Gujarat. The range contains a series of ridges and peaks, which have widths between 6 miles and 60 miles, and elevations that vary between 1,000 ft and 3,000 ft. The details of ecologically sensitive areas near Pipeline route and in Study Area are given below in Table 3-4.

Table 3-4: Details of protected areas, forests & ecologically sensitive areas in Study Area

Ecological sensitive habitat	Description
National Parks/ Wildlife Sanctuary/ Biosphere reserves/ Elephant Reserve/ Any Other Reserve	None

Reserve Forests	7 reserve forests- 1. Forest block area : around 0.3 km away on W side from pipe line "Main Grid Line Mahendragarh GA 2. Alwar forest protected area, nibhor block, 0.1 km away on N-E side from pipeline "CGS to GA entry" after village jhakhrana Khurd. 3. Alwar forest protected area, nibhor A block, appx 0.5 km away on N-E side from pipeline "CGS to GA entry" near village Nibhor. 4. Alwar forest protected area, nibhor B block, appx 0.1 km away on W-S side from pipeline "CGS to GA entry" near village Nibhor. 5. Alwar forest protected area, golabas block, around 0.1 km away on W-S side from pipeline "CGS to GA entry" near village Lukshiwas. 6.Alwar forest protected area, humzapur block, around 0.5 km away on W-E side from pipeline "CGS to GA entry" near village Humjapur. 7.Alwar forest protected area, neemrana block,around 0.1 km away on N-W side from pipeline "CGS to GA entry" near village Neemrana.
Wildlife Corridors & Routes	None
Wetlands / Water bodies	25 Wetlands 7 Farm ponds 1 Canal crossing
Ramsar Site	None
Important Bird Habitats	None
Breeding/nesting areas of endangered species	None
Mangroves	None

3.8.2 FLORA

The study area is mainly represented by modified habitats such as agricultural lands, roads and habitations interspersed with small patches of natural vegetation. The topography of the study area is characterized by plains, hills and gently sloping lands. The terrain is generally flat to gently undulating. Most of the plain areas are utilized for agriculture purposes whereas uncultivated patches are covered mainly by open thorny scrub. The overall natural vegetation cover of study area is scanty and bushy.

Mahendragarh, Charkhi Dadri and Bhiwani districts has Tropical dry deciduous type of forest vegetation. These forests are dominated by smaller trees and shrubs and have abundance of shrubs intermixed with grasses and few other herbaceous species. The chief characteristic feature of the forests is open canopy of small (10-15 m high) trees and abundance of shrubs.

There are 74 floral species observed near Pipeline route and none of the endangered, threatened, endemic floral species were observed near Site. The list of flora is given below in **Table 3-5**.

Table 3-5: List of Flora within the Project Area

Sl. No.	Scientific Name	Family	Common Name
1	Acacia Leacophloea	Fabaceae	Raunj
2	Acacia Jacquemontii	Fabaceae	Babul
3	Acacia Nilotica Var. Indica	Fabaceae	Kikar
4	Acacia Senegal	Fabaceae	Khairi
5	Acacia Tortilis	Fabaceae	Israeli Kikar
6	Achyranthes Aspera	Asclepiadaceae	Puthkanda
7	Adhatoda Vasica	Acanthaceae	Bansa
8	Aerva Javanica	Amaranthaceae	Bui
9	Agava Americana	Asparagaceae	Keora
10	Ailanthus Excelsa	Simaroubaceae	Ulloo Neem
11	Albizia Lebbek	Fabaceae	Siris
12	Alysicarpus Monilifer	Fabaceae	--
13	Amaranthus Gracilis	Amaranthaceae	Cholai
14	Anogeissus Pendula	Combretaceae	Dhauk
15	Argemone Maxicana	Papaveraceae	Kandheli or Kanteli
16	Asphodels Tenuifolius	Xanthorrhoeaceae	Piaza
17	Azadirachta Indica	Meliaceae	Neem
18	Balanites Aegyptica	Zygophyllaceae	Hingo or Hongot
19	Bauhinia Racemosa	Fabaceae	Kachnar
20	Bombax Ceiba	Malvaceae	Semal
21	Boswellia Serrata	Burseraceae	Salai
22	Bougainvillea Spp	Nyctaginaceae	Boungainvillea
23	Butea Monosperma	Fabaceae	Dhak
24	Calotropis Procera	Asclepiadaceae	Aak
25	Cannabis Sativa	Cannabaceae	Bhang
26	Capparis Deciduas	Capparaceae	Kair or Karir
27	Carissa Horrinda	Apocynaceae	Hins
28	Carissa Spinarum	Apocynaceae	Kaaunda
29	Cassia Fistula	Fabaceae	Amaltas
30	Cassia Siamea	Fabaceae	--

31	Cassia Tora	Fabaceae	Panwar
32	Chenopodium Album	Chenopodiaceae	Bathua
33	Citrillus Colocynthus	Cucurbitaceae	--
34	Cordia Dichtoma	Boraginaceae	Lasura
35	Crotolaria Juncea	Fabaceae	--
36	Cucumis Pubescens	Cucurbitaceae	Kachri
37	Cuscuta Reflexa	Convolvulaceae	Akash Bel
38	Cyperus Rotundus	Cyperaceae	Motha
39	Dalbergia Sissoo	Fabaceae	Shisham
40	Datura Alba	Solanaceae	Dhatura
41	Delonix Regia	Fabaceae	Gulmohar
42	Dodonaea Viscose	Sapindaceae	--
43	Eucalyptus Camaldulensis	Myrtaceae	Safeda
44	Eucalyptus Hybrid	Myrtaceae	Safeda
45	Ficus Bengalesis	Moraceae	Barh
46	Ficus Glomerata	Moraceae	Gullar
47	Ficus Religiosa	Moraceae	Peepal
48	Holoptelea Intergrifolia		Pahari Papri
49	Jacaranda Mimosaefolis	Bignoniaceae	Jacarnda
50	Kigelia Pinnata	Bignoniaceae	Kigelia
51	Leucaena Leucocephala	Fabaceae	Su-Babul
52	Loranthus Spp.	Loranthaceae	--
53	Melia Azedarach	Melia azederach	Bakain
54	Mimosa Hamata	Fabaceae	--
55	Mitragyana Parvifolia	Rubiaceae	Phaldu
56	Momordica Charintia	Cucurbitaceae	Bankarela
57	Moringa Oeifera	Moringaceae	Sohanjna
58	Parkinsonia Aculeate	Fabaceae	Parkinsonia
59	Phoenix Sylvestris	Arecaceae	Khajur
60	Pongamia Glabra	Fabaceae	Papri
61	Pongamia Pinnata	Fabaceae	Papri, Karanj
62	Portulaca Oleracea	Portulacaceae	--
63	Prosopis Cineraria	Fabaceae	Jand, andi

64	Prosopis Juliflora	Fabaceae	(Mesquite)
65	Salvadora Oleides	Salvadoraceae	Jal
66	Solanum Zanthocarpum	Solanaceae	Kateli
67	Streculia Urens	Malvaceae	Gum Karaya
68	Syzygium Cumini	Myrtaceae	Jamun
69	Tamarindus Indica	Fabaceae	Imli
70	Trianthema Portulacastrum	Aizoaceae	Santa/Santi
71	Tribulus Terrestris	Zygophyllaceae	Gokhru
72	Tridax Procumbens	Asteraceae	Sadahari
73	Vallaris Heyni	Apocynaceae	--
74	Vallaris Solanacea	Apocynaceae	Dudhi

3.8.3 FAUNA

This section of the report presents the details of the higher faunal species, namely, birds, mammals, reptiles' amphibians and fishes, having recorded ranges that include the study area.

The details of the faunal species having recorded ranges that include the study area are accordingly presented under two separate sub-sections. The faunal tables that follow also give the conservation status of each species, as per the IUCN Red Data List.

Mammals

S.No	Common Name	Scientific Name	IUCN Status
1	Rhesus Macaque	Macaca mulatta	Least Concern
2	Hanuman Langur	Semnopithecus entellus	Least Concern
3	Sambar	Cervus unicolor	Vulnerable
4	Indian Muntjac	Muntiacus muntjak	Least Concern
5	Spotted Deer	Axis axis	Least Concern
6	Nilgai	Boselaphus tragocamelus	Least Concern
7	Blackbuck	Antilope cervicapra	Least Concern
8	Four-horned Antelope	Tetracerus quadricornis	Vulnerable
9	Indian gazelle	Gazella bennettii	Least Concern
10	Wild pig	Sus scrofa	Least Concern
11	Sloth Bear	Melursus ursinus	Vulnerable

12	Jackal	Canis aureus	Least Concern
13	Striped Hyena	Hyaena hyaena	Near Threatened
14	Wolf	Canis lupus	Least Concern
16	Indian Fox	Vulpes bengalensis	Least Concern
17	Red Fox	Vulpes vulpes	Least Concern
18	Common Leopard	Panthera pardus	Vulnerable
19	Caracal	Caracal caracal	Least Concern
20	Jungle Cat	Felis chaus	Least Concern
21	Leopard Cat	Prionailurus bengalensis	Least Concern
22	Fishing Cat	Prionailurus viverrinus	Vulnerable
23	Honey Badger	Mellivora capensis	Least Concern
24	Smooth-coated Otter	Lutrogale perspicillata	Vulnerable
25	Small Indian Civet	Viverricula indica	Least Concern
26	Common Palm Civet	Paradoxurus hermaphroditus	Least Concern
27	Grey Mongoose	Herpestes edwardsii	Least Concern
28	Small Indian Mongosse	Herpsestes javanicus	Least Concern
29	Ruddy Mongoose	Herpestes smithii	Least Concern
30	Indian Pangolin	Manis crassicaudata	Endangered
31	Indian Hare	Lepus nigricollis	Least Concern
32	House Shrews	Suncus murinus	Least Concern
33	Pygmy Shrew	Suncus etruscus	Least Concern
34	Indian Porcupine	Hystrix indica	Least Concern
35	Three-Striped Palm Squirrel	Funambulus palmarum	Least Concern
36	Five-Striped Palm Squirrel	Funambulus pennantii	Least Concern
37	Large Bandicoot-Rat	Bandicota indica	Least Concern
38	Lesser Bandicoot-Rat	Bandicota bengalensis	Least Concern
39	Indian Gerbil	Tatera indica	Least Concern
40	House Rat	Rattus ratus	Least Concern
41	Brown Rat	Rattus norvegicus	Least Concern
42	Soft-Furred Field Rats	Millardia meltada	Least Concern
43	Long-tailed Tree Mouse	Vandeleuria oleracea	Least Concern
44	House Mouse	Mus musculus	Least Concern
45	Little Indian Field Mouse	Mus booduga	Least Concern
46	Indian Flying Fox	Pteropus giganteus	Least Concern
47	Fulvous Fruit Bat	Rousettus leschenaulti	Least Concern
48	Short-Nosed Fruit Bat	Cynopterus sphinx	Least Concern
49	Naked-Rumped Tomb Rat	Taphozous nudiventris	Least Concern

50	Black- Bearded Tomb Rat	Taphozous melanopogon	Least Concern
51	Woolly Horseshoe Bat	Rhinolophus luctus	Least Concern
52	Fulvous Leaf-Nosed Bat	Hipposideros fulvus	Least Concern
53	Greater False Vampire	Megaderma lyra	Least Concern
54	Hodgson's Bat	Myotis formosus	Least Concern
55	Asiatic Greater Yellow House Bat	Scotophilus heathii	Least Concern

Status assigned by the International Union for Conservation of Nature and Natural Resources, where - LC – Least Concern

Sources: Vivek Menon (2003), Indian Mammals: A Field Guide. Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3

