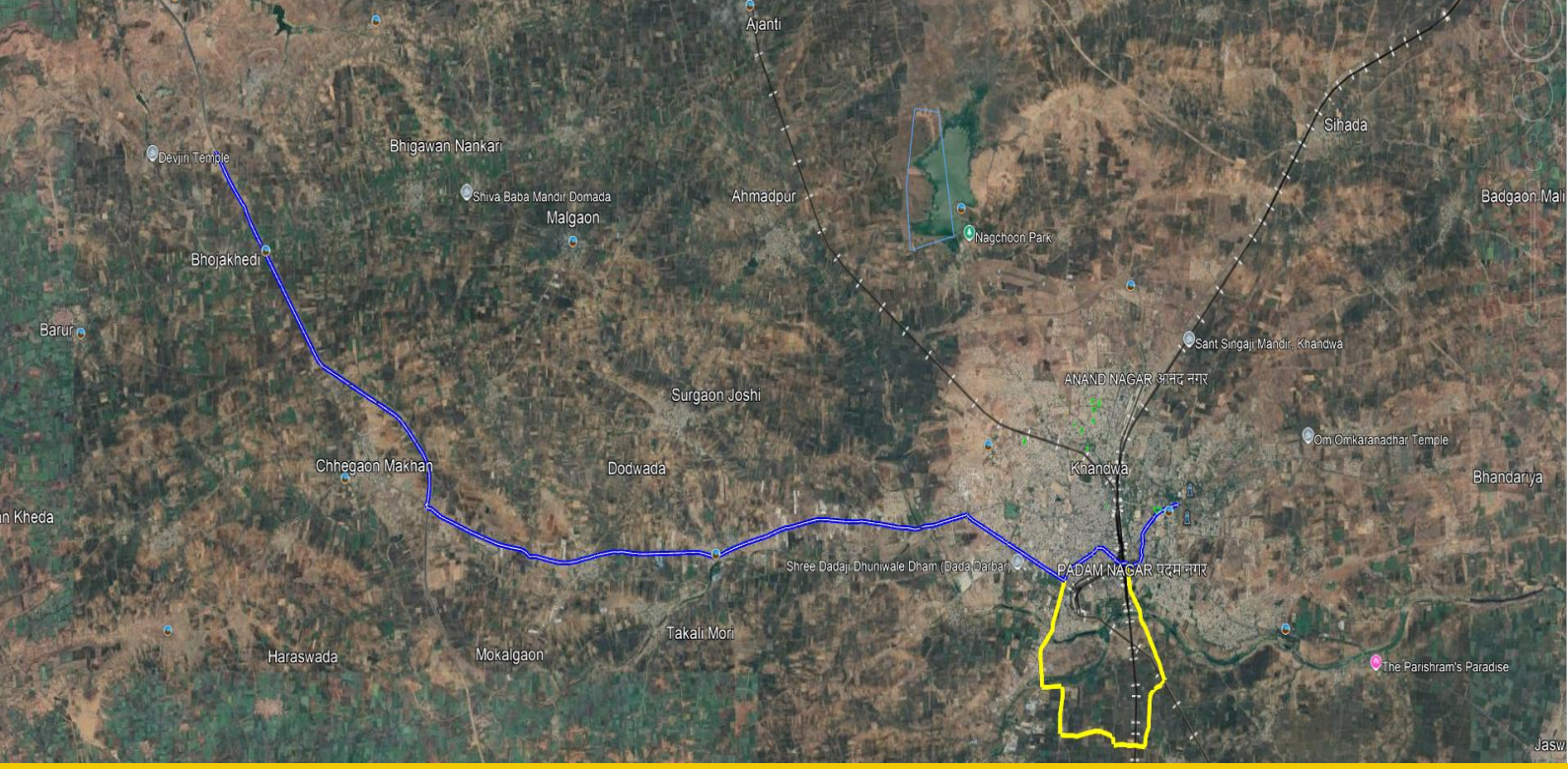

FINAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY FOR CGD NATURAL GAS PIPELINE FOR GA 11.23 IN KHANDWA, DISTRICT- KHANDWA, MADHYA PRADESH

SUBMITTED TO
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adani Gas

Add value.
Inspire trust.

SUBMITTED BY
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JULY 2025

REPORT NO.: 2025/ET-006496/AD/NA/NA/64187

Name of the Project	Natural Gas Pipeline for GA 11.23 in Khandwa, District- Khandwa, Madhya Pradesh
Assignment	Environmental and Social Impact Assessment (ESIA) Study for Natural Gas Pipeline for GA 11.23 in Khandwa and surrounding villages, District- Khandwa, Madhya Pradesh
Enquiry Number	ET-006496
Project Code	4153816077
Assignment to be submitted	ADANI TOTAL GAS LIMITED
Assignment/ report prepared by	TÜV SÜD SOUTH ASIA PRIVATE LIMITED

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Disclaimer:

*This report has been prepared for the use of **Adani Total Gas Limited** (hereinafter referred as **"ATGL"**) in the context of the project mentioned above. We expressly disclaim any responsibility of whatsoever nature or legal liability with respect to any third parties, other than **ATGL**, in relation to the contents of the present report. This report shall not be relied upon for any purpose other than the project above mentioned or relied on any parties other than **ATGL**. The contents of this report are strictly confidential and subject to legal property and privilege. Neither this report nor any of its content may be disclosed to any third parties other than **ATGL** or their officers and employees who are directly involved in the project, nor may it be referred or quoted to, or filed with, any other person or body without our express written consent. This report is strictly limited to the matters set forth herein and is not to be interpreted or construed as extended by implication to any other matter. We have strictly limited our report to those matters relevant to the environmental and social issues as reflected in the documents that were provided to us. In completing this report, we have relied upon what follows:*

-that the information supplied to us for the purpose of preparing this report was (when supplied) and continues to be true, accurate and not misleading in any respect.

-that there are no other materials or other facts of which we have not been informed in relation to such matters.

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ABBREVIATIONS

ATGL	Adani Total Gas Limited
AoI	Area of Influence
ASME	American Society of Mechanical Engineers
BCM	Billion Cubic Meters
CBM	Coal Bed Methane
CGD	City Gas Distribution
CGS	City Gate Station
CGWA	Central Ground Water Authority
CNG	Compressed Natural Gas
COP-26	26th UN Climate Change Conference of the Parties
CPCB	Central Pollution Control Board
DRS	District Regulatory Station
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESIA	Environmental and Social Impact Assessment
G.S. R	Gazette of India, Statutory Rules and Orders
GA	Geographical Area
GA	Geographical Area
GI	Galvanized Iron
GIS	Geographic Information System
H.T. Line	High Tension Line
HDD	Horizontal Directional Drilling
IFC	International Finance Corporation
ISO	International Organization for Standardization
JV	Joint Venture
MoEF&CC	Ministry of Environment, Forests and Climate Change
MSS	Manufacturers Standardization Society
MUT	Mechanized Ultrasonic Testing
NG	Natural Gas
NH	National Highway
NOCs	National Oil Companies
OISD	Oil Industry Safety Directorate
PCV	Pressure Control Valve
PESO	Petroleum & Explosive Safety Organization
PNGRB	Petroleum & Natural Gas Regulatory Board
RoU	Right of Use
RoW	Right of Way
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SOP	Standard operating Procedure
SDG	Sustainable Development Goal
SH	State Highway

UN	United Nations

NON-TECHNICAL SUMMARY

INTRODUCTION

Adani Total Gas Limited (hereinafter referred as **ATGL**) is in the process of developing City Gas Distribution (CGD) networks to deliver Piped Natural Gas (PNG) to industrial, commercial, and residential sectors, as well as Compressed Natural Gas (CNG) to the transportation sector. Natural gas is a reliable, convenient, and environmentally friendly fuel that provides consumers with enhanced safety, convenience, and economic efficiency.

The company has already set up city gas distribution networks in various locations in India. During the 11th round of CGD bidding, Adani Total Gas Limited successfully bid for multiple Geographical Areas (GA) in Chhattisgarh, Madhya Pradesh, Maharashtra, Jharkhand and Odisha the list of all the 11 GAs. To cater industrial, commercial and transportation demand of natural gas **ATGL** has planned to develop a total of "**28.74 Km Natural Gas Pipeline Infrastructure in Khandwa district and surrounding areas in Madhya Pradesh**". The pipeline has been planned to be laid on a single route from Bhojakhedi Village to Naredi Petrol Pump (HP) in Khandwa district.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA STUDY) & SCREENING

TÜV SÜD South Asia Private Limited (hereinafter referred as **"TÜV SÜD"**) has been entrusted by **ATGL** for providing consultancy services of Environmental and Social Impact Assessment Study (ESIA) for City Gas Distribution Project at Khandwa District, Madhya Pradesh, India. The objective of the study is to assess potential Social and Ecological, Environmental Impacts from the project on the environment and social setting and address mitigation measures for the identified impacts. Environmental and Social management Plan (ESMP) has been designed in line with the impact identified and mitigation measures suggested in this report. In accordance with the screening criteria of IFC, and in accordance the observations of site reconnaissance survey, **TÜV SÜD** ESIA team has categorized Project as **Category C**, since the proposed line route does not pass through any forest or eco-sensitive zone.

AREA OF INFLUENCE (AOI) FOR ESIA STUDY

ESIA study to evaluate environment and social risks and impacts associated with the Project.

The overall area covered by the assessment includes the following constituent areas:

- The footprint of the project, hereafter referred to as the 'Project Site'.
- The area extending 500 m (either side) outward from the project site boundary (estimated to contain the potential receptors of any project related environment, social and ecological impacts), hereafter referred to as the 'Area of Influence' or 'AOI'; and
- The buffer zone is 5 km.

LEGAL FRAMEWORK

The Environmental and Social Impact Assessment study report has been prepared in accordance with major international and national regulatory frameworks. The major guidelines considered for the project are the *IFC's EHS Guidelines dated 30th April 2007.* The *IFC performance standard, 2012 and Equators principle "EP4" guideline* has also been considered during the study.

PROJECT DESCRIPTION

ATGL is responsible for laying (8 inches diameter), building, operating or expanding the CGD of natural gas pipeline network planned in approx. 28.74 km stretch across Khandwa Town and nearby villages within the Khandwa district of Madhya Pradesh.

BASELINE ENVIRONMENTAL AND SOCIAL CONDITION

The baseline environmental, ecological, and social conditions of the project area have been assessed within 05 km radius of study area. Assessment of physical environmental parameters is currently under progress and ecological, environmental and social survey was conducted during the site visit from **23rd to 24th January 2025**.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

As per impact assessment study conducted for the proposed CGD for the natural gas pipeline project, environmental and social parameters can be mitigated with prescribed measures. Permission will be required for NH from the NHAI, for SH and ODR from relevant state department and from the Railway department for the pipeline route. Therefore, during the Planning Phase, the impact of land procurement is initially moderate, but with proper mitigation and permissions, it reduces to low.

During construction Phase, various factors such as topography, drainage, water resources, and ambient air and noise quality have moderate impacts, which can be reduced to low with appropriate management. Ecology shows a low impact, which becomes insignificant post-mitigation. Socio-economic impacts are initially low but can turn moderate-beneficial because of community engagement and local employment. Occupational health and safety risks, which are moderate at first, are minimized to low with proper safety measures. In the Operational Phase, the water environment and health & safety impacts are low, and with effective measures, they reduce to insignificant. Summary of impacts has been provided below.

Table: Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to Land Procurement	Moderate	Low
Construction Phase		
Topography and Drainage	Moderate	Low
Water resources and availability	Moderate	Low
Ambient air and noise quality	Moderate	Low
Ecology	Low	Insignificant
Socio-economic Impacts	Low	Moderate-beneficial
Occupational Health and Safety	Moderate	Low
Operational Phase		
Water Environment	Low	Insignificant

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Environment Health & Safety	Low	Insignificant

**Source: Analysis by TUVSUD Team*

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Environmental and Social Management Plan for the project has been designed in accordance with the impact identified during the project lifecycle (Construction and Operation phase). Adequate mitigation measures have been suggested against each identified impact during each of the above-mentioned phases.

Based on the ESIA Study conducted, it may be concluded that the project is eco-friendly and environmentally sustainable in the long run. The project will not only help in reducing the CO_2 emission responsible for global warming but also other gases and particulate emissions, which otherwise would be generated using conventional fossil fuel-based transportation vehicles and to cater energy demand for residential and commercial use. This Baseline ESIA study together with mitigation measures and follow up of recommendations on management actions will help **ATGL** in complying with the environmental & social standards/safeguard policy of MFIs & National regulations as well.

1 INTRODUCTION

1.1 BACKGROUND

Energy has been essential to human advancement since the "Industrial Revolution," and it will continue to be a key component of India's economic growth. India is home to about 18% of the world's population. Only about 6% of the world's basic energy resources are currently consumed by it. India uses around a third of the world's average amount of energy per person. However, as the nation continues to grow and prosper, so too will its energy needs in the years to come. The government's first objective is to guarantee that people have access to clean and sustainable energy sources. The Indian government is making strategic efforts to achieve Sustainable Development Goal (SDG) 7, which is to ***"Ensure access to affordable, reliable, sustainable, and modern energy for all."*** The government has taken various steps to achieve the five nectar elements (Panchamrit) of India's climate action as outlined during COP-26 by achieving the target of net-zero emissions by 2070 and reduction of the carbon intensity of the economy by 45 percent by 2030.

Energy is fundamental to economic development and plays a vital role in driving a country's growth. In India's energy portfolio, the Oil and gas sector holds a significant share of around one-third and is posed to continue serving as a critical enabler of India's rapidly growing economy. Energy is the mainstay of socio-economic growth and development for a nation like India which is currently the third largest primary energy consumer while its per-capita energy consumption is only a third of the global average. As per various projections, India's Energy Demand is expected to grow at 2.7% till 2050 as compared to World's 0.6%. India constitutes ~6% of the global primary energy demand wherein it constitutes 9.4% of the global oil demand and 2.2% of the global gas demand.

The demand for energy is met mostly by fossil fuels as fossil fuels make up 88% of India's primary energy requirement. Coal accounts for 55% of the energy mix, oil, and gas account for 28% and 6%, respectively. During the financial year 2022-23, 67% of natural gas production was by National Oil Companies from nomination regime, 33% of natural gas production was by Private/JV companies/ NOCs from Contract regimes (inclusive of ~2% was from Coal Bed Methane). The import dependency on crude oil and natural gas based on consumption of petroleum products in 2022-23 was about 87.4 % and 43.9 %, respectively. This provides a scope and opportunity for increasing energy consumption by India in near future and it being the central driving force in the global energy narrative. The Oil & Gas sector holds a prominent position as one of India's eight core industries, exerting significant influence on decision-making across various sectors of the economy. [1]

Adani Total Gas Limited (ATGL) is in the process of developing City Gas Distribution (CGD) networks to deliver Piped Natural Gas (PNG) to industrial, commercial, and residential sectors, as well as Compressed Natural Gas (CNG) to the transportation sector. Natural gas is a reliable, convenient, and environmentally friendly fuel that provides consumers with enhanced safety, convenience, and economic efficiency.

[1] Indian Petroleum and Natural Gas Statistics (2022-23), Ministry of Petroleum & Natural Gas, GOI

The company has already set up city gas distribution networks in various locations in India. During the 11th round of CGD bidding, Adani Total Gas Limited has successfully bid for multiple Geographical Areas (GA) in Chhattisgarh, Madhya Pradesh, Maharashtra, Jharkhand and Odisha the list of all the 11 GAs for which Adani Gas Limited has been granted authorization to lay city gas infrastructure and supply natural gas in the XI round of CGD bidding is attached in **Table 1-1** Among these, Adani Total Gas Limited received authorization for development of CGD for the GA: Khandwa District, Madhya Pradesh to cater industrial, commercial and transportation demand of natural gas in Khandwa and surrounding villages, ATGL has planned to develop a total of "***28.74 kms Natural Gas Pipeline Infrastructure***" in Khandwa District via one route.