Birds

Sl. No	Common Name	Scientific Name	Migratory/Resident	IUCN status
1	Black Francolin	Francolius francolinus	Resident	Least Concern
2	Grey Francolin	Francolinus Pondicerianus	Resident	Least Concern
3	Common Quail	Coturnix coturnix	Winter Migratory	Least Concern
4	Rain Quail	Coturnix coromandelica	Resident	Least Concern
5	King Quail	Coturnix chinensis	Resident	Least Concern
6	Jungle bush Quail	Perdicula asiatica	Resident	Least Concern
7	Rock bush Quail	Perdicula argoondah	Resident	Least Concern
8	Indian Pea Fowl	Pavo cristatus	Resident	Least Concern
9	Lesser Whistling Duck	Dendrocygna javanica	Summer visitor	Least Concern
10	Grey lag Goose	Anser anser	Winter Migratory	Least Concern
11	Bar headed Goose	Anser indicus	Winter Migratory	Least Concern
12	Knob billed duck	Sarkidiornis melanotos	Resident	Least Concern
13	Common shell duck	Tadorna tadorna	Occasional	Least Concern
14	Ruddy shell duck	Tadorna ferruginea	Winter Migratory	Least Concern
15	Cotton pygmy Goose	Nettapus coromandalianus	Resident	Least Concern
16	Gadwall	Anas strepera	Winter Migratory	Least Concern

17	Eurasian Wigeon	Anas penelope	Winter Migratory	Least Concern
18	Mallard	Anas paltyrhynchos	Winter Migratory	Least Concern
19	Indian spot biled Duck	Anas poecilorhyncha	Resident	Least Concern
20	Northern Shoveler	Anas clypeta	Winter Migratory	Least Concern
21	Northern Pintail	Anas acuta	Winter Migratory	Least Concern
22	Garganey	Anas querquedula	Winter Migratory	Least Concern
23	Common Teal	Anas crecca	Winter Migratory	Least Concern
24	Red crested Poachard	Netta rufina	Winter Migratory	Least Concern
25	Tufted Duck	Aythya fuligula	Winter Migratory	Least Concern
26	Little Grebe	Tachybaptus ruficollis	Resident	Least Concern
27	Great crested Grebe	Podiceps cristatus	Winter Migratory	Least Concern
28	Painted Stork	Mycteria leucocephala	Resident	Near Threatened
29	Asian open Bill	Anastomus oscitans	Resident	Least Concern
30	Black Stork	Ciconia nigra	Resident	Least Concern
31	Painted Francolin	Francolinus pictus	Resident	Least Concern
32	Red spur Fowl	Galloparadix spadicea	Resident	Least Concern
33	Painted spur Fowl	Galloparadix lunulata	Resident	Least Concern
35	Red-naped Ibis	Pseudibis papillosa	Winter Migratory	Least Concern
36	Eurasian Spoonbill	Platalea leucorodia	Resident	Least Concern
37	Black-crowned Night Heron	Nyctocorax nyctocorax	Resident	Least Concern
38	Indian Pond Heron	Ardeola grayii	Resident	Least Concern
39	Grey Heron	Ardea cinerea	Resident	Least Concern
40	Purple Heron	Ardea purpurea	Resident	Least Concern
41	Cattle Egret	Bubulcus ibis	Resident	Least Concern
42	Great Egret	Ardea alba	Resident	Least Concern
43	Little Egret	Egretta garzetta	Resident	Least Concern
44	Darter	Anhinga melanogaster	Resident	Least Concern
45	Little Cormorant	Microcarbo niger	Resident	Least Concern
46	Great Cormorant	Phalacrocorax carbo	Passage visitor	Least Concern
47	Common Ketrel	Falco naumanni	Winter Migratory	Least Concern

48	Laggar Falcon	Falco jugger	Winter Migratory	Least Concern
49	Peregrine Falcon	Falco peregrinus	Winter Migratory	Least Concern
50	Barbary Falcon	Falco pelegrinoides	Winter Migratory	Not Assessed
51	Black-winged Kite	Elanus caeruleus	Resident	Least Concern
52	Black Kite	Milvus migrans	Resident	Least Concern
53	Osprey	Pandion haliaetus	Winter Migratory	Least Concern
54	Oriental Honey-buzzard	Pernis ptilorhynchus	Resident	Least Concern
55	Short-toed Snake Eagle	Circaetus gallicus	Resident	Least Concern
56	Crested Serpent Eagle	Spilornis cheela	Resident	Least Concern
57	Eurasian Marsh Harrier	Circus aeruginosus	Winter Migratory	Least Concern
58	Shikra	Accipiter badius	Resident	Least Concern
59	White-eyed Buzzard	Butastur teesa	Resident	Least Concern
60	Long-legged Buzzard	Buteo rufinus	Winter Migratory	Least Concern
78	Booted Eagle	Hieraaetus pennatus	Winter Migratory	Least Concern
79	Ballion's Crake	Porzana pusilla	Winter Migratory	Least Concern
80	White-breasted Waterhen	Amaurornis phoenicurus	Resident	Least Concern
81	Brown Crake	Zapornika akool	Resident	Least Concern
82	Yellow-legged Buttonquail	Turnix tanki	Summer visitor	Least Concern
83	Barred Buttonquail	Turnix suscitator	Resident	Least Concern
84	Purple Swamphen	Porphyrio porphyrio	Resident	Least Concern
85	Common Moorhen	Gallinula chloropus	Resident	Least Concern
86	Pheasant-tailed Jacana	Hydrophasianus chirurgus	Resident	Least Concern
87	Black -winged Stilt	Himantopus himantopus	Resident	Least Concern
88	Pied Avocet	Recurvirostra avosettta	Resident	Least Concern
89	Yellow-wattled Lapwing	Vanellus malabaricus	resident	Least concern
90	Red-wattled Lapwing	Vanellus indicus	resident	Least concern

91	White-tailed lapwing	Vanellus leucurus	Winter migratory	Least concern
92	Little Ringed Plover	Charadius dubius	resident	Least concern
93	Kentish Plover	Charadius placidus	Winter migratory	Least concern
94	Greater Painted-snipe	Rostratula benghalensis	resident	Least concern
95	Ruff	Philomachus pugnax	winter migratory	Least concern
96	Common Snipe	Gallinago gallinago	winter migratory	Least concern
97	Marsh Sandpiper	Tringa stagnatilis	winter migratory	Least concern
98	Common Greenshank	Tringa nebularia	winter migratory	Least concern
99	Green Sandpiper	Tringa ochropus	winter migratory	Least concern
100	Wood Sanpiper	Tringa glareola	winter migratory	Least concern
101	Common Sandpiper	Actitis hypoleucos	winter migratory	Least concern
102	Little Stint	Calidris minuta	winter migratory	Least concern
103	Temminck's Stint	Calidris temminckii	winter migratory	Least concern
104	Indian Courser	Cursorius coromandelicus	resident	Least concern
105	Small Pratincole	Glareola lactea	Summer Visitor	Least concern
106	Common Pigeon	Columba livia	resident	Least concern
107	Oriental Turtle Dove	Streptopelia orientalis	winter migratory	Least concern
108	Eurasian Collared Dove	Streptopelia decaocto	resident	Least concern
109	Red collared Dove	Streptopelia tranquebarica	resident	Least concern
110	Sptted Dove	Stigmatopelia chinensis	resident	Least concern
111	Laughing Dove	Stigmatopelia senegalensis	resident	Least concern
112	Yellow-footed Green Pigeon	Treron phoenicopterus	resident	Least concern
113	Rose-ringed Parakeet	Psittacula krameri	resident	Least concern
114	Jacobin Cuckoo	Clamator jacobinus	Summer Visitor	Least concern
115	Asian Koel	Eudynamys scolopaceus	resident	Least concern
116	Sirkeer Malkoha	Taccocua leschenaultii	resident	Least concern
117	Southern Coucal	Centropus(sinensis) parroti	resident	Not assessed

118	Barn Owl	Tyto alba	resident	Least concern
119	Spotted Owk	Athene brama	resident	Least concern
120	Eurasian Eagle Owl	Bubo bubo	resident	Least concern
121	Dusky Eagle Owl	Bubo coromandus	resident	Least concern
122	Brown Fish Owl	Ketupa zeylonensis	resident	Least concern
123	Jungle Nighjar	Caprimulgus indicus	Summer Visitor	Least concern
124	Indian Nightjar	Caprimulgus asiaticus	resident	Least concern
125	Savanna Nightjar	Caprimulgus affinis	resident	Least concern
126	Little Swift	Apus affinis	resident	Least concern
127	Common Hoopoe	Upupa epops	resident	Least concern
128	Indian Roller	Coracias benghalensis	resident	Least concern
129	White-throated Kingfisher	Halcyon smyrnensis	resident	Least concern
130	Common Kingfisher	Alcedo atthis	resident	Least concern
131	Pied Kingfisher	Ceryle rudis	resident	Least concern
132	Green Bee-eater	Merops orientalis	resident	Least concern
133	Blue-cheeked Bee-eater	Merops persicus	Summer Visitor	Least concern
134	Blue-tailed Bee-eater	Merops philippinus	Summer Visitor	Least concern
135	Indian Grey Hornbill	Ocyceros birostris	resident	Least concern
136	Brown-headed Barbet	Megalaima zeylanica	resident	Not assessed
137	Coppersmith Barbet	Megalaima haemacephala	resident	Least concern
138	Yellow-crowned Woodpecker	Dendrocopos mahrattensis	resident	Least concern
139	Lesser Goldenback	Dinopium benghalense	resident	Least concern
140	Common Woodshrike	Tephrodornis pondicerianus	resident	Least concern
141	Small Minivet	Pericrocotus cinnamomeus	resident	Least concern
142	Isabelline Shrike	Lanius isabellinus	winter migratory	Least concern

143	Bay-backed Shrike	Lanius vittatus	resident	Least concern
144	Long-tailed Shrike	Lanius schach	resident	Least concern
145	Southern Gey Shrike	Lanius meridionalis	resident	Vulnerable
146	Black Drongo	Dicrurus macrocercus	resident	Least concern
147	Indian Golden Oriole	Oriolus(oriolus) kundoo	Summer Visitor	Least concern
148	White-browled Fantail	Rhipidura aureola	resident	Least concern
149	Rufous Treepie	Dendrocitta vagabunda	resident	Least concern
150	House Crow	Corvus splendens	resident	Least concern
151	Plain Martin	Riparia paludicola	resident	Least concern
152	Dusky Craig Martin	Ptyonoprogne concolor	resident	Least concern
153	Streak-throated Swallow	Petrochelidon fluvicola	resident	Least concern
154	Wire-tailed Swallow	Hirundo smithii	resident	Least concern
155	Barn Swallow	Hirundo rustica	Winter Migratory	Least concern
156	Red-rumped Swallow	Cecropis daurica	Resident	Least concern
157	Indian Bushlark	Mirafra erythroptera	Resident	Least concern
158	Greater Short-toed Lark	Calandrella brachydactyla	Winter Migratory	Least concern
159	Ashy-crowned Sparrow Lark	Eremopterix griseus	Resident	Least concern
160	Crested Lark	Galerida cristata	Resident	Least concern
161	Oriental Skylark	Alauda gulgula	Resident	Least concern
162	White-eared Bulbul	Pycnonotus leucotis	Resident	Least concern
163	Red-vented Bulbul	Pycnonotus cafer	Resident	Least concern
164	Grey-breasted Prinia	prinia hodgsonii	Resident	Least concern
165	Graceful Prinia	Prinia gracilis	Resident	Least concern
166	Plain Prinia	Prinia inornata	Resident	Least concern
167	Rufous-fronted Prinia	Prinia buchanani	Resident	Least concern

168	Zitting Cisticola	Cisticola juncidis	Resident	Least concern
169	Common Tailorbird	Orthotomus sutorius	Resident	Least concern
170	Clamorous reed Warbler	Acrocephalus stentoreus	Winter Migratory	Least concern
171	Blyth's Reed Warbler	Acrocephalus dumetorum	passage visitor	Least concern
172	Booted Warbler	Iduna caligata	passage visitor	Least concern
173	Sykes's Warbler	Iduna rama	Winter Migratory	Least concern
174	Common Chiffchaff	Phylloscopus collybita	Winter Migratory	Least concern
175	Hume's Leaf Warbler	Phylloscopus humei	Winter Migratory	Least concern
176	Greenish Warbler	Phylloscopus trochiloides	passage visitor	Least concern
177	Green Warbler	Phylloscopus (trochiloides) nitidus	passage visitor	Least concern
178	Lesser Whitethroat	Sylvia curruca	Winter Migratory	Least concern
179	Desert Whitethroat	Sylvia (curruca) minula	Winter Migratory	Not assessed
180	Hume's Whitethroat	Sylvia althaea	passage visitor	Least concern
181	Common Babbler	Turdoides caudata	Resident	Least concern
182	Large Grey Babbler	Turdoides malcolmi	Resident	Least concern
183	Jungle Babbler	Turdoides striata	Resident	Least concern
184	Yellow-eyed Babbler	Chrysomma sinense	Resident	Least concern
185	Bank Myna	Acridotheres ginginianus	Resident	Least concern
186	Common Myna	Acridotheres tristis	Resident	Least concern
187	Asian Pied Starling	Gracupica contra	Resident	Least concern
188	Common Starling	Sturnus vulgaris	Winter Migratory	Least concern
189	Bluethroat	Luscinia svecica	Winter Migratory	Least concern
190	Oriental Magpie Robin	Copsychus saularis	Resident	Least concern
191	Indian Robin	Saxicoloides fulicatus	Resident	Least concern
192	Black Redstart	Phoenicurus ochruros	Winter Migratory	Least concern