Table 1-1: List of 11 GAs for CGD And Supply Natural Gas in XI Round

S. No.	GA ID	GA Name
1.	11.09	Kabirdhan, Raj Nandgaon and Knker districts
2.	11.10	Mungeli, Bemetara, Durg, Balod and Dhamtari districts
3.	11.11	Jashpur, Raigarh, Janjgir-Champa and Mahasamund districts
4.	11.19	Gumla, Latehar, Lohardaga, Simdega, Garhwa and Khunti districts
5.	**11.23**	**Burhanpur, Khandwa, Khargone and Harda districts**
6.	11.24	Tikamgarh, Niwar, Chhattarpur and Panna districts
7.	11.30	Akola, Hindoli and Washim districts
8.	11.31	Amravati and Yavatmal districts
9.	11.34	Bhandara, Gondiya and Garchiroli districts
10.	11.35	Alirajpur, Nandurbar and Barwani districts
11.	11.36	Koraput, Malkangiri and Nabarangpur district

1.2 PROJECT BRIEF

Adani Total Gas Limited (ATGL) is a joint venture between Adani Group and Total Energies. ATGL is one of India's largest city gas distribution companies. **ATGL** specializes in the development of city gas distribution (CGD) networks for the continuous supply of piped natural gas (PNG) and compressed natural gas (CNG).

With intent of catering demand of natural gas of several industrial and commercial service sectors in, ATGL has planned to develop a total of "***28.74 Kms Natural Gas Pipeline Infrastructure in Khandwa district and surrounding areas in Madhya Pradesh***". The pipeline has been planned to be laid in single line route from Bhojakhedi Village along NH347B to Naredi Petrol Pump (HP) in Khandwa district.

ATGL 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, allied equipment and facilities in the NG pipeline network depending upon the potential demand for natural gas. The infrastructure in the network will be adequate to maintain uninterrupted flow of natural gas in the pipelines.

The service for Environment and Social Impact Assessment (hereinafter referred as "ESIA") has been aligned in accordance with the **International Finance Corporation (IFC's)** *Performance Standards (PS) on Environmental & Social Sustainability (2012)*. The pipeline being included within the regulatory framework of host country, attracts MoEF&CC EIA Notification 2006 & its subsequent amendments. The proposed natural gas pipeline has been categorised under "***Item 6(a)*** *i.e., Oil & gas transportation pipeline (crude*

and refinery/ petrochemical products), passing through national parks /sanctuaries/coral reefs /ecologically sensitive areas including LNG Terminal" of Schedule of EIA Notification,2006 & its subsequent amendments[2].

1.3 PROJECT DEVELOPER

Adani Total Gas Limited (ATGL) is a joint venture between Adani Group and Total Energies. ATGL is one of India's largest city gas distribution companies. The company specializes in the development of city gas distribution (CGD) networks for the continuous supply of piped natural gas (PNG) and compressed natural gas (CNG). These networks provide natural gas as a convenient, economical, dependable, and environmentally friendly fuel option, offering consumers safety and convenience. ATGL has ventured into e-mobility and biomass business through two wholly owned subsidiaries – Adani Total Energies E-mobility Limited (ATEL) and Adani Total Energies Biomass Limited (ATBL) respectively.

The company is expanding its operations to include the production and distribution of clean energy derived from biomass, as well as the establishment of electric vehicle charging infrastructure. ATGL is adopting a comprehensive approach by providing a unified wallet offering that encompasses basket of services. Additionally, ATGL has entered the gas meter manufacturing sector (mechanical and smart meters), through its JV, SMTPL.

1.4 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) CONSULTANT

TÜV SÜD South Asia Private Limited (hereinafter referred as **"TÜV SÜD"**) has been entrusted by **ATGL** for providing consultancy services of Environmental and Social Impact Assessment Study (ESIA) for City Gas Distribution Project at Khandwa District, Madhya Pradesh, India.

TÜV SÜD is one of the leading testing, certification, and technical advisory firm. TUV SUD was established in 1995 in India & is a 100% owned subsidiary of **TUV SUD AG, Germany**. It is the trusted advisor to some of the world's leading businesses and institutions. The organization provides products, services, and insights to private, public, and independent sector organizations throughout the capital value chain, drawn from nearly two decades of front-line experience.

Working for many years with evaluation and assessment of sustainability, environment, safety, and social management, supply chain management and performance of companies all over the world and working with Bi-lateral and Multilateral Financial Institutions (MFIs), **TÜV SÜD** has developed an eclectic understanding in Environment, Social, Safety management system and presenting our studies in a balanced and trustworthy manner. Assessment of projects impact on environmental and social aspects and reporting by **TÜV SÜD** will therefore add trust and confidence to the report and your communication with stakeholders.

1.5 SCREENING OF THE PROJECT & RATIONAL

The purpose of this assignment is to evaluate the environmental and social impacts of the proposed project in line with the **International Finance Corporation (IFC's)** Performance Standards (PS) on

[22] standardtorreference.pdf

Environmental & Social Sustainability (2012) and other national and international statutory regulations applicable to the project.

This project has been screened considering guidelines provided in **IFC's** Interpretation Note (IN) on Environmental and Social Categorization, 2012. Categories underlined in **IFC** Project screening methodology are as follows:

- **Category A:** Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- **Category B:** Business activities with potential limited adverse environmental or social risks and/or impacts that are few, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- **Category B+:** The categorization of projects under B+ generally covers small to medium-scale projects which have localized impacts and can be managed through the implementation of specific mitigation measures. These projects might involve changes to land use, small-scale infrastructure development, or activities that don't significantly affect sensitive areas like forests, wetlands, or biodiversity hotspots.
- **Category C**: Business activities with minimal or no adverse environmental or social risks and/or impacts.
- **Category FI:** Business activities involving investments in financial institutions (FIs) or through delivery mechanisms involving financial intermediation.

In accordance with the screening criteria of IFC, and in accordance the observations of site reconnaissance survey, **TÜV SÜD** ESIA team has categorized Project as **Category C**, which specifies that the project has minimal or no adverse environmental or social risks and/or impacts.

1.6 LIMITATIONS OF THE STUDY

The EIA Report has been prepared based on professional judgement to ascertain facts with resultant subjective interpretations. Professional judgments expressed herein are based on the facts available within the limits of the scope of work, information provided by the client or its representatives, prevailing secondary data, budget, and schedule.

The walk-through survey along with a brief discussion with project stakeholders was undertaken during the site visit based on the present understanding of the project. This assessment may change in case of a change in the project location. The documents like SOPs, policy and procedures for EHS&S management were limited for review at the time of pre-project desktop review process. The Traffic Survey was not conducted by TUV team on site, however, the team has prepared a generic Traffic Management Plan enclosed in Section 9.13 of this report for highlighting the suggestions for the client to prepare a detailed Traffic Management Plan as per the site condition.

1.7 CONTENTS OF ESIA REPORT

The report has been divided into the following chapters.

Table 1-2: Contents of ESIA Report

Chapter	Title	Description and Details
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	Legal, Policy and Administrative Framework	Assessment of applicable laws & legislations, and institutional framework for its implementation.
Chapter 4	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 5	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 6	Analysis of Alternatives	This chapter assesses the alternative routes, assesses their feasibility for pipeline construction, and examine the reasons why certain routes may not be viable.
Chapter 7	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 8	Project Benefits	This chapter presents the details of direct and indirect benefits due to proposed project.
Chapter 9	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 10	Summary & Conclusions	This chapter summarizes the potential positive and negative environmental impacts of the project.

1.8 NEED AND SCOPE OF ESIA

The purpose of this ESIA is to assess the potential environmental and social impacts due to the proposed project in a study area of 05 km radius around and 500 m on both sides of the pipeline. The assessment covers both construction and operation phases of the project. The ESIA forecasts changes (positive and negative) that may occur because 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.

The broad scope of work will be undertaken by the consultant for ESIA study includes the following aspects of proposed project but not limited to the following:

- Literature survey, data collection, examination of available environmental, social reports/data, understanding the proposed project through project report and discussions etc.

Baseline environmental studies shall be carried out as below, but not limited to:

- **Physical environment**
  - Temperature, Wind speed, Wind direction, Wind rose patterns, relative humidity, Rainfall, Visibility, Cloud cover, Solar Radiation.
  - Ambient air quality (PM10, PM2.5, SO2, NOx, CO) to be monitored as per be monitored as per CPCB guidelines.
  - Noise levels of the study area shall be monitored and measured as per CPCB guidelines and IFC PS requirements.
  - Ground water quality (drinking purpose) shall be monitored against IS specifications.
  - Surface water quality shall be monitored and measured as per CPCB norms.
  - Soil quality of study area will be monitored and analyzed for parameters as per ICAR specification/guidelines.
  - Geological & hydro geological data/information will be compiled from secondary sources or as per study requirement.
  - Land use information/status will be based on the district census handbooks as well as with the help of satellite imagery.
  - **Ecological environment**
  - This shall include assessments/information of terrestrial and aquatic communities (as applicable), presence of rare, threatened & endangered species etc. if any.
  - The survey also includes identification & presence of national parks, sanctuaries, Biodiversity Park, endangered/threatened/ rare species & assessment of the species diversity, density, abundance etc. and formulation of ecological indexes.
- **Socioeconomic environment**
  - Demographical information/status will be based on census document and other state level / district level databases.
  - Socio-economic information and profile outlining data from census and socio-economic surveys, with information on livelihood profile, infrastructure, vulnerability, gender, indigenous peoples (ethnic minorities, scheduled tribes), and labour.
  - Identification of historical/ archaeological sites/ monuments in the study area (if any) based on

Archaeological Survey of India (ASI)/revenue records.

- Identification of common property resources within project site and mitigation measures, if any.
- Traffic survey for the present daily traffic, peak hour traffic and traffic composition & any change in traffic composition and volumes due to project development.

Assessment of E&S Impacts

- The potential E&S impacts will be assessed based on baseline data generated from studies. It should be analyzed and compared with applicable standards for each environmental attribute. The short term and long-term impacts particularly on sensitive targets such as endangered species, plants and historically important monuments should also be identified.
- A qualitative and quantitative assessment of sources of pollution from proposed project (dust, wastewater, noise pollution, solid waste, etc.) should be done to identify the adequacy of the proposed control measures as well as the likely impact on existing critical areas.
- Discuss the land procurement / acquisition process, considering Indian laws, rules and regulations. Rates of compensation paid in accordance with market rates, consultation before land procurement shall be reflected with relevant evidence in the Study.
- Discuss impacts on indigenous peoples or scheduled tribes.
- Impacts will be assessed for both Construction & Operation phases.

Environmental, Social & Biodiversity management & monitoring plan

- Identify and summarize all anticipated significant adverse E&S impacts along with mitigation measures.
- Define a set of policies and objectives for environmental performance and continual enhancement of performance.
- Monitoring programme for the proposed project (for construction & operation phase) will be worked out covering all E&S attributes as per the best practices in the World Bank/IFC General and sector specific EHS.
- For each potential negative impact identified, recommendations will be presented for avoidance, minimization or mitigation of impacts along with costs associated with potential mitigation. The ESMP will address the following:

i. Recommend monitoring and reporting procedures including the parameters to monitored, methods to be used, sampling locations, frequency of measurements, detection limits and definition of thresholds that will signal the need for corrective actions.

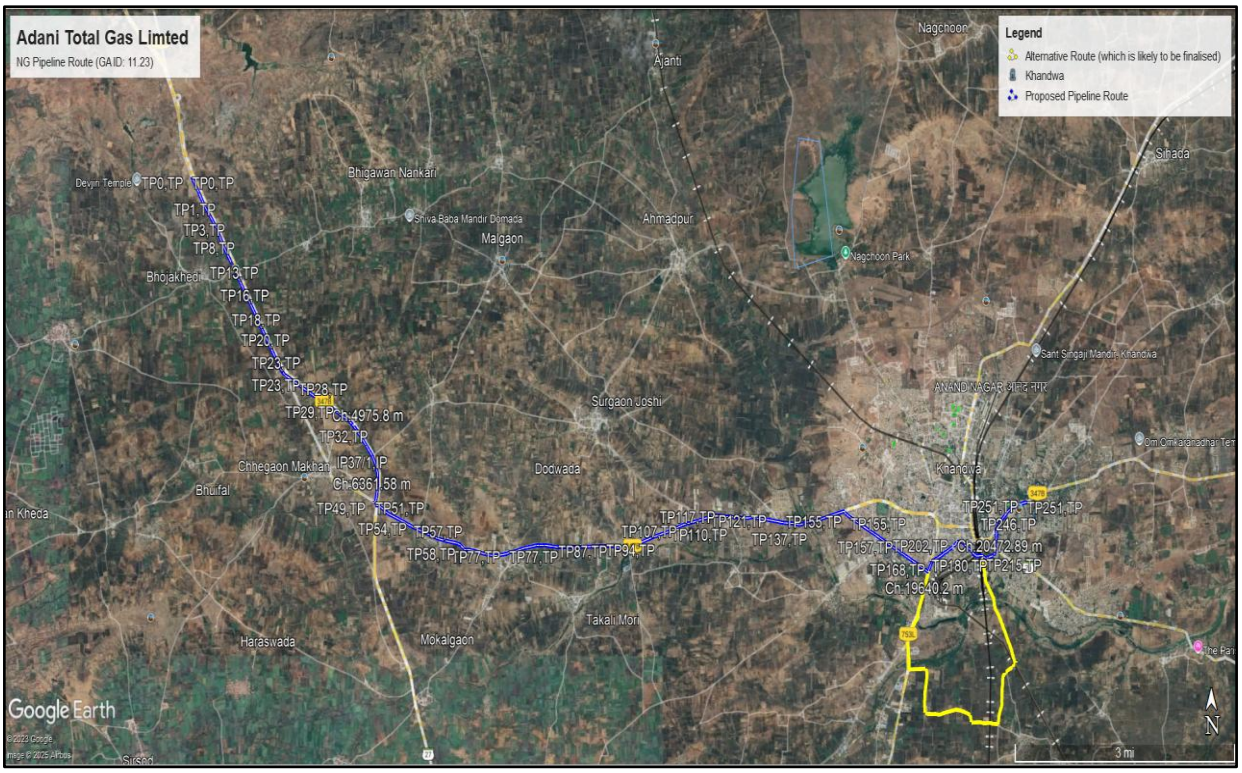
ii. Develop management plan for addressing specific issues such as waste management, disasters, emergencies, external grievances, construction safety, labour management, stakeholder engagement, indigenous peoples etc.

2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF NATURAL GAS PIPELINE NETWORK

Adani Gas Limited has been granted authorization for laying, building, operating or expanding the City Gas Distribution CGD Network in GA 11.23 i.e., Burhanpur, Khandwa, Khargone and Harda districts and the proposed CGD covers four charge areas in the state of Madhya Pradesh. This report covers the Khandwa District GA where ATGL has planned to lay 219 mm; 8" diameter natural gas pipeline network in approx. 28.74 km stretches across the Khandwa Town and nearby villages along NH347B, namely Bhojakhedi, Sulyakhedi, Chhaigaon Makhan, Balkhand Sura, Chhaigaon Devi, Dodwada, Takali Mori and Borgaon Khurd villages and Khandwa Municipal Corporation area.

Adani Gas Limited is responsible for laying, building, operating or expanding the (CGD) network of optimal size of the infrastructure in terms of pipeline of various types including steel belting of the authorized area, allied equipment and facilities in the NG pipeline network depending upon the potential demand for natural gas. The infrastructure in the NG pipeline network will be adequate to maintain uninterrupted flow of natural gas. Error! Reference source not found. provides the details of layout of the pipeline gas n etwork.



Source: Google Earth

Figure 2-1: Route Map of Proposed and Diverted Natural Gas Pipeline Network (on Google Earth)

2.2 PROJECT IMPLEMENTATION SCHEDULE

A grant of authorization was signed on 15th March 2022 by Petroleum and Natural Gas Regulatory Board (PNGRB) vide a letter of authorization to AGL group. The letter schedule D of the letter stated the year wise work program within the 8-contract year period.

2.3 PIPELINE ROUTE & ACCESSIBILITY

The proposed pipeline for the CGD runs along ROW of the Khandwa GA starting near Reliance Jio BP Future Fuels along NH 347B in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. The diverted pipeline route starts from Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town, where it connects with the proposed pipeline route. The detail of each route is given below in **Table 2-1**:

Table 2-1: Basic Details of the Pipeline

Sl. No.	Feature		Proposed Pipeline Route	Diverted Pipeline Route
1.	Name of the Pipeline		Near Reliance Jio BP Future Fuels in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town	Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town
2.	Length		21.15 km	7.59 km
3.		Name	Near Reliance Jio BP Future Fuels in Bhojakhedi (Ch: 0 m; TP 0, TP)	Dharamkata Tiraha (Ch: 19640.2 m; TP 175, TP)
4.		Location co-ordinates	21°52'27.96"N, 76°11'18.89"E	21°48'58.28"N, 76°20'36.31"E

Sl. No.	Feature		Proposed Pipeline Route	Diverted Pipeline Route
5.	Start point	Tehsil	Chhegaon Makhan	Khandwa
6.		District	Khandwa	Khandwa
7.		State	Madhya Pradesh	Madhya Pradesh
8.	End point	Name	Naredi (HP) Petrol Pump in Khandwa Town	Near Deg English Institute in Narayan Nagar, Khandwa Town
9.		Location co-ordinates	21°49'35.87"N, 76°21'50.67"E	21°49'5.99"N, 76°21'18.18"E
10.		Tehsil	Khandwa	Khandwa
11.		District	Khandwa	Khandwa
12.		State	Madhya Pradesh	Madhya Pradesh

The **Figure 2-2**, depicts the location map of the project site, Error! Reference source not found. depicts the combined route map of all the two pipeline routes and

	
Photo 5: Pipeline route along NH-347B	**Photo 6: Aabna River Crossing**

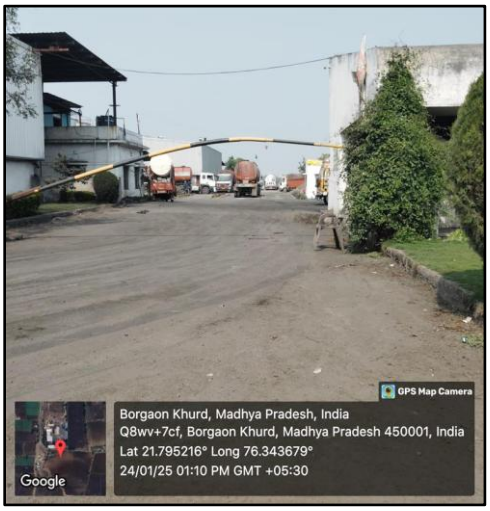
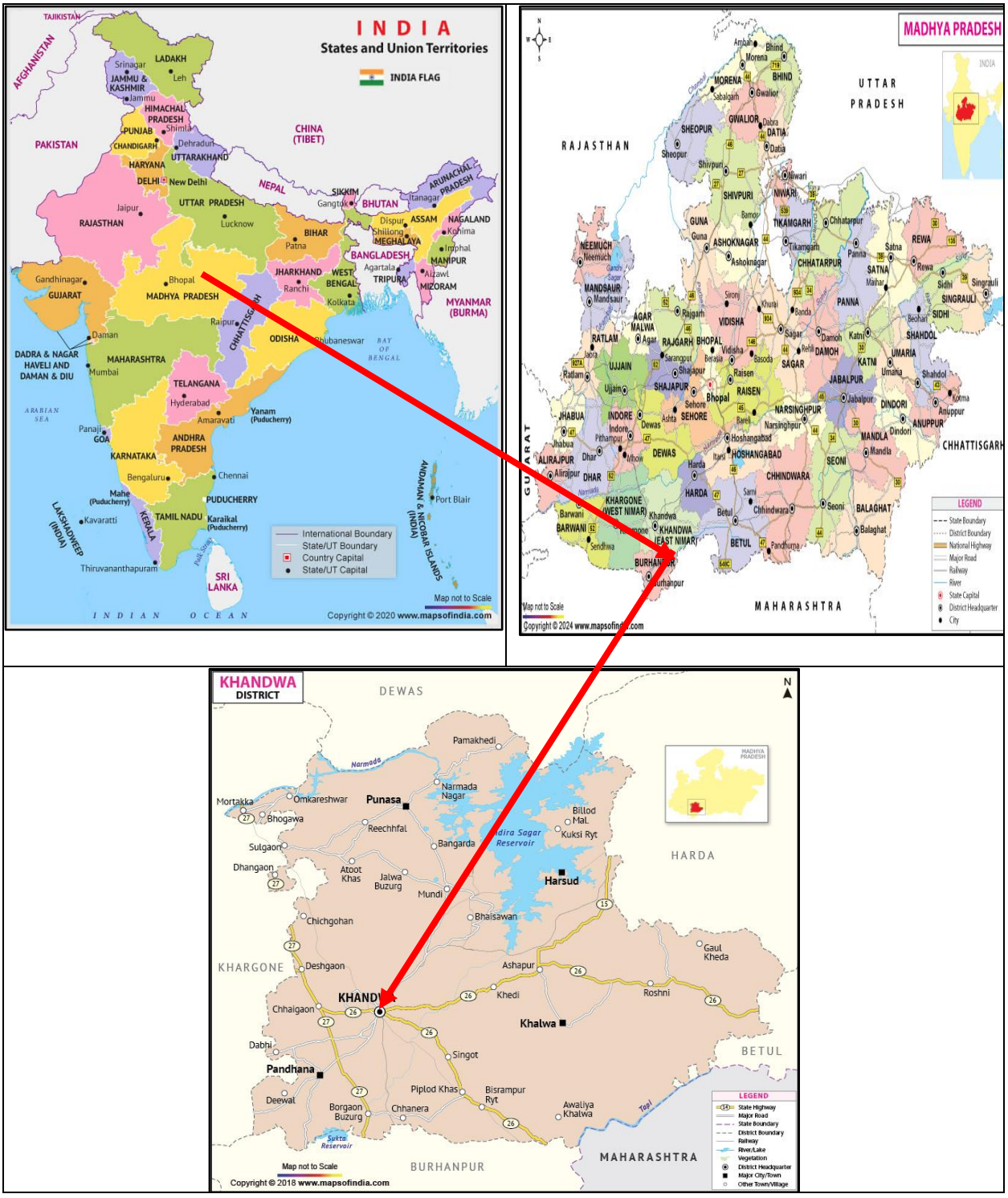
	
Photo 7: Pipeline route in Khandwa-Pandhana Road	**Photo 8: MG Oils in Borgaon Khurd, Khandwa District (located beside the proposed Pipeline Route)**

	
Photo 9: Railway Crossing Checkpost in Borgaon Khurd, Khandwa District	**Photo 10: Pipeline End Location to Naredi (HP) Petrol Pump, Khandwa Madhya Pradesh**

**Source: Primary Survey by TUV SUD Team*

Figure 2-3 provides the photographs of the site as per the primary survey conducted in Khandwa town by the TUV-SUD team.



Source: Maps of India

Figure 2-2: Location Map of Project Site

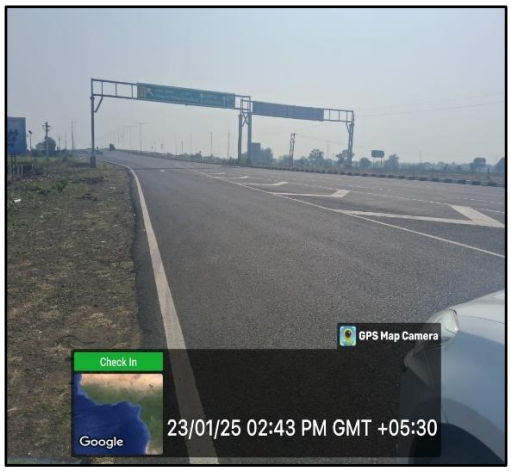


Photo 1: Starting Point of the Pipeline route at Bhojakhedi, Khandwa District, Madhya Pradesh	**Photo 2: Pipeline laying at site for Phase I of the Pipeline project at Balkhand Sura**

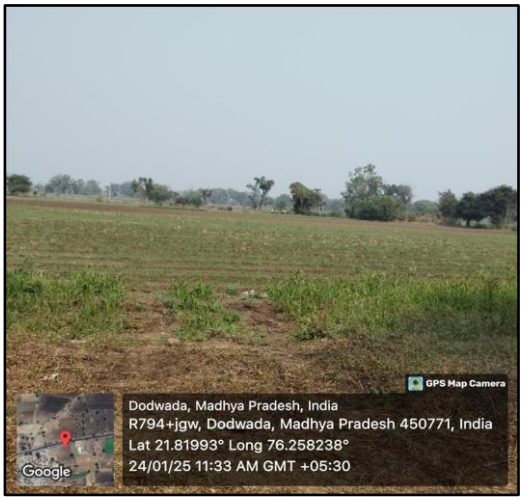
	
Photo 3: Pipeline laying route showing "Men at Work" signage at Balkhand Sura, Khandwa District, Madhya Pradesh	**Photo 4: Area near the Pipeline Route**

	
Photo 5: Pipeline route along NH-347B	**Photo 6: Aabna River Crossing**

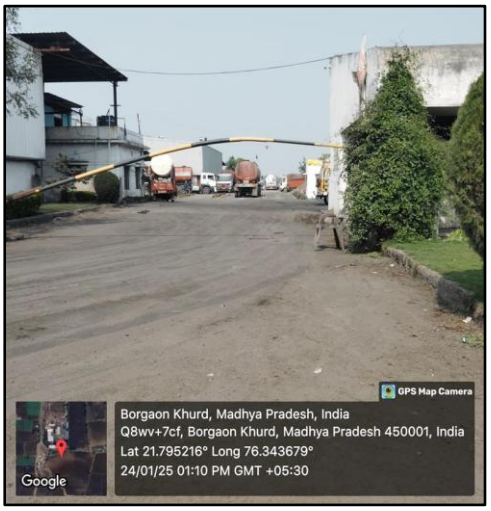
	
Photo 7: Pipeline route in Khandwa-Pandhana Road	**Photo 8: MG Oils in Borgaon Khurd, Khandwa District (located beside the proposed Pipeline Route)**

Photo 9: Railway Crossing Checkpost in Borgaon Khurd, Khandwa District

Photo 10: Pipeline End Location to Naredi (HP) Petrol Pump, Khandwa Madhya Pradesh

**Source: Primary Survey by TUV SUD Team*

Figure 2-3: Photographs from project site

List of the Crossings for all two pipeline routes is given in **Table 2-2** and details of all the major crossings along with its chainages for the pipeline routes has been provided below in

Table 2-3 and

Table 2-4:

Table 2-2: List of Crossings for the Main Pipeline Route and the Proposed Pipeline Route

Sl. No.	Detail of Crossing	Main Pipeline Route	Proposed Pipeline Route
1.	NH	05	08
2.	Road	25	09
3.	Cart track	-	-
4.	Railway	-	01
5.	River	01	03
6.	Canal	01	-
7.	Nala/ Drain	-	-
8.	Pipeline	-	-
9.	H.T/Powerline	-	-
Total		**32**	**21**

**Source: DPR, Adani Total Gas Limited*

Table 2-3: Details of Major Crossing within Proposed Pipeline Route

Sl. No.	Description	Chainage (m)			Location
		Start	Centre	End	
Main Pipeline Route: Near Reliance Jio BP Future Fuels in Bhojakhedi to Dharamkata Tiraha					
ROAD CROSSINGS					

1	Khandwa Indore Highway (NH-347B Diversion crossing)	3812.63	3850.98	4153.2	TP27
2	Khandwa Indore Highway Crossing (NH-347B)	6961.79	6969.25	6976.71	TP48-TP49
3	Khandwa Indore Highway Crossing (NH-347B)	7048.77	7085.8	7122.83	TP52-TP53
4	Diversion point (named “Indore Naka”) near Khandwa Indore Highway (NH-347B)	17532.81	17538.18	17543.54	TP149-TP150
5	Diversion point (named “Dharamkata Tiraha”) between Khandwa Indore Highway (NH-347B) and Khandwa- Pandhana Main Road (NH-753L)	19618.42	19629.31	19640.2	TP174-TP175
WATER BODY CROSSINGS					
6	Bridge over Unnamed Canal in Khandwa Indore Highway (NH-347B)	10825.2	10857.71	10890.21	TP83-TP84
7	Aabna River crossing (i)	16577.25	16617.07	16656.89	TP143-IP143/1

Table 2-4: Details of Major Crossing within Diverted Pipeline Route

Sl. No.	Description	Location
Proposed Pipeline Route: Dharamkata Tiraha to Naredi (HP) Petrol Pump in Khandwa Town		
ROAD CROSSINGS		
1	Dharamkata Tiraha	21°48'58.48"N, 76°20'36.02"E
2	Entry point of the proposed pipeline to road on LHS from and Khandwa- Pandhana Main Road	21°48'6.08"N, 76°20'21.42"E
3	Entry point of pipeline route from pucca road to Khandwa - Dedtalai Rd	21°49'10.66"N, 76°21'27.21"E
4	Pipeline Crossing point in Khandwa - Dedtalai Rd	21°49'17.98"N, 76°21'27.63"E
5	Entry point of pipeline from Khandwa - Dedtalai Road to Khandwa Indore Highway (NH-347B)	21°49'20.79"N, 76°21'27.41"E
6	Crossing point of Pipeline from RHS of its route to its LHS for entry to its end point (Naredi-HP Petrol Pump in Khandwa Town)	21°49'35.48"N, 76°21'50.73"E
WATER BODY CROSSING		
7	Pandhana-Khandwa Main Road-Bridge crossing over Aabna River (ii)	21°48'9.58"N, 76°20'21.40"E
8	Bridge over Aabna River Crossing (iii)	21°48'42.28"N, 76°21'26.00"E
9	Aabna River Crossing (iv)	21°49'5.48"N, 76°21'17.62"E
RAILWAY CROSSING		
10	Railway Checkpost Crossing 1 in Borgaon Khurd, Khandwa District	21°47'37.63"N, 76°21'22.71"E

**Source: DPR, Adani Total Gas Limited and TUV-SUD Primary Survey*

Table 2-5: Technical Specifications of Pipeline

Sl. No.	Description	Piping Details
1.	Pipeline internal Diameter (Inches)	8”
2.	Pipeline Wall Thickness (mm)	6.4
3.	Pipeline Grade/Material Specifications	CS, API5L-X42, ERW, BE
4.	Type of Coating	External 3-Layer Polyethylene Coating
5.	Normal Operating Pressure	26 Bar
6.	Maximum Allowable Operating Pressure (Design Pressure)	49 Bar
7.	Design Throughput (MMSCMD)	1.9811 MMSCMD
8.	Pipeline Design Life	40 years
9.	Design Temperature (°C)	0/+65 Degree C

Sl. No.	Description	Piping Details
10.	Mainline Valve Stations	distance between two subsequent SV shall not be more than 3 km as per PNGRB regulation

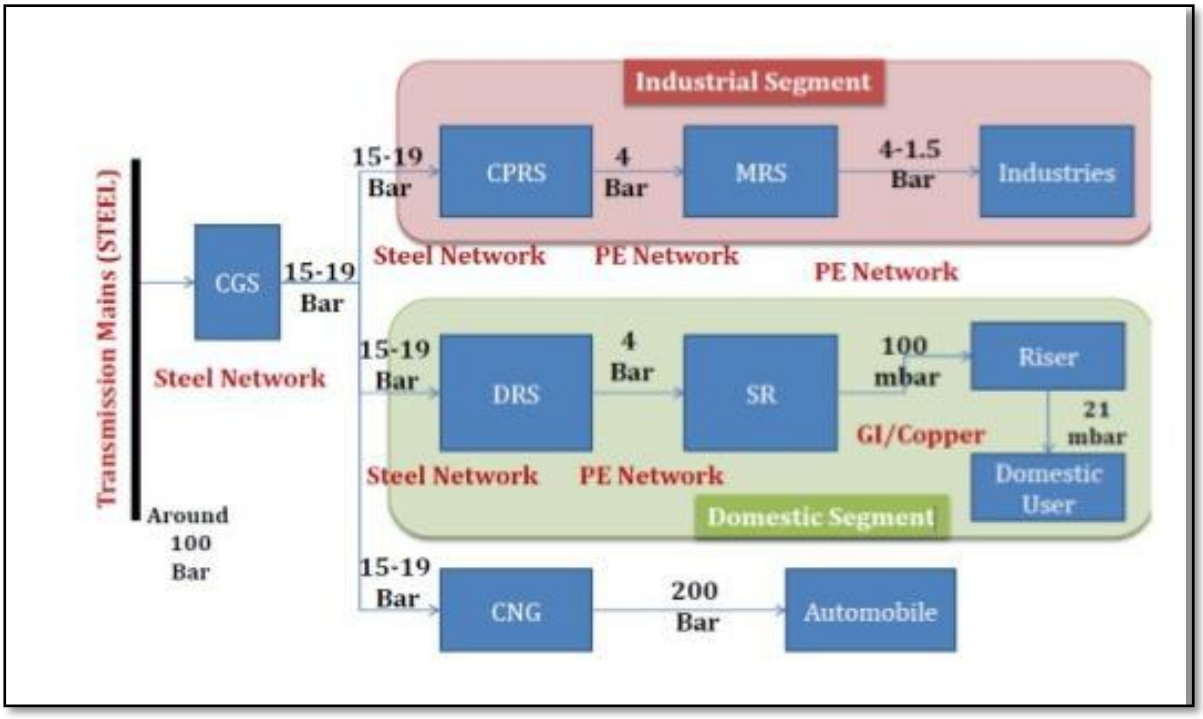
**Source: DPR, Adani Total Gas Limited*

2.4 ASSOCIATED TECHNICAL FACILITIES

2.4.1 CGD Network

A typical CGD network shall comprise of one or more or all the following:

- City Gate Station (CGS)
- Pipeline Network-Steel pipeline, Polyethylene pipeline etc.
- Regulating stations- District Regulating Stations (DRS), Service Regulators, Domestic / Commercial / Industrial Regulators.
- Metering Stations / Metering & Regulating Stations (MRS)
- CNG Stations



**Source: DPR, Adani Total Gas Limited*

Figure 2-4: Network Diagram- Typical Arrangement Network of CGD

Project Company will take tap-off from nearest natural gas transmission pipeline of Gas Suppliers and further lay steel pipeline network, build City Gate Stations (CGS), Compressed Natural Gas (CNG) stations & District Regulating Stations (DRS), lay MDPE pipeline network etc in the various GAs for

supplying piped natural gas to Domestic Households, Commercial & Industrial consumers and CNG to Automotive sector. The steel pipeline route will be mainly along the National or State highways from CGS and will further spread inside city boundaries.