193	Common Stonechat	Saxicola torquatus	Winter Migratory	Least concern
194	Pied Bushchat	Saxicola caprata	Resident	Least concern
195	Desert Wheatear	Oenanthe deserti	Winter Migratory	Least concern
196	Variable Wheatear	Oenanthe picata	Winter Migratory	Least concern
197	Brown Rock Chat	Cercomela fusca	Resident	Least concern
198	Red-breasted Flycatcher	Ficedula parva	Winter Migratory	Least concern
199	Grey-headed Canary Flycatcher	Culicicapa ceylonensis	Winter Migratory	Least concern
200	Purple Sunbird	Cinnyris asiaticus	Resident	Least concern
201	House Sparrow	Passer domesticus	Resident	Least concern
202	Chestnut-shouldered Petronia	Gymnoris xanthocollis	Resident	Least concern
203	Black-breasted Weaver	Ploceus banghalensis	Resident	Least concern
204	Streaked Weaver	Ploceus manyar	Resident	Least concern
205	Baya Weaver	Ploceus philippinus	Resident	Least concern
206	Indian Silverbill	Euodice malabarica	Resident	Least concern
207	Red Avadavat	Amandava amandava	Resident	Least concern
208	Scaly-breasted Munia	Lonchura punctulata	Resident	Least concern
209	Yellow-wagtail	Motacilla flava	Winter Migratory	Least concern
210	Citrine Wagtail	Motacilla citreola	Winter Migratory	Least concern
211	Grey Wagtail	Motacilla cinerea	Winter Migratory	Least concern
212	White Wagtail	Motacilla alba	Winter Migratory	Least concern
213	White-browed Wagtail	Motacilla maderaspatensis	Resident	Least concern
214	Paddyfield Pipit	Anthus rufulus	Resident	Least concern
215	Tawny Pipit	Anthus campestris	Winter Migratory	Least concern
216	Tree Pipit	Anthus trivialis	Winter Migratory	Least concern
217	Olive-backed Pipit	Anthus hodgsoni	Winter Migratory	Least concern
218	Red-headed Bunting	Emberiza bruniceps	passage visitor	Least concern

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered and EN– Endangered*
Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3.

SIDENT - Those species which were observed during all the months of the year were regarded as the resident species.

LOCAL MIGRATORY - Those species which were observed irregular from the study site but are resident of India or move within the country were considered as the local migratory species.

WINTER MIGRATORY - The species which were found only during the winter season were regarded as winter migratory.

SUMMER MIGRATORY - The species which found only during the summer season were regarded as summer migratory.

Endemic / Restricted Range Species

There are no species which are reported as being endemic to, or have restricted ranges that include, the region in which the study area is situated.

Species of conservation concern

There are numerous wetlands in the district and in the study area. Migratory birds become species for conservation concern. There are 81 winter migratory birds and 9 summer migratory birds.

Designated areas

Designated areas include nationally or internationally designated ecologically sensitive areas such as legally protected areas, namely, Protected Forests, Reserve Forests, Wildlife Sanctuaries, National Park, as also, Important Bird Areas and Ramsar Sites.

Legally Protected Areas

The nearest boundary of Khaparwas Wildlife Sanctuary is at a distance of 19 km from point M of proposed pipeline.

Important Bird Areas (IBA)

There are five IBA in Haryana. Nearest IBA, Bhindawas is 25 km from study area.

Ramsar Sites

There are no Ramsar sites in Haryana state.

3.8.4 ECOSYSTEM SERVICES

Provisioning services

The study area provides provisioning ecosystem services through the soil in which agricultural crops are cultivated by the local communities, as also, wild plants that serve the food, fodder, fuel-wood and timber needs of the local communities.

Crops

The list of major crops cultivated in the study area are:

1. Bajra
2. Rapeseed mustard
3. Wheat
4. Gram
5. Cotton

Fodder

The natural vegetation of the study area, including the plant cover of fallow lands, provides fodder to the livestock of the area. Main fodder crop is Jowar. It is grown in kharif season. Cattle are fed Bajra throughout the year due to non-availability of green fodder. During years of poor rain fall, when Bajra crop also fails, stocked Jand leaves, known as pala (*Cenchrus setigerous*)

Fuelwood and Timber

The trees and shrubs growing naturally in the study area provide fuel-wood and timber to the local communities.

Regulating services

The natural functioning of the ecosystems in the study area leads to the following processes that provide both, direct and indirect benefits to the local communities.

Ground Water Recharge

Surface Water Purification

The plants and soil organisms of the study area absorb and process a number of chemical compounds dissolved in local water-flows, effectively recycling wastes and purifying the water. The vegetation cover of the study area, especially its collective root systems, also acts as a physical filtration system, filtering out particulate matter as the water flows towards the area's ponds, lakes, streams and rivers. Thus, the study area contributes to the regulation of the water-quality of the area by purifying surface water.

Soil Erosion Control

The vegetation cover of the study area anchors soil-particles and binds them together, lowering the rate of soil erosion by water and wind. Thus, the study area contributes to control of soil erosion in the area.

Pollination and Pest Control

The vegetation cover of the study area provides habitats to a range of faunal species that include pollinator species, such as, pollen or nectar feeding insects and birds, as well as, insectivorous species, including frogs, lizards, birds and bats. By harboring such species, the study-area provides pollinator-services and pest-control services to natural, as well as, agricultural plants in the area.

Supporting services

The natural functioning of the ecosystems of the study area lead to the following processes that create or maintain basic natural resources, such as soil-nutrients and photosynthetic production, that support human life-sustaining activities, such as farming, food-gathering, cooking and grazing of livestock.

Nutrient Capture and Recycling

The food-chains constituted by the organisms of the study area are continuously involved in the capture and transfer of the macro and micro nutrients in the soil, water and air, effectively recycling nutrients and making them available in the nutrient-sinks of the local ecosystems. The biomass generated by the study-area, and transferred physically by water and wind, helps recharge the soil-fertility in the surrounding area. Thus, the natural vegetation and topography of the study-area contribute to the natural productivity of the area.

Primary Production

The photosynthetic organisms of the study-area act as primary producers, creating food-reserves that directly or indirectly support the consumers of the area, including the local communities. This primary production includes, besides a number of resources utilized directly by local communities (and covered under Provisioning Services), the grass blades and leaves consumed by grazing and browsing animals like grasshoppers, bugs, beetles, snails, goats and sheep, the flowers, pollen and flower-nectar consumed by butterflies, moths, bees and sunbirds, the seeds consumed by seed and grain-eaters like ants, sparrows, larks, pipits and mice, and the fruits consumed by birds and bats.

3.9 DEMOGRAPHY & SOCIO-ECONOMICS

A meeting with the project proponent was initially conducted to develop a common understanding of the project activities, land acquisition for tap off point and status of payment of compensation to the affected PAP, and to identify a continuous point of contact for all future correspondence.

The baseline information included aspects like demographic information, economic activities, literacy profile, land use, infrastructure resource, economic facilities, cultural heritage, life style and other value system.

The following methods were used as a benchmark to collate the baseline information:

- Stakeholders consultation meeting which included the Project Influenced and benefitted Population in Mahendragarh, Charkhi Dadri and Bhiwani;
- Consultations with along the pipeline route to understand the socio-economic status, education facilities and the literacy levels.

The delineation of Preliminary Stakeholders were based on the following points,

- The type of stakeholders, and;
- Their connection and influence levels on the project.

An open ended questionnaire was prepared for the focus group discussions prior to the start of the consultation process to obtain the information from the population. Different stakeholder groups were consulted to understand the concerns/ issues, expectations/ benefits and other advantages that they have on the project.

3.9.1 MAHENDRAGARH, CHARKHI DADRI AND BHIWANI DISTRICT PROFILE

Mahendragarh district is one of the 22 districts of Haryana state in northern India. The district occupies an area of 1,899 km². The district has a population of 922,088 (2011 census). Narnaul city is the administrative headquarters of the district. Mahendragarh is one of the very few districts in India where the name of the district and its main town are different.

Charkhi Dadri District is one of the 22 districts of Haryana state in northern India. Created on 16 November 2016, the district headquarters is the city of Charkhi Dadri. Charkhi Dadri District is situated in south of Haryana

Bhiwani district is one of the 22 districts of the northern Indian state of Haryana. This district was the largest district of the state by area, before the creation of Charkhi Dadri as a separate district, as it occupied an area of 5,140 square kilometres (1,980 sq mi) and administered 442 villages with a population of 1,634,445. Sirsa is now the largest district of the state. The district headquarters is the city of Bhiwani, which is around 124 kilometres (77 mi) from the national capital Delhi. Other major towns in the district are Siwani, Loharu, Tosham, Bawani Khera, Kohlawas, Lamba. As of 2011 it is the third most populous district of Haryana (out of 21), after Faridabad and Hisar.

3.9.2 VILLAGES FALLING UNDER STUDY AREA

There are 50 villages along the proposed pipeline route falling mainly in 3 districts-Mahendragarh, Charkhi Dadri and Bhiwani in Haryana. The main villages through which the proposed pipeline passes are given below in Table 3.11 below.

Table 3-6: List of villages falling in Pipeline Route

S.No	City/ Village		Taluka	District	State
1	51. Janaksinghpura 52. Kalipahari 53. Madhosingpura 54. Mohalariyan	55. Dooghera 56. Patel Nagar 57. Jharoda	Nimrana	Bhiwani	Harayana
2	58. Nasarpur 59. Sagli 60. Nibhor 61. Jakhrana Khurd	62. Jakhrana 63. Bhagwar Kalan 64.	Bhehror		
3	65. Anantpura		Chomu	Alwar (just a minor stretch falling in Rajasthan)	
4	66. Mandhana 67. Bhiwani Jonpal 68. Lohari Jatu 69. Bhiwani Khera	70. Nimriwali 71. Haluwas 72. Alakhpura 73. Kungar	Bhiwani	Mahendragarh	
5	74. Seka 75. Kadeepura 76. Neerpur 77. Bargaon	86. Lehroda 87. Faizabad 88. Hudina 89. Gulawal 90. Kuksi	Narnaul		

	78. Jamalpur ka Johar 79. Narnaul 80. Nasibpur 81. Sainipura 82. Mohalla Kathikan 83. Buchakpur 84. Lutapur 85. NuniAwal	91. Nangal Sirohi 92. Janjariwas 93. Jonawas 94. Paiga 95. Rewasa 96. Marja Khurd			
6	97. Charkhi 98. Sarabha Nagar	99. Paintawas Kalan 100. Kitlana	Charkhi dadri	Charkhi dadri	

3.9.3 DEMOGRAPHIC DETAILS

According to the 2011 Census, the total population of Mahendragarh in 2011 was 922,088 of which male and female were 486,665 and 435,423 respectively. In 2001 census, Mahendragarh had a population of 812,521 of which males were 423,578 and remaining 388,943 were females. Mahendragarh District population constituted 3.64 percent of total Maharashtra population. In 2001 census, this figure for Mahendragarh District was at 3.84 percent of Maharashtra population.

With regards to Sex Ratio in Mahendragarh, it stood at 895 per 1000 male compared to 2001 census figure of 918. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio is 775 girls per 1000 boys compared to figure of 817 girls per 1000 boys of 2001 census data.

Table 3-7: Demographic Profile of Mahendragarh District

Description	2011
Population	9.22 Lakhs
Actual Population	922,088
Male	486,665
Female	435,423
Population Growth	13.48%
Density/km2	486
Proportion to Haryana Population	3.64%
Sex Ratio (Per 1000)	895
Child Sex Ratio (0-6 Age)	775
Average Literacy	77.72
Male Literacy	89.72
Female Literacy	64.57
Total Child Population (0-6 Age)	111,181
Male Population (0-6 Age)	62,638
Female Population (0-6 Age)	48,543
Literates	630,255

Male Literates	380,440
Female Literates	249,815
Child Proportion (0-6 Age)	12.06%
Boys Proportion (0-6 Age)	12.87%
Girls Proportion (0-6 Age)	11.15%

The population of Bhiwani in 2011 is 196,057; of which male and female are 104,026 and 92,031 respectively.

Table 3-8: Demographic Profile of Bhiwani District

Bhiwani City	Total	Male	Female
City Population	**196,057**	104,026	92,031
Literates	**143,446**	81,431	62,015
Children (0-6)	**23,422**	12,937	10,485
Average Literacy (%)	**83.09 %**	89.40 %	76.05 %
Sexratio	**885**		
Child Sex ratio	**810**		

Charkhi Dadri is a Municipal Committee city in district of Bhiwani, Haryana. The Charkhi Dadri city is divided into 19 wards for which elections are held every 5 years. The Charkhi Dadri Municipal Committee has population of 56,337 of which 29,953 are males while 26,384 are females as per report released by Census India 2011.

Population of Children with age of 0-6 is 6765 which is 12.01 % of total population of Charkhi Dadri (MC). In Charkhi Dadri Municipal Committee, Female Sex Ratio is of 881 against state average of 879. Moreover Child Sex Ratio in Charkhi Dadri is around 800 compared to Haryana state average of 834. Literacy rate of Charkhi Dadri city is 83.67 % higher than state average of 75.55 %. In Charkhi Dadri, Male literacy is around 90.33 % while female literacy rate is 76.20 %.

Religion wise Demography details

The religion-wise demography profile indicates that maximum population belongs to Hindus (99.04%) followed by Muslims (0.61%) in Mahendragarh district. The details of religion-wise demography status of Mahendragarh district are given below in **Table 3-9**.

Table 3-9: Religion-wise demographic Profile of Mahendragarh District as per Census data, 2011

Description	Total	Percentage
Hindu	913,251	99.04 %
Muslims	5,660	0.61 %
Christian	301	0.03 %

Sikh	1,737	0.19 %
Buddhist	75	0.01 %
Jain	644	0.07 %
Others	15	0.00 %
Not Stated	405	0.04 %

Hinduism is majority religion in Bhiwani city with 98.16 % followers. Islam is second most popular religion in city of Bhiwani with approximately 0.38 % following it. In Bhiwani city, Christinity is followed by 0.13 %, Jainism by 0.24 %, Sikhism by 0.23 % and Buddhism by 0.23 %. Around 0.00 % stated 'Other Religion', approximately 0.85 % stated 'No Particular Religion'.

Table 3-10: Religion-wise demographic Profile of Bhiwani District as per Census data, 2011

Description	Total	Percentage
Hindu	192,442	98.16 %
Not Stated	1,657	0.85 %
Muslims	751	0.38 %
Jain	463	0.24 %
Sikh	443	0.23 %
Christian	263	0.13 %
Buddhist	36	0.02 %
Others	2	0.00 %

The religion-wise demography profile indicates that maximum population belongs to Hindus (98.31%) followed by Muslims (0.64%) in Charkhi Dadri district

Table 3-11: Religion-wise demographic Profile of Charkhi Dadri District as per Census data, 2011

	Population	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Others	Not Stated
Charkhi Dadri	56,337	98.31%	0.64%	0.07%	0.10%	0.02%	0.55%	0.01%	0.31%

4 ANTICIPATED ENVIRONEMENTAL IMPACTS & MITIGATION MEASURES

This section of the report provides an assessment of the potential impacts on different identified environmental components, which are likely to occur during the laying of pipeline and supply of Petroleum products through the pipeline. However, by adopting appropriate management measures, the majority of the assessed impacts can be mitigated.

The major potential impacts associated with the proposed project are impact on soil, impact on water resources and area drainage, air quality degradation, noise impacts, impact on ecological environment, impact on agriculture, land use changes, impact on health and safety, impact on socio-economic features, impact on community activities, impact on cultural heritage and impact on aesthetics. These impacts can occur at any one of the three stages i.e. planning or design stage, the construction stage and the operation stage.

The identified impacts due to the proposed project can be mitigated through the incorporation of appropriate measures at different stages of the project. This will ensure the best design with minimal damage to or loss of significant or sensitive features such as roadside vegetation, local water resources, etc.

4.1 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

The environmental impacts associated with the proposed project on various environmental components such as air, water, noise, soil, flora, fauna, land, socioeconomic, etc. has been identified using Impact Identification Matrix.

Table 4-1: Impact Identification matrix for the proposed pipeline route and the CNG stations

	Physical				Biological		Socio-Economic		
	Ambient Air Quality	Ground/Surface Water (Quantity/Quality)	Ambient Noise	Land (Land use, Topography, drainage, soil)	Flora	Fauna	Livelihood and Occupation	Infrastructure	Health & Safety
Augmentation of Facilities									
Construction Phase									

Civil and mechanical works	●	●	●	●	●	●	●	●	
Movement of vehicles	●		●			●		●	●
Hydro testing									●
Waste generation, handling and disposal				●					●
Operation Phase									
Operation of pumps and compressors	●	●	●						
Storage of Gas/ Crude	●								
Cleaning & maintenance		●		●					
Movement of vehicles	●		●			●			
Waste generation, handling and disposal		●		●				●	●
Leakage from pipeline	●	●							
Laying of New Pipeline									
Construction Phase									
Preparation of Right of way	●		●	●		●	●	●	●
Pipe laying	●			●					●
Chemical use/handling		●		●					
Movement of vehicles	●		●			●		●	●
Hydro testing		●							●
Waste generation, handling and disposal				●					●
Operation Phase									
Operation of compressors	●		●						
Cleaning & maintenance		●		●					
Waste generation, handling and disposal			●						●
Movement of vehicles	●					●		●	
CNG Stations									
Construction Phase									
Civil and mechanical works	●		●	●	●		●		●
Movement of vehicles	●	●	●			●			●
Waste generation, handling and disposal		●		●	●			●	●
Operation Phase									

Leakage due to corrosion, equipment failure, accidents, human error and as a result of third party interference	●	●							

4.2 IMPACT AND MITIGATION MEASURES- CONSTRUCTION PHASE

4.2.1 AIR ENVIRONMENT

The air quality along the project stretch may get affected during the construction period. Particulate matter will be the predominant pollutant affecting the air quality during the construction phase. As the construction activities are likely to generate dust. Mostly the additional automobile traffic and construction machineries involved during construction activities will generate petroleum pollutants. However, this will not lead to any tangible effect, as the additional traffic volume related to construction activities will be low.

a. Impacts

Potential emissions sources during construction phase include the following:

- Deterioration of air quality due to fugitive dust emissions from construction activities (especially during dry season) like excavation, back-filling and dumping of earth materials, from construction spoils, vehicular movements along unpaved roads, loading / unloading and transportation of construction materials
- Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO2, NOX, and particulate matter
- Operation of equipment and machinery for earth-moving, grading, pipeline laying and civil works at pipeline ROW and other sites
- Operation of temporary Diesel Generator (DG) sets, emission of PM, CO, NOx, & SOx

b. Mitigation Measures

During construction phase of the proposed project appropriate mitigative measures have to be implemented to ameliorate the anticipated air quality problems. The following mitigative measures will be employed during construction period to reduce the pollution level to acceptable limits

- Proper and prior planning, appropriate sequencing and scheduling of all major construction activities have to be done, and timely availability of infrastructure supports needed for construction to be ensured to shorten the construction period vis-à-vis reduce pollution.

- Construction materials to be stored in covered godowns or enclosed spaces to prevent the windblown fugitive emissions.
- Stringent construction material handling / overhauling procedures to be followed.
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads, at vulnerable areas of construction sites to be undertaken to control fugitive dust during material handling and hauling activities particularly near habitations especially in dry seasons.
- The construction material delivering vehicles to be covered in order to reduce spills.
- Low emission construction equipment, vehicles and generator sets to be used
- It has to be ensured that all construction equipment and vehicles are in good working conditions, properly tuned and maintained to keep emission within the permissible limits and engines tuned off when not in use to reduce pollution
- Vehicles and machineries to be regularly maintained so that emissions confirm to standards of Central Pollution Control Board (CPCB)
- Monitoring of air quality at regular intervals to be conducted during construction phase
- Construction workers to be provided with masks to protect them from inhaling dust.

4.2.2 NOISE ENVIRONMENT

During construction phase, noise will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (hot mixer, dozer, tipper, loader, excavator, grader, scrapper, roller, concrete mixer, generator, pump, vibrator, crane, compressor, HDD etc.). During construction the noise generating range will be approximately between 55-70 dB(A). The main sources of noise during construction period are:

- Movement of vehicles during the construction period for procurement of construction material.
- During site preparation, surface preparation, pipeline laying etc.

Noise generated from sources mentioned above will be mostly during daytime. Moreover, villages / settlements being near to the route, significant impact on local people is apprehended (as a few congested human habitations are along the site), as the noise generated will be a problem. However, the workers are likely to be exposed to high noise levels that may affect them.

a. Impacts

- Increase in noise level due to construction activities like operation of construction equipment and vehicular traffic
- Operation of construction machinery will lead to rise in noise level to the range between 80-100 dB(A). The magnitude of impact from noise will depend upon types of equipment used, construction methods and also on work scheduling.

- Since there is a mix of residential, commercial and industrial area in the vicinity of the project, noise have to be kept in check.
- The impacts will be significant on construction workers, working close to the machinery.

b. Mitigation Measures

- Construction camp and temporary labour sheds will be located away from the immediate vicinity of construction sites and major road traffic.
- Protective gears such as earplugs, etc. will be provided to construction personnel exposed to high noise levels as preventive measures.
- It will be ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines tuned off when not in use to reduce noise.
- Construction activities carried out near residential locations will be scheduled to the daytime (i.e. from 10.00 a.m. to 6.00 p.m.) only so as to have minimum disturbance to the residents.
- Whenever possible static noisy machinery will be placed on vibration isolators or temporary sheeting will be provided to check noise propagation.
- Ensuring equipment is maintained to manufacturers standards and that noise baffles are fitted.
- Reducing exposure times for people working near noisy machinery;
- Noise level will be monitored at regular intervals during construction phase, which will help in taking appropriate action to maintain it within the prescribed limit

4.2.3 WATER ENVIRONMENT

Small quantity of water will be used during construction process and hydro testing of the pipeline. Wastewater from construction activities would mostly contain suspended impurities. Other pollutants, which may find their way to it, will be insignificant concentrations and may not cause significant impact on the receiving water bodies. The deterioration of water quality during construction phase is expected due to wastewater disposal from the workers camp and sludge generated from construction sites. If adequate arrangements are not made to ensure proper drainage of wastewater from construction sites, such waters may form stagnant pools and aggravate soil erosion. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.

a. Impacts

- Increase of sediment / silt load in the runoff from construction sites / earth moving activities and increase in turbidity in receiving stream / water bodies.
- Erosion of soil into the water bodies due to removal of vegetation.