The Gas Distribution network will be designed and engineered primarily in accordance with the provisions of the PNGRB Regulations GSR 612(E), Aug' 2008 (T4S) and ASME Standards for Gas Transmissions and Piping Systems (ASME B31.8).

2.4.2 City Gate Station (CGS)

The gas from pipeline owner shall be available at a maximum pressure of 49 Bar(g) at the upstream of CGS. Pressure reduction skid is assumed to be installed by pipeline owner or CGD entity within its premise as per their normal business practice. Un-odorized gas is assumed to be made available from the downstream flange at the outlet of pressure reduction skid after metering at a maximum pressure of 45 Bar(g).

2.4.2.1 Steel Network

Steel pipeline sizes is generally restricted to 16" NB, 12" NB, 8" NB, 6" NB & 4" NB whereas, spur lines shall be of 4" NB. Steel pipeline is proposed to be installed at a minimum depth of 1.2 meters of soil cover, and in accordance with international standards for pipeline laying.

2.4.2.2 District Regulating Station (DRS)

DRS are provided at various demand centers based on the requirement. DRS are located either in customer's premise or at a safe location on the roadsides. DRS capacity may be 5000 SCMH, 2500 SCMH, 1500 SCMH and 1000 SCMH or below is based on its availability and requirement in a particular area.

2.4.2.3 CNG Stations (MOTHER /ONLINE/DAUGHTER/ DAUGHTER BOOSTER Stations)

CNG Station

CNG station is a site consisting of interconnected equipment, which is designed to compress natural gas to a high pressure, store and dispense it directly to a natural gas vehicle. CNG stations are located at various locations in the city based on the demand and availability of land. CNG station can be either – On-line station (including mother stations) or daughter booster station.

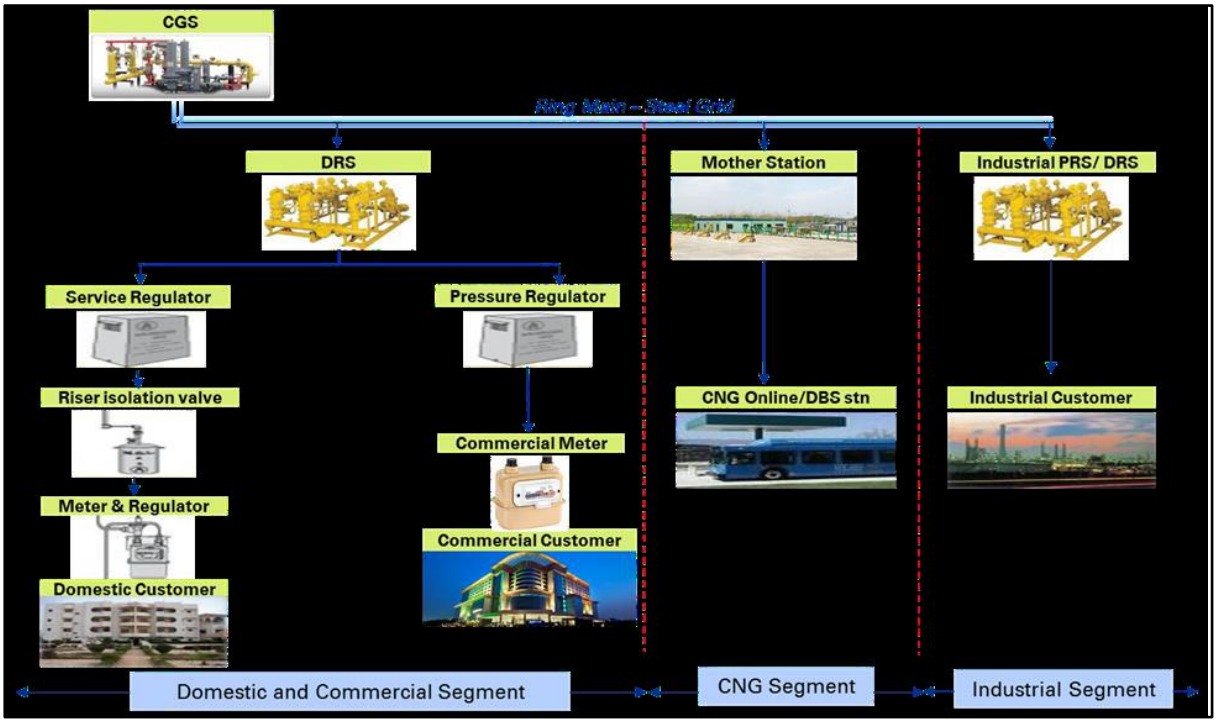
Mother / Online Station

These are equipped with a compressor, which compresses low-pressure pipeline gas to the pressure of 255 bar for dispensing CNG to the vehicle cylinder at a pressure of 200 bar (g). Some of these stations also provide Cascade filling facility at 255 bar (g), used to fill gas in small cascades and transmitted to daughter booster stations. These kinds of stations are referred to as "Mother Stations". Online stations are the same as mother stations except that they do not have the cascade filling facility. The main components of an online CNG station are Compressors along with auxiliaries, Stationary cascades, Dispensers for cars and three-wheelers (autos), Dispenser for buses, Loading Facility for Mobile Cascades, Stainless steel tube connecting compressor, dispenser & cascades laid in

U/G trenches, DG Set, UPS & Battery Bank, AVR, Electrical Control Panel, Instrument Air and Water Facilities and firefighting equipment.

Daughter Booster Station: Daughter station provided with the compressor (Known as booster) to compress the gas we are getting from the mother station are known as daughter booster station.

Daughter station: Daughter stations are established in those areas where laying a pipeline is not possible. In that case gas is delivered from mother station to daughter station, via mobile cascade van. The gas from mother station is filled in mobile cascade by LCV filling point.



**Source: DPR, Adani Total Gas Limited*

Figure 2-5: Typical Arrangement Network of CNG Station

2.4.3 Design Basis/Philosophy Considered for CGD Network Simulation

The detailed market assessment of natural gas demand for all four segments that are Domestic, Commercial, Industrial and CNG Demand is conducted for 25 years. Based on 25th year natural gas demand, the major demand centers are mapped & identified and depicted below in Error! Reference s ource not found. in the geographical area of Burhanpur, Khandwa, Khargone and Harda districts under 11th round of CGD bidding. Network is planned in such a way that it caters all the major demand centers.

The details of the four segments in which natural gas use/ application is primarily segmented are as following:

- **Domestic segment (cooking/residential use**) – This segment includes Households and their usage for cooking and other house utilities such as geyser etc within the geographical area

- **Commercial segment**– This segment includes usage of gas in hotels, hospitals, bakeries, shops, hostels, food plazas, restaurants, sweet shops, malls and other commercial establishments for cooking/ heating purpose within the GA
- **Industrial segment (heating/ power generation use) –** This segment includes small/ medium scale industries (customers having requirement of natural gas up to 50,000 SCMD shall be supplied through the CGD network) located within GA for power generation, heating and other industrial applications.
- **CNG Segment (NGV applications)** – This segment primarily caters to the transportation fuel demand of the various vehicles and potentially inter-city floating vehicles.

2.4.4 SCADA, Telecommunication and Leak Detection System

SCADA system shall be devised to monitor and operate the NG pipeline network. 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. Regular check and control will be conducted to assure the safe continuity of the gas supply to consumers. For the network, patrolling will be conducted by the owner operators. This operation shall include but not limited to the activities like, checking of local device such as levels of liquid, filter DP in filtration skid, regulator/ monitor/ SSV reliability etc. The gas quantity consumed by each end user will be totalized once a year. This package will enable the operator to take optimal control actions and thus ensure the safety and security of the pipeline network.

2.4.5 Filtration Skid

Cartridge type filters will be installed to remove entrained particles (filtration efficiency 99%) made up of Borosilicate fibre glass cartridge type. Equipment like regulators and metering are quite sensitive to dirt. Metering requires no particles above 5 microns.

2.4.6 Pressure Reduction Skid

The pressure reduction system shall consist of the following:

- Slam-shut valve actuated to close in case of downstream pressure increase above safe level; it needs local manual reset.
- *Monitor*: A Pressure Control Valve (PCV) which takes over control in case the Active PCV fails to maintain downstream pressure below required maximum pressure; Fail-safe is to open.
- *Active Pressure Control Valve (PCV)* that regulates the downstream pressure as required.
- Such concept is called “Non-Venting Pressure Safety” and allows avoiding the "Safety Relief Valves" more common in industrial plants. Indeed, large relieves as may be needed by the “Venting Pressure Safety” is then avoided and relevant hazards suppressed.

2.4.7 Metering Skid

Custody transfer metering will be provided before the gas is transferred to the end users. The custody transfer metering system will be Ultra Sonic Meter. The flow meters are connected to a flow computer which calculates the mass flow and corrects for temperature and pressure. Gas quality and gas compressibility data will be provided to the flow computer by a gas chromatograph located at a place before comingling of the gas from various sources.

2.4.8 Odorizer

Natural gas is, by nature, odourless what makes detection of leaks impossible without special gas detection tools. End-users connected to a Natural Gas Distribution System being not supposed to have adequate skill for gas handling, it is mandatory to add an odorant to the gas before it enters the CGD System. Odorization shall be based on the injection of suitable sulphur compound in adequate proportion (in function of actual flow) on the primary network system. The Odorization unit will consists of a Stainless-Steel storage vessel with reserve vessel internal piping & accessories, suitable cabinet & skid. This unit shall be designed to provide the desired odour intensity for the entire gas stream.

A salient feature of odorization skid at CGRS is mentioned in table below in **Table 2-6:**

Table 2-6: Salient Feature of Odorization

Sl. No.	Particulars	Specifications
1.	Operating Pressure	26 Bar (max.)
2.	Operating temperature	5-55 Degree C
3.	Design pressure	49 Bar
4.	Design temperature (min/max)	0/+65 Degree C
5.	Odorization agent	Tetra-Hydro-Thiophene (THT), Ethyl Mercaptan, Tetra-Butyl Mercaptan (TBM)
6.	Dosing rate	Enough for identifying leakage at far-off place

**Source: Standard industry Norms*

2.4.9 Fire Alarm and Fire Fighting System

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, ATGL shall provide an Emergency Control Room, staffed 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 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., 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.

2.4.10 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 conducted through deployment of 4 to 5 spreads. The sequence and methodology of construction of new pipeline is given below (**Table 2-7**):

- **Clearing and grading**: A 30 m wide Right of Use (RoU) area will be cleared off for 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 manoeuvring 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, at least 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 evaluate 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 2-7: Type of Crossings

Sl. No.	Type of Crossing	Method of Crossing
1	National Highway	Conventional Trenching/ Horizontal Directional Drilling (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 green belt activities will be restored along roadside of the project area. 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 topsoil layer.
- Construction of valve chambers and erection of valve.
- Construction of necessary pipe supports anchor blocks.
- Providing line markers

2.5.1 Site Preparation and Laying Methodology

The project is for laying of natural gas pipeline with open trenching. However, for the Portion passing through, train tracks, Canals, Horizontal Directional Drilling Method (HDD) will do ponds bridges 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 several 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 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 layers of PE coated steel pipes for the transportation of gas to its delivery centres.

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 (**Table 2-8**). 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 packs 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 2-8: Minimum Depth of Cover for Buried

Sl. 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

Sl. No.	Location	Minimum Cover (m)
3	Major River Crossings	2.5
4	Rivers with rocky bed	1.5
5	Lined canals/ drains/nalas	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*

2.5.3 Testing, Cleaning and Drying

2.5.3.1 Filling of Nitrogen for Gas-in

The nitrogen shall be injected in the pipeline before filling the pipeline with gas (gas-in) to prevent direct mixing of gas with air. Nitrogen needed for Energization of the pipeline shall be provided by the contractor. The maximum allowable Oxygen content inside the pipeline shall be less than 1% by volume. The pipeline will be evaluated, cleaned, and dried, section after section.

2.5.3.2 Cleaning of Pipeline

Before starting the pigging activity, initial weight of the pig shall be measured at the Launching Station and after receiving the pig at the Receiving Station, the final weight of the pig shall also be measured. The difference between the initial and final weights of the Pig shall not exceed more than 20% of the initial weight of the pig. Air cleaning must be done by oil free compressors only.

2.5.3.3 Testing

Pre-Hydrostatic test Pressure and Final Hydrostatic Test Pressure shall be done at 1.4 times of design pressure. It should be confirmed that the hoop stress should not increase by 95% of SMYS.

2.5.3.4 Thermal Stabilization

If the difference of minimum and maximum atmospheric temperature should cause thermal instability on the pipe section directly exposed to atmospheric condition, the temporary scraper traps and above ground pipeline shall be properly protected. The test medium shall be evaluated to confirm soft non-aggressive water. The water to be used shall be filtered, shall not be contaminated, and free from sand or silt. Before filling operation, air driven pigs will clean the pipeline to remove all mill scale rust/sand from the internal of pipe sections. The final change shall be executed with pigs provided with air jet holes or nozzles to keep the internal dust in turbulence ahead of the pigs. Thermal stabilization shall be considered to have been achieved when a difference not higher than 1°C is attained between the average values of the last two readings.

2.5.3.5 Swabbing and Drying

Poly pigs followed by high and medium density foam pigs shall be propelled with compressed / Dry air for removal of residual water for swabbing operation. Drying shall be conducted round the clock, once started after the swabbing operation. If possible, the swabbing shall be preferably conducted using

drying air to reduce the drying time. Mainline valves shall be kept fully open during operation and by passes shall be used only to check drying stage in between length and drying of valves.

After completion of swabbing and tie-in of valves, tap off etc. in each Hydrotest section, following operations shall be conducted for the drying. A sequence of three nos. of foam pigs, High, Medium & Low density (7 to 10-kg ranges) shall be launched with the super dry air at the interval of 30 minutes each. The discharge of drying unit shall be measured at every 06 hours using digital dew point meter and – 45°C at the outlet of dryer shall be maintained. The foam pigs when received at other end shall be removed and vents shall be kept open on receiving end to ensure min. backpressure. The dry air shall be allowed to flow continuously till – 8 to 10°C is achieved at the receiving end.

2.6 PROJECT REQUIREMENT

2.6.1 Land

The land required for the project is only for natural gas pipeline network measuring 28.74 km starting near Reliance Jio BP Future Fuels along NH 347B in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town.

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 100-200. **ATGL** has contracted out the construction works and management of labour to contractors, local skilled and unskilled workers and service providers are preferred to boost local employment generation. For operational phase is considered, guards will be employed to patrol the pipeline areas, which will be around 10-20 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

The power requirement will be met from DG sets during construction phase of the project. During operational phase, power will be only required for SCADA & associated facilities. The same shall be supplied via state grid.