- Contamination by fuel and lubricants by spills from machineries.
- Contamination of water bodies due to improper sanitation and disposal of wastes at the construction Camps.
- Contamination of water bodies due to water from Hydrotesting of the pipeline.
- Impact on ground water quality due to leachates from the solid waste dumpsites.

b. Mitigation measures

- Quality of construction wastewater emanating from the construction site to be controlled through suitable drainage system with sediment traps (silting basin as water intercepting ditch) for arresting the silt / sediment load before its disposal into the main natural drainage system around the site.
- The trench shall be excavated only so far in advance of pipe laying that it do not causes increased soil erosion and silting of water bodies.
- The discharge of the trench de-watering pumps shall be conveyed either to drainage channel or to natural drains after passing through a catch pit for settling the silt.
- The trench shall be excavated to the exact gradient specified so that no making of the sub-grade by back filling is required and the concrete bed, where required, may be prepared with greatest ease giving a uniform and continuous bearing and support for the pipe.
- All the construction and preparatory activities to be carried out during dry seasons only.
- Construction materials to be stacked together by fencing it with brick or earth in order to prevent spillage into the water bodies, also these materials to be stacked away from the water bodies.
- Proper sanitation facilities to be provided at the construction site to prevent health related problems due to water contamination.
- Waste disposal and sanitation to workers in the construction camp to be properly maintained or taken care off in order to check their entry into the water bodies like ponds, streams etc.
- Vehicle maintenance and refueling to be confined to areas near construction camps designed to trap discarded lubricants and fuel spills from entering into the water bodies;
- Drinking water supply for the workers in the construction camps to meet the Indian National Standards. In order to assess the portability of the supplied water to the construction labour camps water quality to be periodically monitored.
- Garbage to be collected in tanks and disposed off daily in order to check the solid wastes entering into the ponds, streams etc

4.2.4 LAND & SOIL ENVIRONMENT

The construction activities such as earth moving may lead to reduction in vegetal cover on ground thus leading to soil erosion. During the construction period the movement of heavy vehicles will result in compaction of soil by making it hard and impermeable. The erosion at construction stretches will result in increased sediment load in recipient streams. Any leakage of lubricants in equipment yard will cause soil contamination. Solid waste disposal along roadside also adds to impact on the land environment during the construction. During construction activity for laying of pipeline cutting of existing land will be done and the dug material generated will be replaced back after laying of the pipes.

a. Impacts

- Loss of topsoil from excavation areas.
- Loosening of topsoil and loss of vegetative cover (land clearing) along the route and construction areas due to excavation and back filling which lead to enhance soil erosion.
- Compaction of alluvial soils by earth moving equipment.
- Solid waste disposal along the route also adds to impact on the land environment during the construction phase.

b. Mitigation measures

- During excavation, care will be taken to see that the topsoil and the subsoil are stored separately. Topsoil (50cm) of route pits will be conserved and restored after excavation is over and will be replaced back for filling of the pit areas. Whereas the top soil (25cm) stripped from agricultural field and forest area will be stacked separately as top soil dump of not more than 1m in height and the same will be redistributed to the pit after laying of pipeline. During refilling, care will be taken to see that the topsoil is replaced back at the top while refilling after laying of pipeline. This will help grasses growing earlier on the surface, to grow back. Also, the less fertile soil of lower horizon will not be placed on the top thus avoiding degradation of land.
- Back filling shall be carried out immediately after the pipeline has been laid in the trench. On no account the topsoil from ROW shall be used for this purpose. The backfill material shall not contain any extraneous material and/or hard lumps of the soil. After the initial backfill has been placed into the trench to a level slightly above the surrounding ground, the backfill material shall be compacted.
- When the trench has been dug through driveways or roads all backfills shall be executed with sand or a suitable material and shall be thoroughly compacted
- Trench excavated in dykes which are the property of the railways or which is part of main road shall be graded and backfilled in their original profile and condition

- Also necessary contour bunding, gully plugging and staggered trenching shall be carried out wherever required in the pipeline corridor and in areas where excavated soil will be dumped to check soil erosion
- Stone pitching will be provided at the slopes near the irrigation and natural drainage / rivers to prevent silting of soil into these water bodies.

4.2.5 ECOLOGICAL ENVIRONMENT

The initial construction work at the pipeline route involves land clearance, but it would not include clearing of trees. However, the pipeline runs along/ in the protected forest area as well as the ecologically sensitive region.

All the construction work will be carried out in the premises of the pipeline boundary and the CNG station boundary only. Development of Green belt all around the stations will be started along with the construction activities to contain the dust and noise due to construction activities within the boundary. Therefore, no impact on the ecological environment is proposed due to the construction activity of the project.

a. Impacts

- The proposed pipeline passes through notified protected forest land, but no vegetation clearance will be undertaken as part of the pipeline route laying activity.
- The proposed project may not cause any impacts on fauna and wildlife of the study area during construction phase.
- No wildlife corridor and migratory routes comes in the pipeline route. Construction activity during monsoon and post monsoon period may not cause any impact on the movement of wildlife.

b. Mitigation measures

- No vegetation clearance will be undertaken in the pipeline route as well as the CNG stations plot boundary
- While planning / selection of route care to be taken to route the pipeline alignment in such a way to avoid areas with trees and shrubs and thus no major impact of loss of vegetation is anticipated.

4.2.6 SOCIO-ECONOMIC ENVIRONMENT

The project will provide either direct or indirect job opportunities to the local population as far as possible. There will be some migration of skilled labor force from outside the project area during construction phase, which may put some pressure on the local settlements and resources. Considering the size and type of construction activities envisaged the immigration of work force for construction phase (including contractor' labours) would have marginal impact on demography (e.g. changes in total population, sex ratio, literacy level, main workers etc.) of the immediate vicinity area.

In addition, Traffic volume might will increase on nearby roads and the project roads due to movement of heavy vehicles during the construction phase, which may cause public inconvenience. This will have minimal affect considering the size and nature of the Project.

a. Impacts

- Strain on civic amenities (like road, transport, communication, water supply and sanitation, health care and recreational utilities etc.) due to increase in floating population.
- Increase in traffic volume and congestion in the areas and roads.
- Increase in employment opportunity to non-workers in the project area as nonskilled and semi-skilled workers.

b. Mitigation Measures

- It is difficult to assess the above impacts quantitatively on a measurable scale. However, most of these impacts will be short term and limited to the construction period only.
- Development of traffic management plan to ease the situation.
- Transport of construction materials and machineries shall be carried out during lean traffic period of the day or during night.

4.3 IMPACTS & MITIGATION MEASURES- OPERATION PHASE

The impact during the operation phase will be continuous in nature. For a gas-based pipeline and CNG station the potentials for imparting adverse impacts is not high. However whatever impact on environment is present will be minimized through incorporation of efficient technologies for pollution control measures.

4.3.1 AIR ENVIRONMENT

a. Impacts

- The pipeline will be 1.2-2 m below the ground and thus no air pollution due to operation of the project is anticipated.
- Some vehicular emission from maintenance is anticipated during maintenance phase, which will be temporary
- The impacts of the operational CNG station would not have any impacts on Air pollution of the area. The increased frequency of the vehicles at the station would not lead to any increased air pollution.

b. Mitigation Measures

Not Required

4.3.2 NOISE ENVIRONMENT

a. Impacts

- The pipeline will be 1.2 m below the ground and thus no noise pollution due to operation of the project is anticipated
- The residents / staff may be exposed to high noise levels during maintenance phase, which will be temporary.
- Noise and vibration during operations will be gas engine, various major and large compressors, air compressor, ventilation fans and miscellaneous equipment's for the CNG stations

b. Mitigation Measures

- In the stations, a closely spaced green belt to be planted all around the premises to attenuate noise
- Machinery to be maintained and lubricated as per manufacturers' guidelines to reduce noise generation.
- Personnel deployed in compressor stations will be issued personal noise protection equipment (ear plugs, ear muffs)
- If necessary, their duty hours will be regulated to keep noise exposure levels within standards.
- All equipment in the station would be designed / operated to have a noise level not exceeding 85dB, as per the requirement of Operational and Safety and Health Administration Standard (OSHA).
- Adopting modern design and the use of sound-absorbing materials will minimize noise and vibration from the station.

4.3.3 WATER ENVIRONMENT

a. Impacts

- The material/product to be transported is compressed gas, so during the operation period, the expected impacts on the water resources are not anticipated.
- The aquatic biological environment in the vicinity of the proposed project pipeline will not be affected, as no discharge is proposed form the CNG stations. Hence, there will be no impact on aquatic ecosystem due to operation of the project.

b. Mitigation Measures

- The discharge from the toilets from the stations will be routed to through the sewage pipelines to the nearest treatment plant, No open discharge will be done.

4.3.4 ENVIRONMENT, HEALTH AND SAFETY

c. Impacts

- There could be impacts on environment, health and safety due to leakage from pipelines from likely external physical forces, e.g. seismicity, floods, landslides, permafrost, vegetation;
- . **Mitigation Measures**
  - Leak Detection and Control System shall be in place
  - SCADA monitoring shall be carried out by AGL
  - Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan of AGL

Prevent leaks by

- Installing positive pipe corrosion control measures, for example, coatings, cathodic protection, chemical additives, heaters;
- Ensuring that the SCADA is well maintained and used correctly to control flow and pressure.
- Detect leaks by installing leak detection equipment, e.g. monitoring the flow in the pipe through pressure sensors connected to alarms and automatic pump shutdown systems;
- Continuous metering to provide a comparison between input and output for leak detection;

- **Emergency response**

- Introduce accident, fire and explosion precautions and emergency response procedures;
- These should be tested and drills should occur regularly with appropriate reporting on response times etc.;
- Introduce environment, health and safety training for all employees and contractors;
- Plan the route of the pipeline to reduce the impact on the surrounding area;
- Bury pipelines along the entire length to a minimum of 1m to the top wherever possible;
- Schedule periodic inspection and maintenance to avoid disturbance/disruption of sensitive habitats;
- Good housekeeping should be maintained at all times in all areas of the site;
- Prevent unauthorised or unintentional intrusion to protected areas through fencing or flagging;

5 ADDITIONAL STUDIES

5.1 QUANTITATIVE RISK ASSESSMENT

Quantitative Risk Assessment (QRA) study should be undertaken for the proposed 8"& 4" diameter underground pipeline for the transfer of compressed natural gas. The aim of QRA study will be to identify potential hazards, assess the consequences and frequency of hazards and evaluate the risk to personnel, property and public. To assess the relative level of risk posed by the proposed project, a comparison will be made with risk criteria that is considered tolerable (ALARP) for similar operations

The overall approach and methodology employed for the study will be based on the guidelines given in IS 15656 : 2006, Indian Standard – Hazard Identification and Risk Analysis – Code of Practice, May 2006, using PHAST Software/Correlations.

The pipeline system will be provided with state of the art safety systems like protection system, SCADA, leak detection system / pipeline application software, Fire and gas detection systems, etc. The proposed transfer of gas will be examined for inherent hazards or the potential to result in an unplanned event or sequence of events at different sections along the pipeline route. Several hazards that can cause failure of pipelines will be identified. These included loss of integrity/ damage due to interference from third parties, corrosion, accidents, human error, sabotage, etc., during normal operation. Analysis of past accidents are to be used to establish the credibility of accident scenarios.

5.2 GUIDELINES FOR EMERGENCY RESPONSE PLAN

Emergency response plan will be developed with the resources available within the company. The important stages of the response plan are declaration of an emergency, identification of resources & manpower, ending of an emergency and rehearsal of the plan. Declaration of an emergency would involve recognizing a leak and reporting to Station in charge of nearest compressor station.
Other features are summarized below:
Emergency Response Structure: An emergency response structure will be developed for effective response to the emergency. The structure defines the main functions of the decision makers and the individual roles as well.

Roles & Responsibilities of Team: Emergency response team (ERT) to respond to fire, accidents and technical emergencies will be constituted from operations personnel, who can be

called upon 24 hours a day, supported by senior management field personnel as and when required. The ERT will receive specific training for their roles and exercised on a regular basis. The proposed functions of employees that are planned to be deployed will be finalized prior to commissioning.

Operations Control: The pipeline operation will be monitored and controlled through Local control system and POC in command which will have the provision for emergency shut down or isolation of Pipeline. Security: Surveillance of the entire pipeline will be held periodically through ground patrolling. Using operators with knowledge of local area will be deployed for ground patrolling of the pipeline route.

Medical and First Aid: All arrangements will be made available at SHPPL site offices and camps for medical and first-aid. First–Aid facility will be provided at compressor stations, master pipeline operation center/ local control center, MLVs and M&Rs. Adequate first-aid training will be provided to employees at these locations.

Communication: Responsibility for external and internal communication will be assigned at each station. Dedicated fiber optic cable based communication system will be provided for quick communication between the control stations, dispatch and delivery station(s) of the pipeline. The backup system will consist of appropriate combination of fixed telephone lines/data-bandwidth of the local service provider, mobile phones, VHF sets etc.