2.6.4 Water Requirement

Water requirement will be minimal for the project associated only with domestic use by the workers during construction, for the sprinkling purpose to avoid air pollution and office staff will require during constructions and operations period at the distribution centres. The water requirement for construction phase will be contracted out to private tankers. There will be no water requirement during operation phase expect for domestic usage of staff and workers.

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 LEGAL, POLICY AND REGULATORY FRAMEWORK

The emerging environmental scenario calls for attention on conservation and judicious use of natural resources. There is a need to integrate the environmental consequences of development activities and for planning suitable measures to ensure sustainable development of the region. The environmental and social considerations in any developmental process have become necessary for achieving sustainable development. To achieve such goals, the basic principles to be adopted are:

- To enhance the quality of environment in and around the project area by adopting proper measures for conservation of natural resources.
- Prevention of adverse environmental and social impact to maximum possible extent; and
- To mitigate the possible adverse environmental and socio-economic impact on the project-affected areas.

This section highlights the environmental and social regulations applicable to proposed City Gas Pipeline distribution network project. The section broadly focuses institutional framework, applicable environment, health and safety and social legislative, World Bank's guidelines and IFC's Performance Standards requirements relevant to the proposed project.

3.1 ENFORCEMENT AGENCIES

All the permissions and the approvals must be taken from concerned ministries, line departments and the local civic bodies for any upcoming project in India. The environmentaland social governance approach in the country consists of:

1. Regulatory and implementing entities.
2. Legal framework including policies, acts, and laws; and
3. Permitting system.

With the aim to create a National Gas Grid (One Nation, One Gas Grid) and increase the availability of natural gas across the country, Petroleum and Natural Gas Regulatory Board (PNGRB) under Ministry of Petroleum and Natural Gas has authorized to lay Natural Gas Pipeline network across the country and the environmental aspects are governed by Ministry of Environment, Forests and Climate Change (MoEF&CC), Central Pollution Control Board (CPCB). The social governance aspects at the micro level are addressed by institutions like panchayats and municipal bodies.

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following sub-sections:

3.1.1 Ministry of Environment, Forests and Climate Change (MoEF&CC)

The Ministry of Environment, Forests and Climate Change (MoEF&CC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and

overseeing the implementation of India's environmental and forestry policies and programs. The primary concerns of the ministry are implementation of policies and programs related to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests, and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programs, the ministry is guided by the principle of sustainable development and enhancement of human well-being. The specific functions of MoEF&CC are as follows:

1. Environmental policy planning.
2. Effective implementation of legislation.
3. Monitoring and control of pollution.
4. Environmental Clearances for industrial and development projects covered under EIA notification.
5. Promotion of environmental education, training, and awareness; and
6. Forest conservation, development, and wildlife protection.

3.1.2 Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB) was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached tothe MoEF&CC. CPCB works towards control of water, air and noise pollution, land degradationand hazardous substances and waste management. The specific functions of CPCB are as follows:

1. Prevent pollution of streams and wells.
2. Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution.
3. Co-ordinate the activities of SPCB's and provide them with technical and research assistance.
4. Establish and keep under review quality standards for surface and groundwater and for air quality.
5. Planning and execution of national program for the prevention, control, and abatement of pollution through the Water and Air Acts; and
6. The CPCB is responsible for the overall implementation and monitoring of air and water pollution control under the Water Act, 1974, and the Air Act, 1981.

3.1.3 Madhya Pradesh Pollution Control Board (MPPCB)

Madhya Pradesh Pollution Control Board (MPPCB) holds significant power and responsibility through various environmental laws to prevent pollution. MPPCB presently looks after the implementation of following Acts/Rules:

- Water (Prevention Control of Pollution) Act,1974
- Air (Prevention & Control of Pollution) Act, 1981
- Environment Protection Act, 1986 (certain sections)
- Public Liability Insurance Act,1991
- Madhya Pradesh Jaiv Anaashya Apashista (Niyantran) Act & Rule

The primary goal of **MPPCB** is to preserve water, air, and soil in a healthy and usable state for various purposes. To achieve this, the Board operates 2 Zonal Offices (Jabalpur, Mandideep), 13 Regional Offices, and 4 District Offices, all staffed with trained personnel and advanced equipment, who continuously monitor environmental activities across the state.

3.1.4 Petroleum and Explosives Safety Organization (PESO)

The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of Explosives is responsible to deal with provisions of

1. The Petroleum Act 1934 and the Rules 2002.
2. The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000,2004.
3. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000.

3.1.5 Ministry of Petroleum and Natural Gas

The MoPNG is the nodal ministry of Government of India for all matters related to petroleum and Natural Gas. The ministry formulates policies for the exploration, production, refining, distribution, and marketing of petroleum and natural gas. The ministry, through the Petroleum and Natural Gas Regulatory Board (PNGRB), authorizes entities to develop City Gas Distribution networks. These networks supply piped natural gas (PNG) to households, industries, and commercial establishments, and compressed natural gas (CNG) for vehicles. MoPNG promotes the development of infrastructure for natural gas, including pipelines and import terminals, to enhance the availability and accessibility of natural gas across the country. The ministry issues guidelines for the allocation and pricing of natural gas to ensure its efficient and equitable distribution.

3.1.6 Central Ground Water Authority (CGWA)

Central Ground Water Authority (CGWA) was constituted under sub-section (3) of Section 3 of the Environment (Protection) Act, 1986 for the purposes of regulation and control of ground water development and management. The authority is entrusted with powers of:

- To resort the penal provisions contained in section 15 to 21 of the said act.
- To regulate and control, management and development of ground water in the country and to issue necessary regulatory directions for the purpose.

- Exercise of powers under section 4 of Environment (Protection) Act, 1986 for the appointment of Officers.

CGWA is regulating withdrawal of ground water by industries/ projects. CGWA has published guidelines/ criteria for evaluating proposals/ requests for ground water abstraction (with effect from 16/11/2015). As per the guidelines, for non-notified areas, NOC for ground water withdrawal will be considered for Industries as per the criteria given in the notification, presented in Table 1-1**Table 3-1** below.

Table 3-1: Criteria for granting NOC to Industries/ Infrastructure/ Mining in Non-Notified Areas

Category	Requirement of NOC			
	Safe	Semi-Critical	Critical	Overexploited
Domestic use (rural & urban)/Rural drinking water supply schemes/armed forces establishment/MSME abstracting less than 10 cum/day	Not Required	Not Required	Not Required	Not Required
Residential Apartments / Group Housing Societies / Govt. Water Supply Agency	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)
Agriculture	Not Required	Not Required	Not Required	Not Required
Industrial Use	Required	Required	Required	Prohibited except MSME excluding new packaged water industries
Mining	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW restoration charges to be paid)
Infrastructure Projects	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Prohibited for Water Parks/Theme Parks/Amusement Parks. For construction allowed only if alternate option such as treated sewage water is not available within 05 km.

3.2 IFC EHS GUIDELINES

The IFC's EHS Guidelines dated 30th April 2007 shall be applicable for the project. **ATGL** should ensure using the Guidelines as guiding framework for addressing impacts on Environment, Occupational Health and Safety, Community Health and Safety during construction, operation as well as decommissioning phase of the project.

The IFC's EHS Guidelines provides industry specific management measures for addressing impacts on biodiversity, occupational health, and safety as well as community health and safety as early as possible in the project cycle, including the incorporation of EHS considerations into the site selection, to maximize the range of options available to avoid and minimize potential adverse impacts.

The EHS Guidelines for Electrical Power Transmission and Distribution dated 30th April 2007 should be followed by **ATGL** for addressing EHS issues associated with electric power transmission and distribution that occur during the construction and operation phases of the project along with recommendations for their management.

3.3 IFC PERFORMANCE STANDARDS

The Performance Standards (PS) established stipulates that the project shall meet the following throughout the life of an investment by IFC or other relevant financial institution:

- **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts.
- **Performance Standard 2:** Labour and Working Conditions.
- **Performance Standard 3:** Resource Efficiency and Pollution Prevention.
- **Performance Standard 4:** Community Health, Safety and Security.
- **Performance Standard 5**: Land Acquisition and Involuntary Resettlement.
- **Performance Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources
- **Performance Standard 7:** Indigenous Peoples; and
- **Performance Standard 8:** Cultural Heritage.

These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts. A brief on the requirements as laid down in the performance standards is described below in **Table 3-2**:

Table 3-2: Applicable performance Standards

PS No.	Performance Standards	Applicability
PS-1	Assessment and Management of Environmental and Social Risks & Impacts	• Yes ○ No
PS-2	Labour and Working Conditions	• Yes ○ No
PS-3	Resource Efficiency and Pollution Prevention	• Yes ○ No
PS-4	Community Health, Safety, and Security	• Yes ○ No
PS-5	Land Acquisition and Involuntary Resettlement	○ Yes • No
PS-6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Yes ○ No
PS-7	Indigenous Peoples	○ Yes • No
PS-8	Cultural Heritage	○ Yes • No

The details of applicability of IFC Performance Standards for proposed solar power project are given below **Table 3-3:**

Table 3-3: Applicability of IFC Performance Standards for CGD Project

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
Assessment and Management of Environmental and Social Risks & Impacts (PS-1)	PS-1 establishes the importance of integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; the client's management of environmental and social performance throughout the life of the project.	The PS-1 is applicable to projects with environmental and/or social risks and/or impacts. The proposed project is a CGD of NGP Project and will have environmental and social impacts such as stress on existing water resources, generation of noise, air emission during construction activities and transportation, biodiversity impacts etc.	***Applicable*** ***Policy and Environment and Social Assessment and Management System*** **ATGL** in coordination with other responsible government agencies and third parties asappropriate, will conduct a process of environmental and social assessment. The client will also establish anoverarching policy defining the environmental & social objectives and principles that guide the project to achieve sound environmental and social performance. Further, **ATGL** needs to adhere with respect to measures suggested in ESMP of this report to manage the risks associated with its operations like stakeholder engagement, emergency response plan, contractor management plan, grievance redressal etc. and decommissioning phase of the project. ***Requirements: Identification of Risks and Impacts and Management Programs.*** **ATGL** will establish and maintain a process for identifying the environmental & social risks and impacts of the project. Management Programs will be developed depending upon nature and scale of the project. Impacts identified during construction and operation phase of the project have been detailed in **Chapter 5** of this ESIA report. **Chapter 9** defines framework for environmental and social management plan for the proposed project. ***Requirements: Organizational Capacity and competency*** **ATGL** in collaboration with appropriate & relevant third parties, will establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities in association with the project. Organization structure for implementation of environmental and social management plan has been detailed in **Section 09, EMP** of the report. It reflects the role of corporate and site level EHS team in managing EHS

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			aspects at site and outlines a clear responsibility of the EHS team in management of EHS with respect to ESMP. Some of the specific trainings that will be carried out on routine basis are as follows: • Occupational Health & Safety • Fire Safety & Prevention • Emergency Response Preparedness • Operational Training • HR Induction Training • PPE Training • Driver Safety • Implementation of Environmental and Social Management/Action plans The above-mentioned trainings are preliminary trainings which will be undertaken at inception stage once the employee/worker joins the company and/or project. Post that, monthly refresher training can be taken especially for the workers. **ATGL** will draw project specific HSE plan and other management plans like water management, waste management, labour management, site security etc ***Requirements: Emergency Preparedness and Response*** The **ATGL** will establish emergency preparedness and response system to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people and/or the environment. The client is required to design emergency preparedness and response plans based on the risks to community health and safety identified during the risks and impacts identification process. The level of planning and communication should be commensurate with the potential impacts.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			ATGL will establish procedures to monitor & measure effectiveness of management program, as well as compliance with any related legal and/or contractual obligations and regulatory requirements. This ESMP will have to be monitored on aregular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments. ***Requirements: Monitoring and Review*** The monitoring process will cover all stakeholders including contractors, labourers, suppliers, and local community impacted by project activities and associated facilities. Inspection and monitoring of environmental & social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring, **ATGL** will ensure that all contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by **ATGL's** trained team & external agencies/experts. The entire process of inspections & audits will be documented. The inspection and audit findings will be implemented by contractors in their respective areas. ***Requirements: Stakeholder Engagement, Disclosure of Information and Consultations*** **ATGL** should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialogue with all stakeholders. **ATGL** will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks & impacts. It will be tailored to characteristics and interests of the affected communities. **ATGL will** provide affected communities with access to relevant information on: (i) Purpose, nature, and scale of the project.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			(ii) Duration of project activities (iii) Any risks to and potential impacts on such communities and Relevant mitigation measures. (iv) Envisaged stakeholder engagement process. (v) Grievance mechanism. When affected communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the affected communities with opportunities to express their views on project risks, impacts and mitigation measures. It will allow the client to consider & respond to them. **Chapter 8** of the report details the stakeholder identification and engagement related to the project. A stakeholder's engagement plan is also formulated as a part of ESIA report to correct any gaps and ensure adequate stakeholder engagement going forward.
Labour and Working Conditions (PS-2)	Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The objectives of PS 2 are: • To promote fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain, and improve worker- management relationship. • To promote compliance with national employment and labour	The proposed project will involve employment of direct and contracted workers during construction and operation phase. The client will engage direct workers, workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).	***Applicable*** ***Requirements: Working Conditions and Management of Worker Relationship*** The client will provide workers with documented information that is clear and understandable, regarding their rights under national labour and employment law. The proponent shall ensure measures to: • Prevent child labour, forced labour, and discrimination. • Freedom of association and collective bargaining shall be provided. • Wages, work hours and other benefits shall be as per the national labour and employment laws. **ATGL** will ensure that reasonable working conditions and terms of employment for both direct and contracted workers through contractor agreements are provided. Contractor engaged by **ATGL** for various activities should ensure that terms of employment include wages and benefits, wage deductions, hours of

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and health of workers. • To avoid use of forced labour.		work, breaks, rest days, overtime arrangements, overtime compensation, medical insurance, pension, leave for illness, vacation, maternity, and holiday are communicated to workers clearly. Migrant workers, if employed shall also be provided same working conditions equivalent to those of non-migrant workers performing the same type of work. It will be the responsibility of all theconstruction contractors engaged by **ATGL** for the project, to provide accommodation, transportation, and basic services including water, sanitation, & medical care to workers. ***Requirements: Non-Discrimination and Equal Opportunity*** **ATGL** will not discriminate with respect to any aspects of employment relationship, such as recruitment, hiring, compensation (including wages and benefits), working conditions, terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. **ATGL** will take appropriate measures to prevent any discriminatory treatment of migrant workers. Measures to prevent any harassment, including sexual harassment or psychological mistreatment within the workplace will also be undertaken. ***Requirements: Retrenchment*** **ATGL** should ensure that all workers receive notice of dismissal and severance payments mandated by law and collective agreements in a timely manner. **ATGL** should ensure that proper consultations are undertaken with the workers before retrenchment, if any. Selection criteria for those to be laid off should be objective, fair, and transparent. The retrenchment should not be based on personal characteristics and unrelated to inherent job requirements.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			Requirements: Grievance Mechanism **ATGL** will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. In providing a grievance mechanism through which workers may raise workplace concerns, **ATGL** should ensure that matters are brought to management's attention and addressed expeditiously. **ATGL** needs to document all grievances and follow up on any corrective actions. ***Requirements: Protecting the Work Force*** **ATGL** will not employ children in any manner that is economically exploitative or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. **ATGL** is required to ensure that no child labour (as defined in IFC PS 2), forced labour is employed by the contractor during construction and operation phase of the project. **ATGL** should also exercise diligence regarding key contractors and subcontractors so that they do not knowingly benefit from practices that lead to bonded or indentured status of workers. ***Requirements: Occupational Health and Safety (OHS)*** **ATGL** will provide a safe and healthy work environment, considering inherent risks in its sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women. **ATGL** will extend a safe and healthy work environment to contracted workers and to any other workers who provide project-related work and services. **ATGL** should ensure that training is provided to all workers on relevant aspects of OHS associated with their daily work, including emergency arrangements and OHS briefing for visitors and other third parties accessing the premises. All occupational injuries,