Emergency control room: A safe location will be designated as emergency control room (ECR) within the compressor stations.

Emergency Procedures: SHPPL will evolve easy-to-follow procedures for responding to the identified situation. The plan will be rehearsed once in three months.

Ending of an emergency: After controlling an emergency, the site ERT Leader will declare as “All Clear”. The siren will be sounded for 2 minutes to indicate that the Emergency is over.

The basic elements for an effective plan have been included in the development. Prior to the commissioning of the project, copies of the plan are to be given to the authorities.

5.3 STAKEHOLDER CONSULTATIONS

Stakeholder Consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate.

Consultations were done at all districts of the projects, along the pipeline route. These meeting included the Project Influenced and benefitted Population in Mahendragarh, and Bhiwani. This was undertaken to understand the socio-economic status, education facilities and the literacy levels of the population as well as their interest in the upcoming project in their area.
The delineation of Preliminary Stakeholders were based on the following points,

- The type of stakeholders, and;
- Their connection and influence levels on the project.

An open ended questionnaire was prepared for the focus group discussions prior to the start of the consultation process to obtain the information from the population. Different stakeholder groups were consulted to understand the concerns/ issues, expectations/ benefits and other advantages that they have on the project.

Discussions with Local Inhabitants in Mahendragarh

Name of the location : Mahaveer Chowk Date : 02/12/2019
District : Mahendragarh

Participants:

S.No.	Name	Occupation	Land ownership/Local Inhabitants in vicinity of Project Site
1	Kanwar Singh	Farmer/ Business	--
2	Hemant Singh	Farmer/Shop Owner	--
3	Ram Vilas	Salaried Employee	--
4	Dharampal	Farmer/ Business	--

Discussions with Local Inhabitants in Bhiwani

Name of the location : Kungar Date : 03/12/2019
District : Bhiwani

Participants :

S.No.	Name	Occupation	Land ownership/Local Inhabitants in vicinity of Project Site
1	Jagwinder	Farmer/ Business	--
2	Nabe Singh	Farmer/Shop Owner	--
3	Rajbir	Salaried Employee	--
4	Rampal	Farmer/ Business	--
5	Azaad	Salaried Employee	--
6	Ava Singh	Farmer/ Business	--
7	Dharamveer	Farmer/Shop Owner	--
8	Ajay		--

Summary of Responses received from locals residing in area

Questions	Summary of responses received from affected parties
What is the present mode of cooking (Fuelwood/ LPG/Kerosene Stove)	LPG Cylinder
Is there any piped gas supply in the vicinity?	No
Any apprehensions/concerns/odour/safety issues w.r.t. present project in the area	Yes, about fire and explosion safety. Suggests that a demo to be given to the village about the safety aspects of gas pipeline
Are people contended with fuel switchover from present mode to Piped Gas Supply?	Yes, very much willing. Had heard of the project and are eagerly waiting as it will help in business and residential proliferation.
Are the people contended with the present upcoming project in the area?	No
Have any of the locals objected so far/raised Grievance related to similar projects/proposed project?	No
What is the general perception about CGD projects?	Very positive

Other projects nearby or any other industry	--

Summary of Responses received from land sellers (near to Tap Off Station in case of Pvt. Land Parcel)

Questions	Summary of responses received from affected parties
What is the Land Use of the project site?	Non irrigated farmland. Exact land is not yet decided.
Has any land from local villages been acquired for the project?	--
Are the land disbursers contended with the remuneration received?	--
Have any of the landowners who sold their land for the project gone landless?	--
What is the general perception about CGD Projects?	Positive
Other projects nearby or any other industry	The CGD project is coming in the major towns of the district. Bhiwani has industries however the pipeline route is not falling near Industrial Area. There are no other gas distribution project in the districts.

Source: TUVSUD Primary Survey

Figure 5-1: Photographs taken during the stakeholder consultations in Bhiwani

6 ANALYSIS OF ALTERNATIVES

Route selection is a process of identifying constraints, avoiding undesirable areas and maintaining the economic feasibility of the pipeline. Diversion of pipeline around obstacles can be very costly. The ideal route, of course, would be a straight line from the origin to the terminal point. However, physiographic, environmental, design and construction constraints usually alter the route

The pipeline route should be optimized based on the following considerations:

- Safety of public lives and property and safety of the pipeline from engineering and other considerations.
- Shortest pipeline length.
- Easy and favorable terrain condition free of large water bodies, low lying marshy lands, obstacles like ravines, depressions and unstable grounds, meandering rivers, etc.
- Ground profile for pipeline hydraulics and avoidance of steep rising and falling ground, hills and valleys having sloping right of way.
- Availability of infrastructure and access to the pipeline route during construction and maintenance.
- Environmental impact and avoidance of environmentally sensitive lands, such as reserved forests, marine parks, built-up areas, places of worship, burial and public events.
- Minimum crossing of existing pipelines, transmission lines, parallel alignment, etc.
- Minimum road, rail, river and canal crossings.
- Avoidance of rugged and intricate grounds with hard strata, exposed rocks, boulders and quarries.
- Existing and future developments in the region, such as roads, rail lines, canal network, reservoirs, townships, industrial units, etc.
- Scope for future expansion of the pipeline.

The Petroleum and Natural Gas Regulatory Board (PNGRB) was constituted under The Petroleum and Natural Gas Regulatory Board Act, 2006 (NO. 19 OF 2006) notified via Gazette Notification dated 31st March, 2006. The Act provide for the establishment of Petroleum and Natural Gas Regulatory Board to protect the interests of consumers and entities engaged in specified activities relating to petroleum, petroleum products and natural gas and to promote competitive markets and for matters connected therewith or incidental thereto.

Further as enshrined in the act, the board has also been mandated to regulate the refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil and natural gas so as and to ensure

uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country. Hence the project was acquired through the bidding process and the area, number of customers, total CNG stations were already mentioned in it. So the route selection was done within the allotted area.

The options for applying and analysis for alternatives was not a feasible option, as the deadlines have been already mentioned and the work was supposed to start from the date of signing the document. Since all the requirements in the projects were predefined, scope for alternate analysis was quite slim, as to which the route passes through mix and heavily populated area, eco-sensitive zones and the notified protected forest zones.

7 PROJECT BENEFITS

7.1 CONTRIBUTION TO NATIONAL ENERGY SECURITY

Energy is the key input for economic growth and Indian Energy sector play a vital role in country's Economy. Energy is a key input to the production processes that transform inputs to goods and services. India became the third largest energy consumer in the world after United States and China. Key drivers for increasing energy demand in India are population growth, industrialization and urbanization. Energy security and sustainability are interdependent because emissions from energy consumption contributes to climate change in greater extend globally. Indian government is also committed to increase the share of natural gas in country's energy mix up to 15% by 2030 and Ministry of Petroleum and Natural Gas intervening with policy reforms in natural gas sector. India requires a sustained supply of energy to support its ambitious growth and welfare targets for the coming years. In a survey by NITI Aayog, it was noted that India's energy consumption will reach 2,300 million tonnes of oil equivalent (mtoe) by 2047 out of which natural gas will contribute 173 mtoe under the determined effect scenario.

According to the International Energy Agency(IEA), Indian gas market is considered one of the most growing energy markets in the world, the Agency expected that Indian gas demand will increase in the coming decades at 5.4% per annum over 2007-30 (IEA ,2009) reaching 132 BCM by 2030. India had about 43.8 TCF of proved natural gas reserves by the end of 2012; production of natural gas arrived in 2011, 2012 to 47.559 BCM, India was self-sufficient in natural gas until 2004, where it began to import liquefied natural gas from Qatar to meet the growing needs where India occupied the sixth rank globally in the import of natural gas. In spite of the Indian increase production of gas in 2010, an increase of up to more than 44%, but India and because of the high economic growth has increased the import at an annual rate of 10 % from 2001-2011. In 2011, India consumed 2.3 trillion cubic feet (TCF) which is equivalent to a quarter of the Indian natural gas needs. Qatar is India's main supplier of liquefied natural gas, where the parties signed long-term contracts to supply India around 7.5 million tons of LNG every year from Qatar for 25 years and the first shipments has reached to India in 2004.

With the growing need for oil and gas in India since the nineties of the last century, the Indian government has worked to develop the oil and gas sector through the development of mechanisms of action and the issuance of new regulatory laws, 1993, private investors have been allowed to import and market liquefied petroleum gas (LPG) and kerosene freely, private investment is also allowed in lubricants, which are not subject to price controls. In the 11th Five Year Plan, the Indian government has focused in particular on the energy sector in order to self-

reliance for energy resources, particularly oil and gas by encouraging of exploration and extraction operations and reduce dependence on overseas. The government also worked on the development of oil and gas infrastructure such as pipelines, refinery, ports, and railways. India currently has 22 refineries with a capacity (215.066 MMTPA),17 refineries under public sector and 3 under private sector. The Indian government is also working to improve of the oil and gas pipelines, and in spite of networks of gas and oil pipelines are still weak but the government is seeking to develop it, in collaboration with private sector companies.

7.2 REDUCED RISKS & COSTS

Natural gas pipeline has been regarded as the most cost effective and safest channel of gas transportation and has extraordinary strategic significance for the country. Pipeline is regarded as the most cost effective and safest channel to transport the oil and gas from upstream oil field or port to the downstream users or refineries. The gas is significantly replaced by oil in all sectors i.e. power generation, domestic and transportation due to price hike in oil prices globally and cheaper availability of natural gas. During the last five years the oil import has reduced by 8 %. The other reason for that may be the availability of cheaper, safe and durable mode of gas transportation system (main and distribution network of pipeline), which is continuously expending.

The gas pipeline projects helps in reducing the travel cost in comparison to other resources and it is also very safe and cheaper for domestic, commercial and industrial uses. The proposed pipeline project would be very feasible and cost effective as it is totally underground and there will be continuous access to the gas for the use.

7.3 SOCIO- ECONOMIC DEVELOPMENT

The proposed project will create socio-economic development across the pipeline route and in the near vicinity as well. The project will provide employment during construction and operation phase to the local labours. Further, it also helps in the development across the project area by providing the CNG stations along the roads and gas pipeline supplies to the households and commercial establishments. The proposed project will provide 60 CNG stations throughout the project route due to which the local community can easily access the cheapest way for their transportation.

8 ENVIRONMENTAL MANAGEMENT & MONITORING PROGRAM

8.1 INTRODUCTION

The Environmental Management Plan (EMP) provides an essential link between predicted impacts and mitigation measures during implementation and operational activities. EMP outlines the mitigation, monitoring and institutional measures to be taken during project implementation and operation to avoid or mitigate adverse environmental impacts, and the actions needed to implement these measures. The likely impacts on various components of environment due to the project during developmental activities have been identified and measures for their mitigation are suggested. The EMP lists all the requirements to ensure effective mitigation of every potential biophysical and socio-economic impact identified in the EIA. For each attribute, or operation, which could otherwise give rise to impact, the following information is presented:

- A comprehensive listing of the mitigation measures
- Parameters that will be monitored to ensure effective implementation of the action.
- Timing for implementation of the action to ensure that the objectives of mitigation are fully met

The EMP comprises a series of components covering direct mitigation and environmental monitoring, an outline waste management plan and a project site restoration plan. Therefore, environmental management plan has been prepared for each of the above developmental activities.