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			illnesses and fatalities are to be documented and should be clearly communicated to third parties, and if possible, to workers engaged by these third parties.
Resource Efficiency and Pollution Prevention (PS-3)	Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. The objectives of PS 3 are: • To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project related GHG emissions.	**ATGL** shall assess the impacts and risks associated with generation, use, storage, release, and/or disposal of pollutants during the ESIA, and implement them as per action plan. Also, pollution control measures shall be planned and implemented right from the project conception stage. Practices like minimal release of waste, handling of hazardous waste, safe disposal of waste, wastewater management etc. shall be considered prior to each phase. PS -3 is therefore applicable for the proposed project. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for development of project will entail generation of wastes like wastewater, waste oil and construction debris. The operation phase will result in generation of minor quantities of waste such as transformer oil and wastewater from cleaning of solar panels.	***Applicable*** **Requirements: Resource Efficiency** **ATGL** will implement technically and financially feasible and cost-effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities. ***Requirements: Greenhouse Gases*** **ATGL** needs to work on the management, mitigation, and reduction of GHG emissions associated with the construction, operation, and decommissioning of the pipeline. These emissions primarily include methane (CH_4), which is a potent GHG associated with natural gas distribution, and other related carbon emissions. ***Requirements: Water Consumption*** During the construction phase, water will be primarily required for dust suppression on the site, hydrostatic testing, concrete mixing, and providing catering and sanitation for the workforce. Sustainable sourcing prevents over-extraction, proper wastewater management prevents contamination. Compliance with local regulations and monitoring are crucial for sustainable water use. Continuous adjustment is essential to meet IFC Performance Standard 3 requirements and avoid the significant adverse impacts on others. ***Requirements: Pollution Prevention*** **ATGL** will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			ATGL should monitor emissions to ensure that requirements of PS-3 are being met. Monitoring frequency of pollutant emissions should be appropriate to the nature, scale, and variability of potential impacts. ***Requirements: Waste and Hazardous Materials Management*** **ATGL** will avoid generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, they will reduce generation of waste, recover and reuse waste in a manner that is safe for human health and the environment. **ATGL** should investigate options for waste avoidance, waste recovery and/or waste disposal during the design and operational stage of the project. MSDS for all the hazardous chemicals to be used during construction and operation phase should be readily available. Also, arrangements for storage yard and scrap yard needs to be made for storage of construction material and disposal of scrap. The arrangements need to be made for segregation of biodegradable and non-biodegradable waste and a CPCB authorized vendor is required to be hired for waste handling and management.
Community Health, Safety, and Security (PS-4)	PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Its main stress is to ensure that safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.	The proposed project will involve transportation of construction material and movement of construction machinery using existing village road which may pose safety risks to the affected communities.	***Applicable*** ***Requirements: Community Health and Safety and Community Exposure to Disease*** Community health and safety considerations should be addressed through a process of environmental & social risks and impact identification resulting in action plan for disclosure to project affected communities. **ATGL** is required to address community health and safety associated with the construction and operation phase of the project. A transport and traffic management plan required to be implemented during different phases of the project. Since the project will be using existing roads for transportation of equipment and machinery, impacts due to transportation on the community could be mitigated through implementation of Traffic Management Plan.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			Requirements: Infrastructure and Equipment Design and Safety For the **ATGL** it is essential to minimize risks and protect the health and safety of both workers and the surrounding community, they should also build its internal capacity to monitor engineering design and managing the potential hazards associated with the distribution of natural gas, including leaks, explosions, fire risks, and other operational safety concerns. *During Construction Phase*: The safety-first approach in pipeline design involves integrating safety features like gas leak prevention measures, pressure relief systems, and venting systems. It also ensures easy emergency access and provides worker safety equipment to minimize risks associated with natural gas exposure. The project will pass through and will involve movement of vehicles through the NH, SH, MDR and other roads mainly for transportation of construction material. The traffic management plan needs to be properly implemented to avoid impacts on community safety and security. The speed limit should not exceed 20 km/hr in proximity of settlements and habitation in villages. Also, the village road should be continually repaired if damaged due to project activity. *During Operation Phase*: It is necessary for **ATGL** to ensure the Gas Distribution Safety systems such as automated shut-off valves, pressure regulation systems, and gas detection sensors to minimize the risk of leaks, fires, and explosions. Corrosion protection, Leak Detection Systems, Emergency Shut-Off Systems and worker's safety. ***Requirements: Hazardous Materials Management and Safety*** **ATGL** will avoid or minimize potential for community exposure to hazardous materials and substances that may be released by the project. The project will not use any hazardous chemicals. Limited number of hazardous substances such as diesel in DG sets, transformer oil etc., will be required. **ATGL** will either engage a contractor for handling used oil or will ensure

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			proper handling and storage procedures will be followed to minimize any contamination due to accidental spills of such substances. ***Requirements: Ecosystem Services*** CGD of NGP project being linear project there will be no significant change to physical environment, such as natural vegetation cover, existing topography, and hydrologic regime due to the project. ***Requirements: Emergency Preparedness and Response*** **ATGL** will assist and collaborate with affected communities, local government agencies, and other relevant parties to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. **ATGL is** required to design emergency response plans based on risks to health and safety of the affected community and other stakeholders. Emergency plans should be developed in close collaboration and consultation with potentially affected communities and other stakeholders. The plans should include detailed preparation to safeguard health and safety of workers and communities during emergency. ***Requirements: Security Personnel*** When the client retains direct or contracted workers to provide security to safeguard its personnel and property, it will assess risks posed by its security arrangements to those within and outside the project site. **ATGL** will make reasonable inquiries to ensure that those providing security are not implicated in past abuses; will train them adequately in use of force (and where applicable, firearms), and appropriate conduct toward workers and affected communities.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
Land Acquisition and Involuntary Resettlement (PS-5)	PS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. The main aim is to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.	In this case, the project will be located entirely within the existing Right-of-Way (ROW) of an operational road, which means the pipeline will be constructed along land that has already been designated for road use. This pre-existing ROW likely already includes agreements or easements that allow for infrastructure development. No new land acquisition will occur for the pipeline, as the land needed for construction is already allocated for road use. Hence, there will be no involuntary resettlement, displacement of people, or loss of access to land or resources. The project avoids the need for additional land purchases or changes to land use, which are the primary triggers for PS-5. Compliance to PS-5: Given that the ROW is already dedicated to infrastructure (the road), no new displacement or land acquisition is involved. Therefore, PS-5 does not apply, as there is no involuntary resettlement or physical displacement anticipated.	***Not-Applicable*** ***Requirements: verification of ROW and Land Use*** **ATGL** shall ensure that the ROW is legally clear for pipeline construction and that no new land acquisition or involuntary displacement occurs. Monitoring for Potential Issues: Even though PS-5 is not applicable, it's prudent to monitor the social and environmental impacts during construction, particularly regarding temporary disruption or access issues that could affect communities near the pipeline route. ***Requirements: Community Engagement and Engagement with Relevant Authorities*** **ATGL** shall engage with affected communities, including host communities, through the process of stakeholder engagement. **ATGL** engaged community for disclosure of relevant information and participation of affected communities during planning & implementation stage of the project. A Stakeholder Engagement Plan was developed as a part of environment and social management plan. **ATGL** shall engage with local authorities and stakeholders to ensure that the project complies with any regulatory or land-use guidelines relevant to the ROW, as well as any applicable local laws that may govern infrastructure development within road corridors. ***Requirements: Grievance Mechanism*** **ATGL** shall establish a grievance mechanism consistent with Performance Standard 2 in the project development phase. **ATGL** shall ensure to resolve grievances at the community level. It is also to be ensured that a designated person will be trained and available to receive grievances and coordinate efforts to redress those grievances through the appropriate channels, taking into consideration of any customary and traditional methods of

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			dispute resolution within the affected communities. Grievance Redressal Mechanism is already in place with **ATGL** and the same will be implemented at project level. During consultation with the land seller and Sarpanch under which all the project villages fall, it was confirmed that they have no objection or any other concern with projects plan or the acquisition of land. They expressed their satisfaction with rates from market rate compensation they got from land sale. ***Requirements: Economic Displacement*** Economically displaced persons who face loss of assets or loss of livelihood during the development of project or access to assets shall be compensated for such loss at full replacement cost.
Biodiversity Conservation and Sustainable Management (PS-6)	PS 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This standard is aimed to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.	Ground vegetation will be cleared for development of project. The project activities are not likely to have any significant impact on the ecology.	***Applicable*** ***Requirements: Protection and Conservation of Biodiversity*** For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, that may be considered only after appropriate avoidance, minimization, and restoration measures. Baseline studies for ecological aspects have been described in "**Chapter 4 ENVIRONMENTAL DESCRIPTION**" of the report. The study has been collected through site survey, literature review and initial desktop analysis. The extent of the literature review will depend on sensitivity of biodiversity attributes associated with project's area of influence and ecosystem services that may be impacted. There is no critical habitat with high biodiversity value, including: i. habitat of significant importance to critically endangered and/or endangered species. ii. habitat of significant importance to endemic and/or restricted-range species. iii. habitat supporting globally significant concentrations of migratory species and/or congregatory species.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			iv. highly threatened and/or unique ecosystems; and/or v. areas associated with key evolutionary processes in the project area of influence (AoI) and its associated facilities and in buffer zone. The line route does not pass through any forest or eco-sensitive zone. **ATGL** should adopt mitigation measures to achieve no net loss of biodiversity wherever feasible. Appropriate actions include: • Avoiding impacts on biodiversity through the identification and protection of set asides. • Restoring habitats during operations and/or after operations; and • Avoiding intentionally introduces any new alien species. **ATGL** should take all precautionary measures during laying of the pipeline to avoid any impact during project construction activities. It is advised that the pipeline should adhere to the mitigation measures given in "**Chapter 5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES" of ESIA Report.** ***Requirements: Management of Ecosystem Services*** With respect to impacts on priority ecosystem services of relevance to affected communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. Being a cleaner source of energy, no significant degradation and loss of ecosystem services are associated with the project that can pose operational, financial, and reputational risks to project sustainability.
Indigenous Peoples (PS-7)	Performance Standard-7 recognizes that indigenous peoples, such as social groups with identities that are	In Khandwa district of Madhya Pradesh, where the CGD project is proposed, Schedule Caste (SC) constitute of 17.54% of the	***Not Applicable*** Since, for the pipeline route project no land acquisition is required, hence it can be said that no land of ST population is getting affected. However, **ATGL**

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.	population, while Schedule Tribe (ST) people constitute nearly 24.67%.	has policy of not buying any land from SC/ST or other vulnerable community members to the maximum extent possible.
Cultural Heritage (PS-8)	PS 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the convention concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage during their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity. For this Performance Standard, cultural heritage refers to tangible forms of cultural heritage, such as tangible moveable or immovable	No archaeological monument or place of importance is located within a 05 km radius from the project site. However, during site visit, a tourist attraction spot, namely, Kishore Kumar Memorial, is located at an aerial distance of around 56 meters from the pipeline route towards the right side of the route, near Ch: 16908.64 m; TP 145.	***Not Applicable*** ***Requirements: Protection of Cultural Heritage in Project Design and Execution*** In addition to complying with applicable law on the protection of cultural heritage, World Cultural and including national law implementing the host country's obligations under the Convention Concerning the Protection of the Natural Heritage, the client will identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented. No clearance is required to be obtained from ASI as proposed development not identified within 200 meters of the protected site. However, project should be monitored during construction phase so that environmental pollution from the project would not impact the natural and cultural heritage sites around the project site. ***Requirements: Project's Use of Cultural Heritage*** Where a project proposes to use the cultural heritage, including knowledge, innovations, or practices of local communities for commercial purposes, the

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values.		client will inform these communities of (i) their rights under national law; (ii) the scope and nature of the proposed commercial development; and (iii) the potential consequences of such development. The client will not proceed with such commercialization unless it (i) enters a process of ICP as described in Performance Standard 1 and which uses a good faith negotiation process that results in a documented outcome and (ii) provides for fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with their customs and traditions. The proposed project of gas pipeline, it **will not use cultural heritage** or the archaeological site for commercial purposes.

3.4 PROJECT SPECIFIC REGULATORY GUIDELINES

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.

As per project/ activity 6 (a) of Schedule of EIA Notification 2006, oil and gas transportation pipelines that pass through national parks, sanctuaries, coral reefs, or ecologically sensitive areas sites require Environmental Clearance (EC).

A recent notification by dated 7th November 2014 by MoEF&CC (Annexure-1) accorded general approval under the Forest (Conservation) Act, 1980 (FC Act) for underground laying of optical fibre cables, telephone lines, drinking water supply pipeline and CNG/ PNG pipelines along the petroleum pipelines within existing right of way not falling in National Parks and Wildlife Sanctuaries, without felling of trees, where the maximum size of the trench is not more than 2.00 meter depth and 1.00 meter width.

The present project does not fall under any notified area in the state of Madhya Pradesh hence no clearance is required. However, the client needs to intimate the project detail to the respective State Environment Impact Assessment Authority (SEIAA) Madhya Pradesh following the procedure prescribed under the EIA Notification, 2006.

The pipeline passes along main other district roads, state and national highway hence it is required to obtain clearance from the National Highway Authority of India (NHAI) and Madhya Pradesh Road Development Corporation Limited (MPRDC). It also crosses railway lines hence will be requiring clearance from Indian Railways. The project also requires permission from irrigation department as the pipeline passes through rivers and canals (**Table 3-4**).

The line route does not pass through any eco-sensitive zone or forested area, which specifies that the project has minimal or no adverse environmental or social risks and/or impacts. Hence the proposed project can be categorized as **"Category C"** project.

Table 3-4: Applicability of all acts, laws & rules to Pipeline Project

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
1.	Environmental (Protection) Act & Rules, 1986	To protect and improve overall environment	All environmental notifications, rules and schedules are issued under this act	MoEF&CC GoI, Forest, Ecology & Environment Department, CPCB, & Madhya Pradesh Environment Conservation Board (MPECB)	Yes
2.	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 NG pipeline across either side of the flowing water course of all canals, branches, distributaries, major-minor channels etc.	Water Resources Department Madhya Pradesh (PWD)	Yes Application to be made to the Water Resources Department
3.	The Railways Act, 1989	To manage safety of railways	For using land under the right of way basis for laying the NG pipeline	Indian Railways (IR)	Yes. Permission/NOC is required from Railways Department as the NG pipeline crosses railway track at 2 locations in Khandwa.
4.	The Control of National Highways (Land and Traffic) Act, 2002	To manage safety National Highway, State Highway	For using land along the highway on right of way basis for laying the NG pipeline	National Highway Authority of India (NHAI) & Road and Building Department	Yes. Permission/NOC is required.
5.	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).	MoEF&CC	No

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
			The project lies in Category A of the notification.		
6.	Forest (Conservation) Act, 1980 and amendments thereof	To check deforestation by restricting conversion of forested areas into non-forested areas.	Not Applicable.	Forest Department Khandwa (Madhya Pradesh)	No
7.	National Forest Policy (Revised), 1988	To maintain ecological stability through preservation and restoration of biological diversity	Not Applicable.	Forest Department Madhya Pradesh (Madhya Pradesh)	
8.	Wildlife Protection Act, 1972 & 2022 (Amended)	To protect wildlife sanctuaries and National Parks	Not Applicable.	NBWL, SBWL & Chief Wildlife Warden, MoEF&CC	No
9.	Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof	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.	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
10.	Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	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.	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
11.	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.	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
12.	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.	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
13.	Public Liability Insurance Act, 1991	Insurance for the purpose of providing immediate relief to the persons affected	Contractor needs to stock hazardous material like diesel, Bitumen,	Madhya Pradesh Environment	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
		by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto	Emulsions etc. safely in designated locations within the construction camp	Conservation Board (MPECB)	
14.	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (Amended,2023)	Storage, handling, transportation, and disposal of hazardous waste	Storage and handling of hazardous waste during construction	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
15.	Solid Waste Management Rules, 2016	Management and handling of solid waste	For disposal of solid waste generated during construction	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
16.	Construction and Demolition Waste Management Rules, 2016	Management of construction and demolition waste	For disposal of solid waste generated due to construction and demolition	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
17.	Batteries (Management & Handling) Amendment Rules, 2023	Management and handling of used lead acid batteries	Safe disposal of used lead batteries through authorized e waste recyclers	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
18.	E-Waste (Management) Amendment Rules, 2023	Effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes	Handling of e-waste	Madhya Pradesh Environment Conservation Board (MPECB)	Yes
19.	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
20.	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 as the transportation and distribution of compressed natural gas will take place	Ministry of Petroleum & Natural Gas	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
21.	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 as the distribution of natural gas will take place in Madhya Pradesh	Ministry of Petroleum & Natural Gas	Yes
22.	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 industrial, residential and commercial areas.	Ministry of Petroleum & Natural Gas	Yes
23.	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
24	NOC from Gram Panchayat	As per Madhya Pradesh Panchayat Raj Adhiniyam, 1993	Madhya Pradesh Panchayat Raj Adhiniyam, 1993	Village Sarpanch	Application to village Panchayat falling in the stretch is to be made

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 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 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, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home 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).

3.5 PIPELINE DESIGN AND CODE

According to the PNGRB Notification 2008, the design, materials and equipment, welding, fabrication, installation, testing, operation and maintenance, and corrosion control of the CGD network shall comply with the requirements of ASME B31.8, except where such requirements are specifically cancelled, replaced, or modified by the regulations specified in this notification.

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 (**Table 3-5**).

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 3-5: Applicable Standards and Codes

Sl. No.	Code No.	Description
1.	ASME B31.8	Gas Transmission and Distribution Piping Systems
2.	ASME B16.5	Specification for Pipe flanges and flanged fittings
3.	ASME B16.9	Specification for Factory made Wrought Steel Butt welding fittings
4.	ASME B16.11	Specification for Forged Fittings, Socket – Welding and Threaded
5.	ASME B16.34	Pressure and temperature ratings for forgings, castings, plate, bar, and tubular products
6.	API 5L	Specification for Line Pipe
7.	API 6D	Specification for Pipeline Valve
8.	API RP 1102	Steel Pipelines Crossing Railroads & Highways
9.	API 1104	Welding of Pipelines and Related Facilities
10.	API RP 2201	Procedures for Welding or Hot. Tapping on Equipment in Service
11.	ASTM A106	Specification for Seamless Carbon Steel Pipe for High- Temperature Service

Sl. No.	Code No.	Description
12.	ASTM A234	Specification for Piping Fittings of Wrought Carbon steel and alloy steel for moderate and High Temp. service
13.	ANSI 16.20	Ring-joint Gaskets & Grooves for Steel Pipe Flanges
14.	T4S	Technical Standards and Specifications Including Safety Standards for City or Local Natural Gas Distribution Networks
15.	INFRA/IMP/CGD/1/2013	Integrity Management System for City or Local Natural Gas Distribution Network
16.	G.S.R. 478(E)	Determining capacity of Petroleum, Petroleum products and Natural Gas Pipeline
17.	Codes	Details
18.	G.S.R 720(E)	Code of Practice for Quality-of-Service City or Local Natural Gas Distribution Networks
19.	G.S.R 196(E)	Authorizing Entities to Lay, Build, Operate or Expand City or Local Natural Gas Distribution Networks
20.	OISD 141	Design and Construction Requirements for Cross- Country Hydrocarbon Pipeline
21.	DIN 30671	Thermoset Plastic Coating for Buried Steel Pipes
22.	DIN 30672	Tape and Shrinkable Materials for the Corrosion Protection of buried or Underwater Pipelines without Cathodic Protection for Use at Operating Temperatures Up to 500 ^{o}C
23.	DIN 30673	Bitumen Coatings and Linings for Steel Pipes, Fittings and Vessel
24.	DIN 30675-1	External Corrosion Protection of Buried Pipes & Range of Applications for Steel Pipes
25.	DIN 30677	Protection of Buried Valves Against Corrosion Coating (External) with Duroplastics
26.	DIN 30670	Polyethylene Coating on Steel Pipes and Fittings
27.	EN 12062	Non-Destructive Examinations of Welds-General Rules of Metallic Materials
28.	EN 10285	Steel tubes and fittings for on shore and offshore pipelines- external three-layer extruded polyethylene-based coating
29.	EN 12068	Cathodic Protection – External Organic Coatings for the Corrosion Protection of Buried or Immersed Steel Pipelines Used in Conjunction with Cathodic Protection of Steel Structures
30.	IS 8062	Code of Practice for Cathodic Protection of Steel Structures
31.	IS 12944-5	Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint System
32.	ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness
33.	ISO 9305	Seamless Steel Tubes for Pressure Purpose Full Peripheral Ultrasonic Testing for the Detection of Transverse Imperfections
34.	ISO 10124	Seamless 7 Welded (Except Submerged Arc Welded) Steel Tubes for Pressure Purposes. Ultrasonic Testing for the Detection of Laminar Imperfections
35.	ISO 12094	Welded Steel Tubes for Pressure Purpose. Ultrasonic Testing for the Detection of Laminar Imperfections in Strips / Plates used in Manufacture of Welded Tubes
36.	ISO 15741	Paints and Varnishes – Friction-Reduction coatings for the interior of on- and offshore steel pipelines for non- corrosive gases
37.	ISO 15590-1	Petroleum and natural gas industries-induction bends, fittings and flanges for pipeline transportation system- part:1 induction bends
38.	ISO 21809-3	Petroleum and Natural gas industries-external coatings for buried or submerged pipelines used in pipeline transportation system

Sl. No.	Code No.	Description
39.	MSS-SP-44	Steel Pipeline Flanges
40.	MSS-SP-25	Standard Marking System for Valves
41.	MSS SP75	Specification for High Test, Wrought, Butt Welding Fittings
42.	G.S.R 198€	Exclusivity for City or Local Natural Gas Distribution Network
43.	OISD 105	Work Permit for Testing & Commissioning
44.	OISD 226	Natural Gas Transmission Pipeline & City gas Distribution
45.	OISD 179	Safety Requirements on Compression, Storage, Handling & Refueling of Natural Gas (CNG).

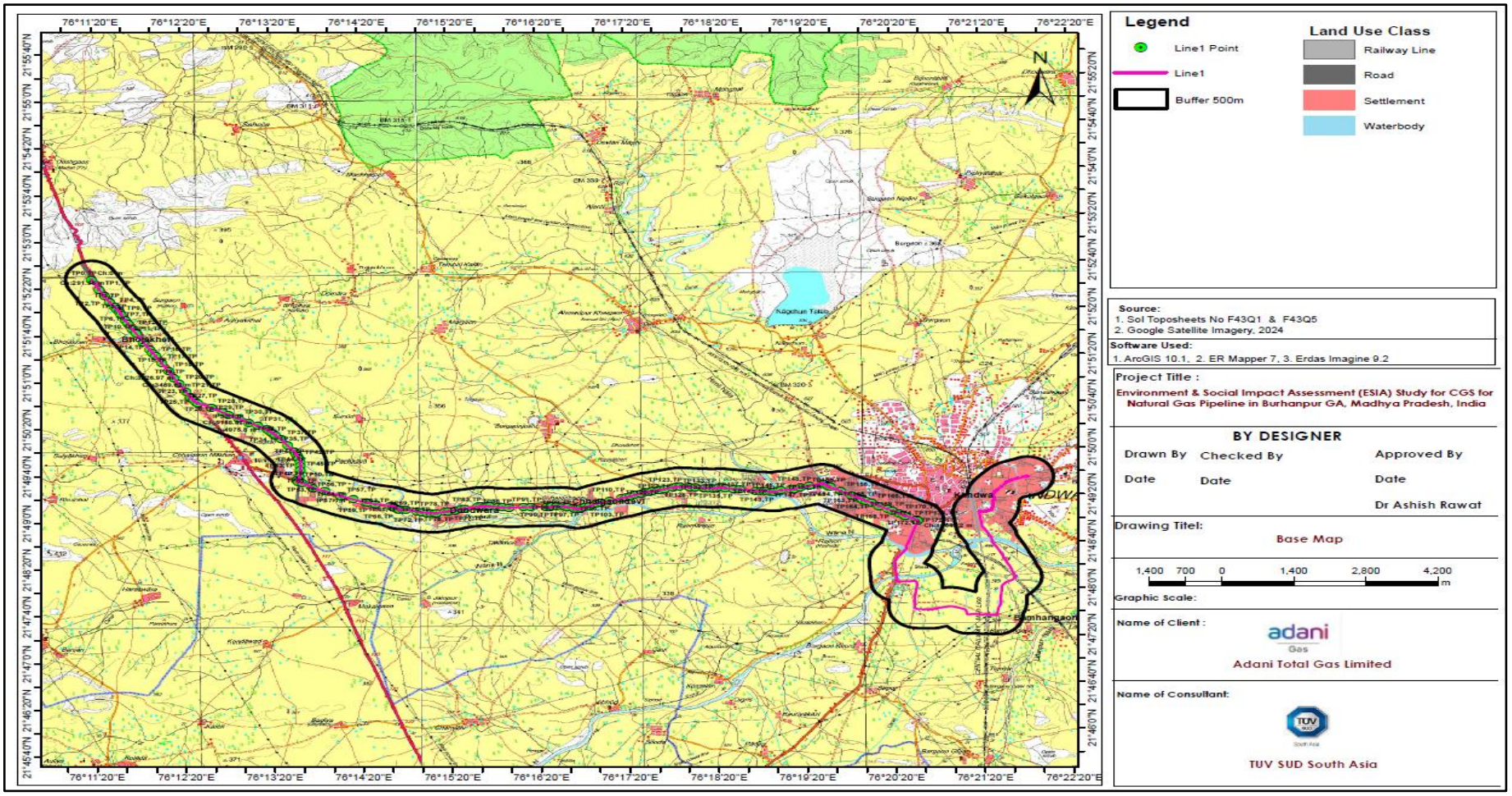
**Source: ATGL Due Diligence Report*

4 ENVIRONMENTAL DESCRIPTION

Baseline data generation forms an integral part of the EIA study and helps to evaluate the predicted impacts on the various environmental and social attributes in the study area by using scientifically developed and widely accepted environmental and social impact assessment methodologies.

4.1 STUDY AREA

The study area comprises “Project Footprint Area” (area to be physically impacted by the project activities across all phases) and “Area of Influence (up to 500 m on both sides)” and the “buffer zone” (5 km). The primary field investigations for the physical and biological and socio-economic environment have been collected from Area of influence on **23rd and 24th January 2025**.



**Source: TUVSUD GIS Mapping*

Figure 4-1: Project Study Area superimposed on Toposheet

4.2 PROJECT FOOTPRINT AREA

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities across all phases. The proposed pipeline for the CGD runs along ROW of the Khandwa GA starting near Reliance Jio BP Future Fuels along NH347B in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. The diverted pipeline route starts from Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town, which connects with the main pipeline route.

4.3 AREA OF INFLUENCE (AOI)

Baseline monitoring for Environmental Impact Assessment study has been designed with primary data collection followed by secondary data review for establishing and interrelating the baseline condition of the project area. To collect the data for baseline study, the 'Area of Influence' (AoI) has been defined as the area in which a direct or indirect impact on the physical, biological, social, or cultural environment might occur, and it has been considered as 500 m to maximum buffer up to 5 km surrounding of the project footprint area. For the detailed analysis of the current baseline of the project, the following areas of influence have been defined in **Table 4-1.**

Table 4-1: Detailed Area of Influence (AOI) considered for Different Attributes

Sl. No.	Environmental & Social issues	Area of Influence (AoI)	Justification
Physical Environment			
1.	Ambient Air Quality	Immediate vicinity of the project foot-print area	Dust Emissions, Fugitive dust etc. is typically observed within 100-200 meters from the Construction/operation areas. AoI minimum of 500 m to maximum 1.00 km has been taken to capture all sources of emissions including vehicular movement in surrounding and across access road.
2.	Noise Pollution	500 m-1.00 km	Primary Noise effect from a noisy source can often be detected up-to 400-500 m from any operation. However, keeping in view, an AoI of 500 m to maximum 01.00 km has been considered from noise pollution from all sources including vehicular movement.
3.	Surface Water	Surface Water Bodies (within 05 km of the project foot-print area)	The entire project area of influence has been considered for Surface Water Sampling. Surface water samples were collected from multiple surface water sources, which are coming within AoI (500-05 km) aerial distance from project foot-print areas.
4.	Ground Water condition	5.00 Km	Ground water quality of the project study area has been assessed in project influence area, close to the proposed construction activity sites and habitation areas.
5.	Land Environment	500 m	An area of 500 m has been considered around the project footprint area and near to habitation areas to predict the indirect effects usually occur due to accidental release of hazardous waste, vehicular/heavy machinery movement and activities at allied sites.
Biology and Environment			
1.	Terrestrial Ecology	500 m-05.00 Km	Area of Influence has been considered as 10.00 km around the project footprint area to identify the biodiversity of the area and its impacts due to the project.

Sl. No.	Environmental & Social issues	Area of Influence (AoI)	Justification
Socio-economic Environment			
2.	Socio-economic conditions	05.00 km	An AoI of 05.00 Km radius is considered for the socio-economic consultations to determine perceived impacts due to the project including employment opportunity and increased anthropogenic/vehicular activities in remote areas.

4.4 METHODLOGY FOR ENVIRONMENTAL AND SOCIAL BASELINE SURVEY

Environmental & Social study includes the study of various baseline environmental aspects covering Physical, Biological and Socio-Economic parameters. Integration of these parameters gives an overall perception of positive and negative impacts due to construction of underground NG pipeline within the port area.

Initially after primary desktop assessment of the project, detailed project reports and site details were collected from Adani Total Gas Limited. A team comprising of Social, ecological, and environmental Experts from TÜV SÜD visited the site on **23rd and 24th January 2025** to collect the primary baseline data of drainage, land-use, topographic, ecological condition of the site and collect data on socio-economic scenario of the project study area. Baseline monitoring plan has been finalized and subsequently, in accordance with the baseline monitoring plan, environmental monitoring is currently under progress and will be completed in March 2025 in accordance with the Terms of Reference and Guidelines of MoEF&CC & CPCB.

Apart from the baseline environmental monitoring for Ambient Air, Noise, Soil, Water (Groundwater & Surface water) various other attributes such as aquatic and terrestrial avifaunal habitat & biodiversity, socio-economic status, geology, hydrology, and land-use pattern etc. of the study area was also studied and data has been collected from primary and authenticated secondary sources (**Table 4-2**).

Table 4-2: Secondary Data Sources for Baseline Study

Data	Source
Long term Climatological Data	India Meteorological Dept. (IMD), Govt. of India and data from other Remote climate monitoring stations
Toposheets	Survey of India (SOI), Dehradun
Soil Maps	NBCC Nagpur
Satellite Data	NRSA, Google Earth, etc.
Forest Characteristics, Forest Types & Resources	Forest Survey of India (FSI)
Details of Flora, Fauna & Wildlife Habitats	From various publicly available research papers, journals, and manuscripts
Land Record and Demography Status	State Revenue Dept., District Statistical Handbook & Census of India, etc.
Drainage Pattern	Water Resource Dept., NASA SRTM data
Hydro-geology Status	District Ground Water Report, Central Ground Water Board (CGWB)
Technical Data	Details provided by **ATGL**

Prior to the site visit, the following relevant and available documents related to the underground NG pipeline project at Khandwa and adjacent villages in Khandwa District, Madhya Pradesh have been collected from **ATGL**:

- Project Location Maps
- Project specifications and technical details of the project – DPR

Primary environment baseline monitoring and secondary data collection was undertaken as per process tabulated below in **Table 4-3.**

Table 4-3: Environmental and Social Attributes studied

Sl. No.	Attributes	Parameters	Source & Frequency
1.	Ambient Air Quality	SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO	Twice a week for 1 month
2.	Ambient Noise quality	Noise level in dB(A)	Daytime and night-time sampling for single day for all locations
3.	Soil condition and its quality	Physical and chemical parameters	Composite sampling in all locations
4.	Ground water quality	Physical, chemical, biological parameters as per IS 10500:2012	Single sampling (mainly from Bore well/tube well)
5.	Surface water quality	Physical, chemical, biological parameters of different surface water stream/body within the project study area.	Single Sampling from surface water bodies.
6.	Socio-economic aspects	Socio-economic, demographic, livelihood characteristics	Secondary sources data like primary census abstracts of Census of India 2011.
7.	Hydrology & Drainage	Drainage area and pattern, nature of streams, aquifer characteristics,	Based on primary site visit and data collected from secondary sources.
8.	Ecology	Floral and faunal distribution, Terrestrial and water birds citing, identification of any migratory corridor within the project study area	From different places within study area

4.5 SECONDARY DATA COLLECTION

The environmental monitoring stations were selected for ambient Air Quality, Ambient Noise Quality, Surface Water Quality, Ground Water Quality and sediment Quality, Soil Quality NABL accredited & MoEF&CC approved laboratory is selected for conducting secondary environment baseline monitoring at project study area, under supervision of **TÜV SÜD** representative. In accordance with the Scope of Work, the baseline environmental monitoring will be carried out in the project footprint and study area during March 2024.