8.2 ENVIRONMENT MANAGEMENT PLAN

Table 8-1: Environment Management Plan

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
Air Pollution	Dust generation	• Access limited to demarcated ROW and specified access roads. · Strict enforcement of project speed limits ·	• Review and approval of the contractors Transport management plan, Pollution Prevention Management Plan, detailed construction method statements and Reinstatement Plan	AGL	• Pre-construction
		• Reinstatement as early as practical ·	• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
		• Damping down of ROW ·	• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
		• Identification of areas of particularly sensitive receptors (e.g., villages or crops)	• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction

	Metal Vapour Emissions	Ensure adequate ventilation and dispersion of vapours Ensure welding is undertaken by appropriately trained personnel	• Review and approval of the contractors Employment and Training Management Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
	Combustion gases (CO2, CO, NO2, NO, SO2, PM, CH4, VOCs)	• Maintenance of all vehicles and plant to meet relevant international standards and manufacturer's recommendations· • Monitoring of vehicle and plant emissions · • Optimization of plant running time (where appropriate)	• Review and approval of the contractors Transport management plan, Pollution Prevention Management Plan, Construction Camp Management Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period

			• Spot checks on the contractor's performance • Routine review of discharge monitoring data	AGL	• Throughout Construction Period
	Vehicle movements	• Selection of appropriate routes for vehicles using public road network and project access roads · • Provision of environmental training for vehicle drivers and equipment operators · • Control of operational speeds and operating times · • Maintenance of vehicles and plant	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan and Employment and Training Management Plan	AGL	• Pre-construction
			• Routine monitoring, documentation and review of traffic management and training processes	Contractor	• Throughout Construction Period
			• Collection and review of incident and near miss data	Contractor	• Throughout Construction Period
			• Spot checks on procurement and waste management processes Routine review of incident and near miss reports	AGL	• Throughout Construction Period
Noise Pollution	Noise emissions	• Control of vehicle and plant noise generation ·	• Review and approval of the contractors Transport management plan,	AGL	• Pre-construction

		• Control of operating hours · • Appropriate selection and maintenance of plant, vehicles and access routes · • Appropriate selection of construction techniques · • Community liaison • Ensure environmental considerations are incorporated into the siting and design of camps · • Implement workforce education with respect to minimising disruptive activities. • Incorporate into the project induction training· • Implementation of camp rules including restrictions on noisy activities	Construction Camp Management Plan, Pollution Prevention Management Plan, Infrastructure and Services Management Plan, Community Liaison Management Plan, Procurement and Supply Management Plan and detailed construction method statements.		
			• Routine monitoring, documentation and review of application of mitigation measures	Contractors	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-monitoring
Water Pollution	Disposal of liquid wastes/water (Hydro test	• Risk assessment to be undertaken before any chemical additives are used in hydro test water	• Review and approval of the contractors Pollution Prevention Management Plan, Procurement and Supply	AGL	• Pre-construction

	Specific Measures)	• Controlled discharge of water to reduce soil erosion Testing and treatment of water before discharge • Responsible disposal of waste water; no disposal of incompatible water in areas of groundwater or surface water vulnerability	Management Plan, Waste Management Plan, Infrastructure and Services Management Plan and detailed construction method statements		
			• Routine monitoring, documentation and review of application of mitigation measures	Contractors	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
	Abstraction of Ground Water	• Sampling and analysis of water from existing boreholes · • Adherence to national and local licensing policy for abstractions · • Test-pumping of new abstractions and monitoring of impacts on existing abstractions · • Monitoring of water levels in wetlands	• Review and approval of the contractors Pollution Prevention Management Plan, Infrastructure and Services Management Plan, Community Liaison Management Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractors	• Throughout Construction Period

		• Ensure appropriate consolidation of backfill · • Implementation of erosion control measures • Ensure that groundwater disposal is undertaken in accordance with the Construction Environmental Management Plan· • Filter discharge if contains visible suspended solids · • Use of appropriate measures to minimise scour at the discharge point	• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
	Disruption of drainage / irrigation channels	• Undertake pre-construction surveys of irrigation and drainage systems as necessary to identify existing systems and devise temporary replacement measures if required, · • Undertake liaison with land owners/land occupiers/land users ·	• Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period

		• Include provisions for drainage/irrigation management	• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
	Increased flood risk	• Ensure that gaps are left in topsoil stacks to allow floodwater through · • Ensure the continued viability of pre-existing drainage and irrigation systems throughout the project	• Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction

	Disposal of trench-water	• Ensure that trench-water disposal is undertaken in an appropriate manner	• Review and approval of the contractors Pollution Prevention Management Plan, Waste Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
	Sediment release	• Avoid open cut river crossings during monsoon season· • Include environmental considerations in the selection of crossing design and choice of methodology	• Review and approval of the contractors Pollution Prevention Management Plan, Emergency Response Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period

	Modified river flow		• Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
Land & Soil	Use of raw materials & natural resources	• Development and implementation of procurement, supply and waste management procedures	• Review and approval of the contractors Procurement and Supply Management Plan and Waste Management Plan	AGL	• Pre-construction
			• Routine monitoring, documentation and review of procurement and waste management processes	Contractor	• Throughout Construction Period

			• Spot checks on procurement and waste management processes	AGL	• Throughout Construction Period
	Railway Crossing	• Mitigation measures to be formulated in conjunction with local railway department	• Review and approval of the contractors Transport management plan, Infrastructure and Services Management Plan, Community Liaison Management Plan, Community Safety Management Plan and Procurement and Supply Management Plan	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Throughout Construction Period
	Potential for accidental spillage of	• Development and implementation of specific	• Review and approval of the contractors Pollution Prevention Management Plan,	AGL	• Pre-construction

	hazardous materials (e.g. lubrication fluids, oils, paints, diesel etc.).	procedures for hazardous materials management • Minimisation of acquisition and storage of hazardous materials Training of personnel in safe use & handling of hazardous materials • Provision of appropriate spill response equipment and spill response training Rapid response in event of spillage	Employment and Training Management Plan, Transport Management Plan, Procurement and Supply Management Plan, Waste Management Plan, Emergency Response plan, and construction method statements		
			• Recording and regular review of incidents and near misses	Contractor	• Throughout Construction Period
			• Routine monitoring, documentation and review of training, procurement, storage and waste management processes	Contractor	• Throughout Construction Period
			• Spot checks on contractor performance and record keeping Routine review of incident and near miss data.	AGL	• Throughout Construction Period
	Disturbance of land surface & vegetation	• Vehicle movements confined to defined access routes • Provision of environmental training to drivers and plant operators	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan, Community Liaison Management Plan and	Contractor	• Throughout Construction Period

		• Community liaison to discourage local use of ROW as road Common access routes to be used for pipeline were practical Traffic movements to be preceded by an assessment of ground conditions	Community Safety Management Plan		
			• Routine monitoring, documentation and review of traffic management and community liaison processes	Contractor	• Throughout Construction Period
			• Spot checks on traffic management, training and community liaison processes. • Routine review of access route condition and adherence to defined access routes.	AGL	• Throughout Construction Period
	Soil compaction	• Protection of soil storage areas from vehicle movements · • Protection of soil surface in areas of soft ground · • Provision of appropriate drainage and regular regrading	• Review and approval of the contractor's management plans, detailed construction method statements and Reinstatement Plan	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development	AGL	• Pre-construction

			of mitigation actions for sensitive sites		
	Soil erosion	• Implementation of erosion control measures · • Compaction of soil stack surface to minimize erosion · • Preparation & implementation of approved crossing methods	• Review and approval of the contractors Pollution Prevention Management Plan, Reinstatement Plan and detailed construction method statements (with specific attention to those concerning river crossings)	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
	Loss of soil structure and fertility	• Ensure appropriate segregation, storage, management and reinstatement of stripped soil	• Review and approval of the contractor's management plans, detailed construction method statements and Reinstatement Plan	AGL	• Pre-construction

			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
	Loss of viability of soil seed bank	• Undertake an environmental review of the route to identify areas where preconstruction seed collection, harvesting of seeds from surrounding areas and/or the establishment of nursery crops should be carried out · • Ensure appropriate segregation, storage, management and reinstatement of topsoil	• Review and approval of the contractor's management plans, detailed construction method statements and Reinstatement Plan	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
	Modified topography	• Ensure that reinstatement is sympathetic to existing contours	• Review and approval of the contractors Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction

			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
	Disposal of surplus subsoil	• Ensure that the generation of surplus soil is minimised and that disposal is conducted appropriately ·	• Review and approval of the contractors Waste Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
		• Ensure that any potential subsoil disposal sites and disposal plans are subject to an environmental review prior to their adoption	• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary additional assessments and development of appropriate mitigation actions	AGL	• Pre-construction
	Disturbance of known/unknown	• Avoid construction in areas of known or suspected	• Review and approval of the contractors Pollution Prevention Management Plan,	AGL	• Pre-construction

	contaminated land	contamination as far as is practical · • Ensure that where contaminated land is encountered it is effectively managed	Waste Management Plan, Reinstatement Plan and detailed construction method statements		
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary additional assessments and development of appropriate mitigation actions	AGL	• Pre-construction
	Potential for drilling fluid breakout/spillage (During HDD)	• Adequate geotechnical survey work conducted during design · • Risk assessment to be undertaken before drilling in vicinity of sensitive surface waters · • Storage of drilling muds in bunded area ·	• Review and approval of the contractors Pollution Prevention Management Plan, Emergency Response Plan, Waste Management Plan and detailed construction method statements	AGL	• Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period

		• Avoid use of toxic chemicals in drilling fluid	• Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
Ecology	Loss of habitat	Development and implementation of: · • Environmental management plans· • Construction method statements (including clearance) • Transport Management (including route selection) • Reinstatement Plan Additional ecological surveys and translocation programmes	Review and approval of the contractor's management plans, detailed construction method statements and reinstatement plan	AGL	• Pre-construction
			Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout Construction Period
			Spot checks on the contractor's performance	AGL	• Throughout Construction Period
			Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	AGL	• Pre-construction
			Routine monitoring of species translocation programmes	AGL	Pre-construction and during

					construction in sensitive areas
	Impeded movement of wild animals, and domestic herds	• Ensure that gaps are left in soil stacks at strategic locations · • Leave gaps in welded strings at critical locations to allow passage of domestic herds · • Minimise interval between welding and ditching	Review and approval of the contractors Community Liaison Management Plan, Infrastructure and Services Management Plan, detailed construction method statements and Reinstatement Plan	AGL	• Pre-construction
			Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout construction period
			Spot checks on the contractor's performance	AGL	• Throughout construction period
	Public & animal safety	• Erection of warning barriers where significant risk to public and livestock exists · • Installation of soft plugs in ditch with sloped edges to allow animal egress	Review and approval of the contractors Community Safety Management Plan, Infrastructure and Services Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction
			Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout construction period
			Spot checks on the contractor's performance	AGL	• Throughout construction period

Social	Vehicle Movements	• Selection of appropriate routes for vehicles using public road network and project access roads · • Provision of environmental training for vehicle drivers and equipment operators · • Control of operational speeds and operating times · • Maintenance of vehicles and plant	Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan and Employment and Training Management Plan	AGL	• Pre-construction
			Routine monitoring, documentation and review of traffic management and training processes	Contractor	• Throughout construction period
			Collection and review of incident and near miss data	Contractor	• Throughout construction period
			Spot checks on procurement and waste management processes Routine review of incident and near miss reports	AGL	• Throughout construction period
	Partial road closure	• Use non-open trench crossing techniques for major roads · • Minimise duration of closure of roads and provide temporary access where necessary · • Use steel plates across trench to maintain access ·	Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan, Community Safety Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	AGL	• Pre-construction

		• Institute temporary traffic control, where necessary · • Undertake community consultation	Routine monitoring, documentation and review of application of mitigation measures	Contractor	• Throughout construction period
			Spot checks on the contractor's performance	AGL	• Throughout construction period
	Loss of boundaries	• Reinstatement of boundaries following construction · • Ensure consultation with landowners, occupiers and users	Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan and Reinstatement Plan	Contractor	• Throughout construction period
			Routine monitoring, documentation and review of traffic management and community liaison processes	Contractor	• Throughout construction period
			• Spot checks on community liaison processes. • Routine review of access route condition and adherence to defined access routes.	AGL	• Throughout construction period
	Grievance Redressal Mechanism	Community Grievance Process	Spot follow up of complaints recorded in complaints register to assess whether process has been carried out correctly.	AGL	• Monthly during Construction period

		Implementation of general construction mitigation measures	Spot checks at ROW, construction sites and affected communities to ensure mitigation measures are being implemented. This will look specifically at: · • Implementation of measures to avoid disruption to infrastructural services such as telecoms, electricity, gas and water. · • Implementation of community safety measures (fencing near residential areas, fencing on public trench crossings, warning lights and warning signs at open areas of trench). • Suitable diversions are in place where necessary · • Dust and noise mitigation measures are in place · • Alternative water sources are provided as appropriate	AGL	Monthly for first 3 months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bimonthly with review of written activity reports submitted on a weekly basis.
Health and Safety		Community Safety	• Spot monitoring of health and safety incidence rates for community members and full review of any serious incidents.	AGL	Monthly Two to three times in first four months and if training is seen as acceptable,

			• Spot monitoring of community traffic safety meetings		revert to once every six months. If training is not of sufficient quality, then continue at two to three every four months.
		General Safety Measures during	Spot monitoring of implementation of safety measures during construction as outlined in 'Implementation of general construction mitigation measures', General Construction Impacts section above.	AGL	Monthly for first three months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bimonthly with review of written activity reports submitted on a weekly basis
		Health and safety training	Monitor HR records to ensure training is provided to all workers and spot monitor all courses (general health and safety, safe driving training, job specific health and safety) provided to ensure training is adequate	AGL	

8.3 MONITORING SCHEDULE

The objectives of monitoring are:

- To check effectiveness of mitigation measures
- To evaluate the adequacy of Environmental Impact Assessment
- To assess status of compliance to legal requirements
- To assess if the Environmental Management Plan needs revisions/ updating.

The proposed environmental monitoring program during both construction and operation phases of the project are given in Table below:

Table 8-2: Environment Monitoring program- Construction & Operation Phase

S. No	Component	Location	Parameters	Frequency
Construction Phase				
1	Stack emission characteristics	Stacks attached to emission sources (e.g. DG sets)	Stack monitoring for PM, SOx, NOx and HC	Once in a month
2	Ambient air quality	Nearest Residential Areas, and busy commercial locations	Ambient air quality parameters as per NAAQS viz. PM10, PM2.5,SOx, NOx, CO	Once in a month
3	Ground water quality (used as source of domestic water)	Point used for drinking water	Parameters listed in ISO:10500	Once in a month
4	Effluent quality	Discharge header of hydrotested pipeline/ tank	According to general discharge standards	As per requirement
5	Waste (including hazardous)	Construction sites and camps	Quantity/ volume generated and disposed	Once in a day
6	Equipment noise levels	1 m from DG set	dB(A)	Once in a month
7	Ambient noise levels	Nearest residential areas/ Silent zones etc	Ambient noise levels (Leqday & Leqnight)	Once in a month
Operation Phase				
8	Greenbelt development		Plant density, health, growth and survival rate	Once in 6 months
9	Waste (including hazardous)	At CNG stations	Quantity/ volume generated and	Once in a month

			disposed at new CNG facilities	
10	Effluent quality	At CNG stations	Monitoring of treated water from outlets of ETP & STP	Once in 6 months

9 SUMMARY & CONCLUSIONS

9.1 SUMMARY OF IMPACTS

Among the pipeline lifecycle stages of construction and operations, due to temporary nature of the pipeline laying/construction, most impacts are likely to be short term and reversible in nature. The impacts that shall be most significant and of primary concern are summarized in the subsequent sections.

9.2 IMPACT DUE TO PIPELINE ROUTE SELECTION

The proposed pipeline route has been so selected such that there are:

- Shortest length of the pipeline between source and destination points
- Avoidance of sensitive areas such as national parks, sanctuaries and wildlife corridors
- Minimum impact to reserve forests and other sensitive areas
- Minimum number of water crossings
- Minimum impact to the environment
- Avoidance of populated areas/ industrial area
- Easy access to the route during construction, operation and maintenance of the pipeline.

9.3 IMPACTS DURING CONSTRUCTION OF PIPELINE

- Earth work excavation, embankment formation, transport of construction materials, handling, laying and jointing of pipelines - These activities would cause a general increase in levels of dust and suspended particulate matter in the ambient air. However, this increase in concentration would be of temporary nature and localized.
- Movement of vehicles for transportation of construction material – These activities would cause a marginal increase in the levels of oxides of nitrogen, carbon monoxide and hydrocarbons.
- Impact from sediments being washed into the water bodies while the pipeline is laid across them. The pipeline will not be laid in rainy season, which will avoid adverse impacts on water body.
- Drinking water for base camps will be made available through local supply system. The domestic sewage from the construction camps will be either disposed off into the local sewage system and if required, will be treated in soak-pits and septic tanks.
- Water consumption during hydro-testing of pipeline - Efficient use of water will be made to reuse test water in different test sections. Water will be tapped from different sources along the pipeline route, without unduly disturbing its normal users.

- At major crossings, Horizontal Directional Drilling (HDD) method will be deployed so there will be no disturbance to the natural water flow or cause any pollution to the water body. Hence there will not be any obstruction/damage to fishing, recreational and navigation activities. The pipeline will be laid at a minimum depth of 2.5 meter below the bed level of water crossings.
- The pipeline will be buried all along its length hence impact on landuse pattern will be marginal and reversible.
- Some quantity of earth excavated for pipeline laying will become surplus after installation of the pipeline and may be required for disposal.
- However, as this excess of earth will be taken to low lying area for filling purpose, the aesthetics of the pipeline RoU and soil quality will not be affected.
- Noise Generation - The major human settlements are along the pipeline route where the noise levels due to construction activities are estimated to be around 70-90 dB(A). Such onetime exposure is not expected to last for more than few weeks and shall not exceed the stipulated standards. The pipeline laying work would be done in night only as there is lots of traffic in day time and creates disturbance to the locals.
- Selection of the pipeline route has been done in such a way that eco-sensitive areas which may be affected during the construction of the pipeline are minimised.

9.4 IMPACTS DURING OPEARTION OF PIPELINE

- No impact on Aravalli Hills area is envisaged during operation
- No air emissions will be generated during the operation phase.
- The compressing station enroute will be kept in a built-in-area that will reduce the noise level to minimum. The incremental noise level in the nearest village due to the proposed operations will be minimal.
- There will be no significant impact on ecological environment during the operational phase of the project.
- The probability of leakage will be significantly reduced by adoption of appropriate safety measures and SCADA system.
- The probability of leak from a pipeline is remote. Pipeline will be buried minimum 1.5 m in the cross-country section and 2.5 meter below the bed level at major crossings.

9.5 MITIGATION AND ENVIRONMENTAL MANAGEMENT PLAN

General

The mitigation measures to reduce environmental impacts, described in this EIA, can be divided into the following categories:

- Those which can be regarded as good working practice.
- Project decisions taken by AGL with environmental protection in mind.
- Such measures are designed to avoid, eliminate or reduce potential impacts that may occur to the environment in the course of the proposed activities.

Post Monitoring Program

The implementation of mitigation measures during construction and operation phases will be monitored. The monitoring plan would provide for periodic revision, if necessary in light of the baseline status to indicate progress in project implementation and changing environmental conditions so as to provide a basis for evaluation of project impacts. The post monitoring program would include the following:

- Approved means of leak detection would be employed as per the provisions of Schedule I -E of PNGRB Regulations, 2008 and as per ASME B 31.8, Appendix - M.
- Regular and adequate patrolling of pipeline particularly at crossing locations and settlements.
- Monitoring of pressure, coating conditions and cathodic protection

9.6 CONCLUSIONS

There will be a beneficial effect from pipeline project that will directly and indirectly boost the living standards of the people, save foreign exchange and with increase in industrial activities, create more jobs in the local economy. Thus, it can be concluded on a positive note that after the implementation of the mitigation measures and EMP, the proposed activities of AGL will have negligible impact on environment and will improve economy of the nation.

Annexures

Annexure 1: AGL QHSE Policy

adani
Gas

QUALITY, HEALTH, SAFETY & ENVIRONMENT POLICY

We, at **ADANI GAS LIMITED (AGL)** engaged in providing energy solution to the nation with efficient, environment friendly, safe & cost effective fuel.

"Safety first in everything we do at AGL" is an integral part of AGL culture

AGL firmly believes that all types of injuries, illness & incidents are preventable.

We at AGL are committed to ensure continuity of natural gas supply & reliability of services to the customers and also committed to demonstrate continual improvement in our Quality, Occupational Health, Safety & Environmental (QHSE) management performance by:

- Assessing needs & expectations of Interested Parties and satisfying them with continual improvement effort;
- Continual Improvement by reviewing and monitoring Organizational Context & Strategic Direction by use of process approach and risk based thinking;
- Adopt and implement the best available technology and systems from design to the delivery of gas to customers and also the work practices to reduce the QHSE risks as low as reasonably practicable and minimize the impact on environment; public and assets
- Integrate QHSE aspects in all our business processes;
- Pro-actively comply with all applicable legislation & other requirements; Establish, review and strengthen our QHSE Management Systems and CGD network integrity in an ongoing and auditable manner;
- Institutionalize practices for pollution prevention, waste avoidance an prevention of injury & ill health;
- Enhancing the competencies and commitment of employees through suitable training programs, involvement and motivation

We shall make this policy available to all our stakeholders.

Date: 05-11-2018

Suresh P Manglani
Chief Executive Officer

Annexure 2: EHS Organogram of AGL

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Adani Gas Limited

EMERGENCY RESPONSE & DISASTER MANAGEMENT PLAN (ERDMP)

Doc. No. :HSE-102
Rev No : 01
Eff. Date: 01.03.15

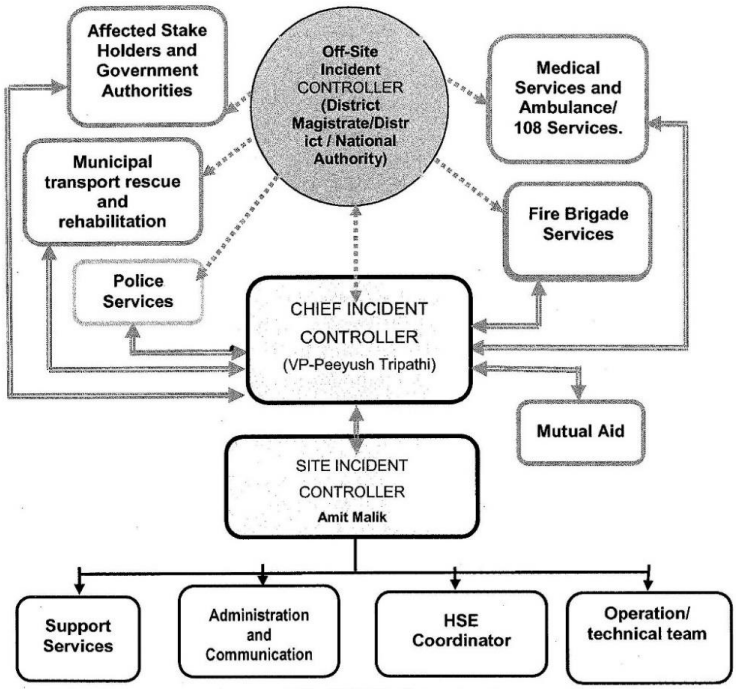

Chart-01-AGL: ERDMP- Organogram

Level – I
Level II
Level III

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Annexure 3: Mock Drill Format of AGL

adani Adani Gas Limited	EMERGENCY RESPONSE & DISASTER MANAGEMENT PLAN (ERDMP)	Doc. No. :HSE-102 Rev No : 00 Eff. Date: 01/03/15

adani Adani Gas Ltd.	EMERGENCY PREPAREDNESS MOCK DRILL RECORD

Mock Drill Date & Time : Mock Drill No. :

Sr. No.	Item Description	Standard Time	Time Start	Time End	Total Time Taken
1	Emergency Hooter / Operation of manual call points Started at [Time]	0 sec			
2	Evacuation started to Assembly Point at [Time]	60 sec			
3	Last person arrived at Assembly point at	Within 60 sec			
4	Activation of emergency control center	30 sec			
5	Information of incident to Emergency Team	10 sec			
6	Information to all key members at Perticular Location	45 sec			
7	Safe shut down activities in the plant	45 sec			
8	Fire Mitigation started by Security/members at [Time]	55 sec			
9	Fire Mitigation completed at [Time]	Within 55 sec			
10	Emergency vehicle arrival at entrance	Actual			
11	Head count started at [Time]				
12	Head count completed at [Time]				
13	Total Head Count				
14	Nearest Fire station distance from the site.				
15	Nearest hospital distance from the site				
16	Hooter for returning back to work started at				
17	Last person returned to work at				

Observations on overall preparedness effectiveness :

Area of Improvement of the Mock-drill exercise:

Action Planned to mitigate the draw backs:

Target Date	Person Responsible	Action Taken	Review By	Remarks [if any]

Report Prepared by: Report Reviewed by:

Annexure 4: Geographical Area and project detail