4.6 PHYSICAL ENVIRONMENT

The study related to physical environment was conducted through site visits and review of the data from secondary sources such as Census of India, District Statistical Handbook, State of the Forests Report, Central Groundwater Development Board Report, District Revenue Office, and other published peer information in respect of the topographical and physiographical features, regional and the local geology of the project area, climatology, and seismicity.

Soil characteristics were established through physio-chemical tests of the soil samples revalidated though the published literature while land use and land cover; slope of the study area were established through remote sensing by using GIS tools. Prior the initiating the baseline survey, monitoring design was prepared in coordination with TÜV SÜD Environmental Experts and the same was fine-tuned during site survey prior to the baseline monitoring.

The components of physio-chemical environment discussed in this section include:

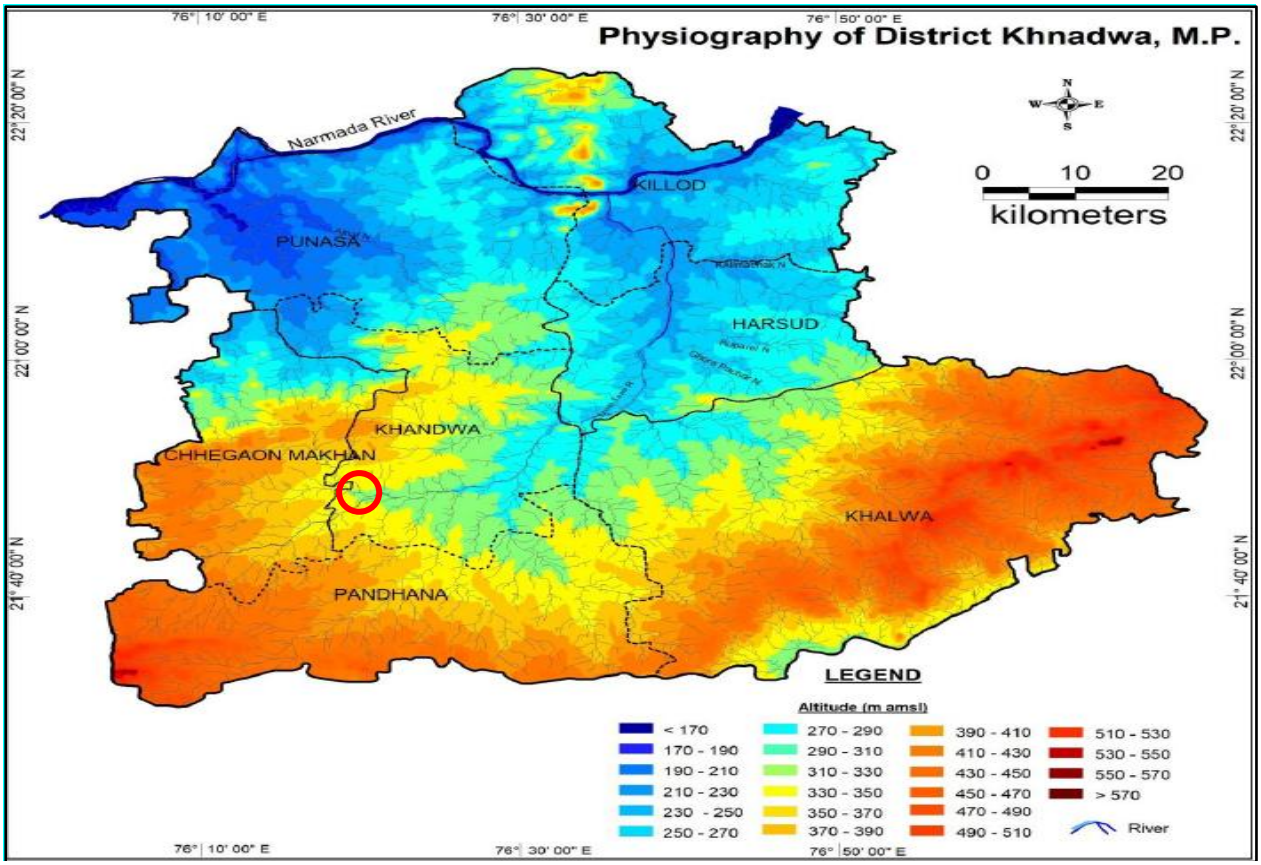
1. Physiography & Topography
2. Geomorphology and Drainage
3. Land-Use & Land Cover
4. Soil Quality
5. Seismicity & Natural Hazards
6. Climate & Meteorology
7. Ambient Air Quality
8. Ambient Noise Levels
9. Ground Water Quality
10. Surface Water Quality

4.6.1 Physiography and Topography

The NG pipeline runs underground along NH-347B starting from the CGS near Bhojakhedi village and extends all the way to Naredi Petrol Pump (HP Petrol Pump) in Khandwa town.

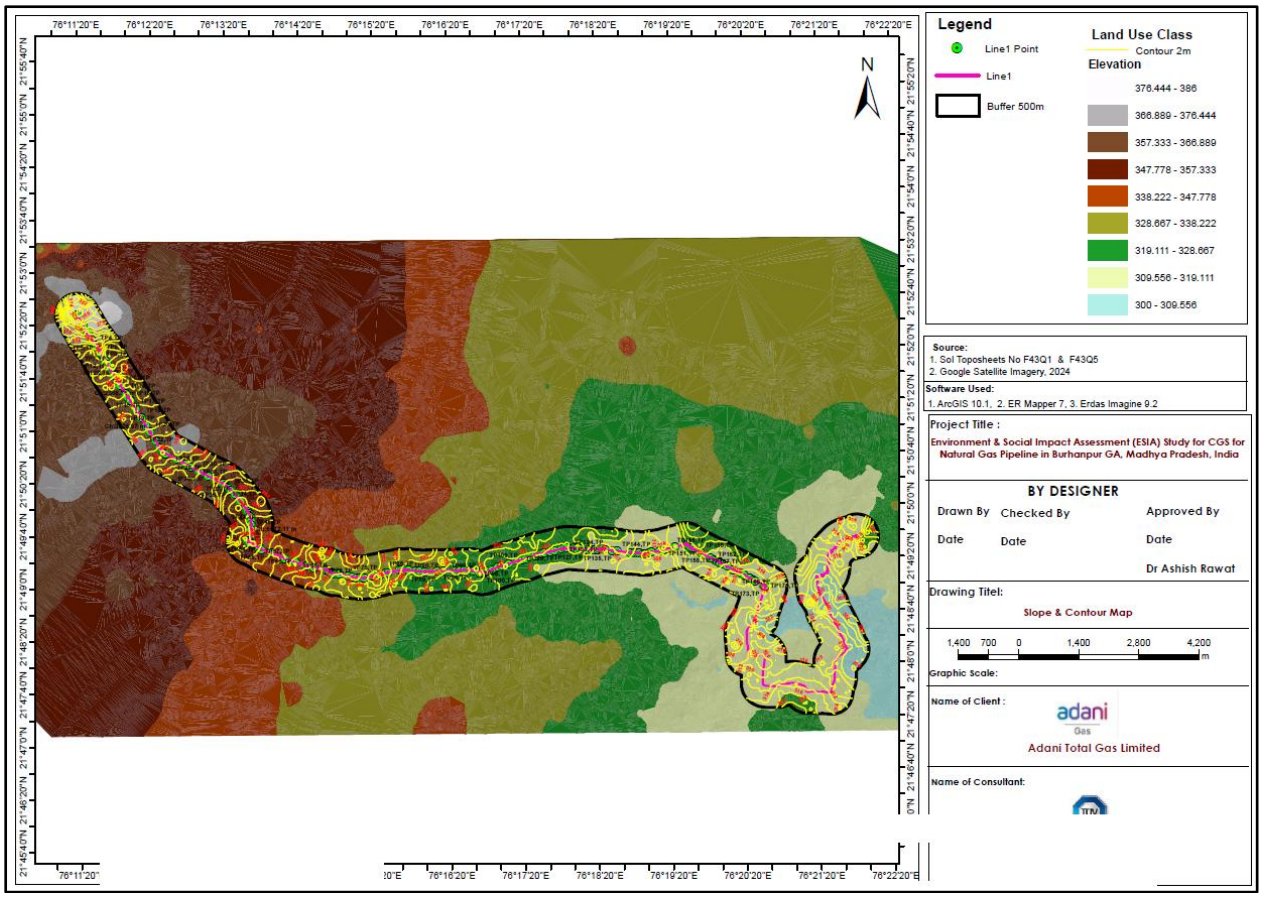
Khandwa district is situated between 21° 33' N latitude to 22° 25'N latitude and 76° 10'' longitude to 77° 13' E longitude. The highest point in the district is 905.56 meters above mean sea level, while the lowest is 180.00 meters. The district is bordered to the east by Betul and Hoshangabad districts in the Hoshangabad Division, and to the south by Burhanpur District in the Indore Division. To the west, it is bordered by West Nimar District in the Indore Division, and to the North, it adjoins Dewas District, also in the Indore Division.

Khandwa district features a varied landscape. The highest point in the district, located in the southern area, reaches an elevation of 570 meters above mean sea level (amsl). The western part of the district is also notably elevated. The lowest elevation is found along the southern and northern edges of the district. Most of the district falls within an elevation range of approximately 210 to 380 meters above mean sea level. The Contour Map (**Figure 4-2**) of the project AOI is shown below, which indicates that the project area falls between 310-350 m amsl.



**Source: Aquifer Map and Management Plan- Khandwa District*

Figure 4-2: Physiographic Map (Red Circle: Project AOI)



Source: TUV SUD GIS Mapping Study

Figure 4-3: Terrain and Contour Map of Project AOI

4.6.2 Geology

Khandwa district is primarily characterized by the structural hills of the Vindhyan and the denudation hills of the Deccan traps. In addition to these, the district also features other geomorphic features such as:

- Floodplains,
- Alluvial plains
- Valley fills
- Intermountain depressions
- Volcanic pediments

4.6.3 Geomorphology and Drainage

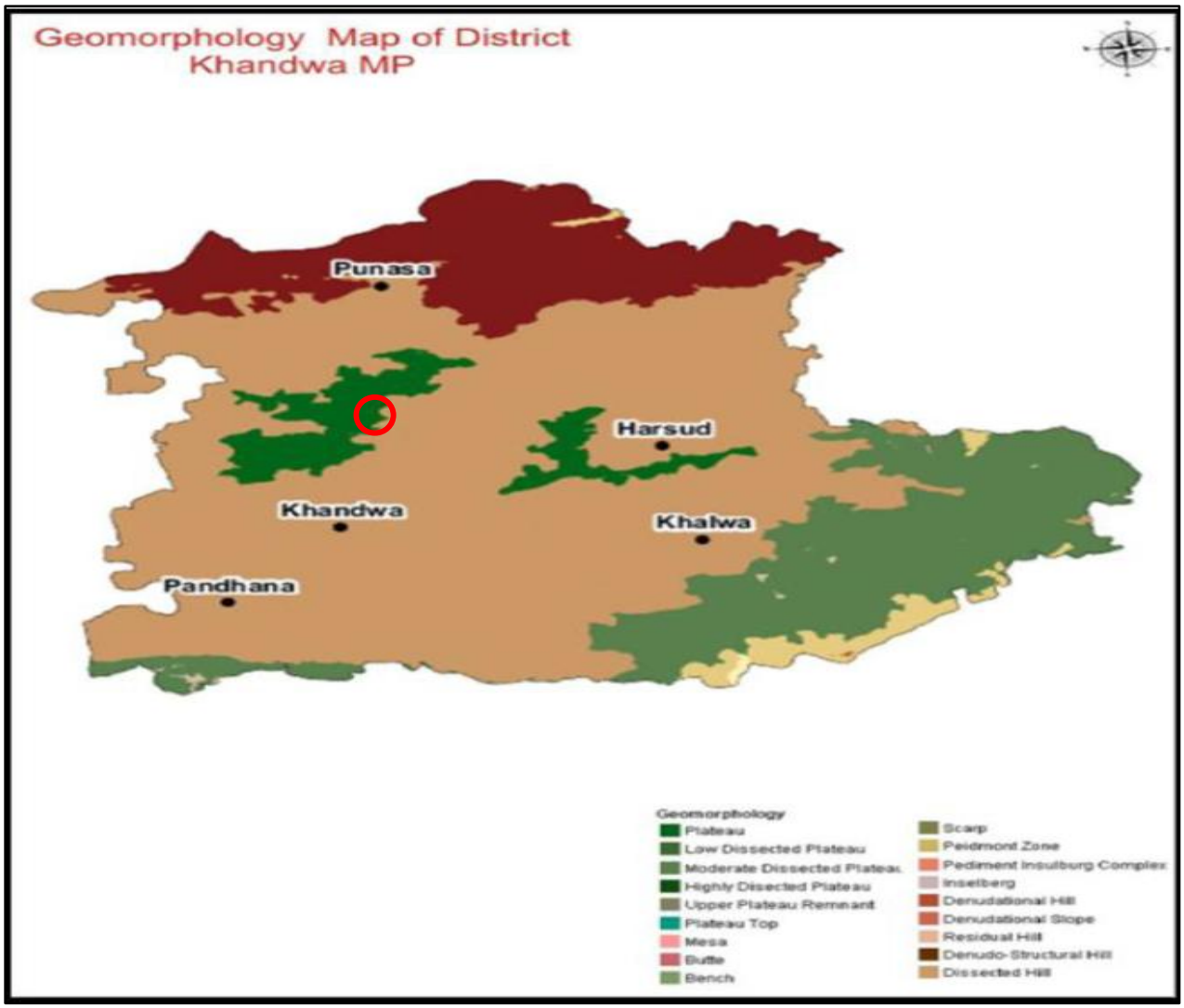
4.6.3.1 Geomorphology

The Khandwa district is primarily characterized by structural hills of the Vindhyan and denudation hills of the Deccan traps. In addition to these, other geomorphic features such as flood plains, alluvial plains, valley fills, intermountain depressions, and volcanic pediments are also present. The district is mostly located on uplands situated between the valleys of the two major rivers, the Narmada and Tapti, which flow parallel to each other from east to west. The Hatti hill range borders and overlooks the Tapti valley

to the south throughout its length in the district. The highest point above sea level is 905.56 meters, and the lowest is 180.00 meters. The district is divided into two main natural physiographic regions:

- **Narmada Valley**: The Narmada River flows east to west through the northern part of the district, with streams like Khari and Kanar (Lohar) joining it from the North. These are the only perennial streams in the area. The hills in the Chandgarh and Selani regions rise from 220 to 500 feet (61 to 152 meters) above the plains, with the average heights being around 750 feet (228 meters) in Selani and 850 feet (285 meters) in Chandgarh. A notable sandstone hill sits at the junction of the Chhota Tawa and Narmada rivers, rising about 500 feet (152 meters). The southern tributaries of the Narmada flow toward the North or northwest, following the slope of the Narmada Valley in the district. The eastern part of the valley is at an average height of 800 feet (243 meters), while the western plain near Mandhata is about 700 feet (213.4 meters) above sea level. The Chhota Tawa's catchment area lies at around 1,000 feet (304.8 meters) above sea level.
- **Tapti Valley:** The Tapti River flows through a narrow valley situated between two parallel Satpura ranges in the southern part of the district. It extends for approximately 50 miles from the East-North East to the West-South West.
- **Satpura ranges:** The Satpura refers to a vast and intricate system of mountain ranges and highlands, stretching about 600 miles long and 100 miles (161 km) wide. It lies directly south of the Narmada, extending from the western coast of India to the Amarkantak hills in the east. This system also includes ranges that extend as far south as the Southern Maikal range or the Saletakeri hills.

In Nimar (East), the general elevation is about 1,000 feet (304.8 meters) above sea level, with variations ranging from 618 feet (188.4 meters) at the Narmada riverbed in the extreme northwestern to 3,010 feet (917.5 meters) at the Pipardol peak of the Hatti range.



Source: Aquifer Map and Management Plan- Khandwa District

Figure 4-4: Geomorphological Map of Khandwa District (Red Circle: Project AOI)

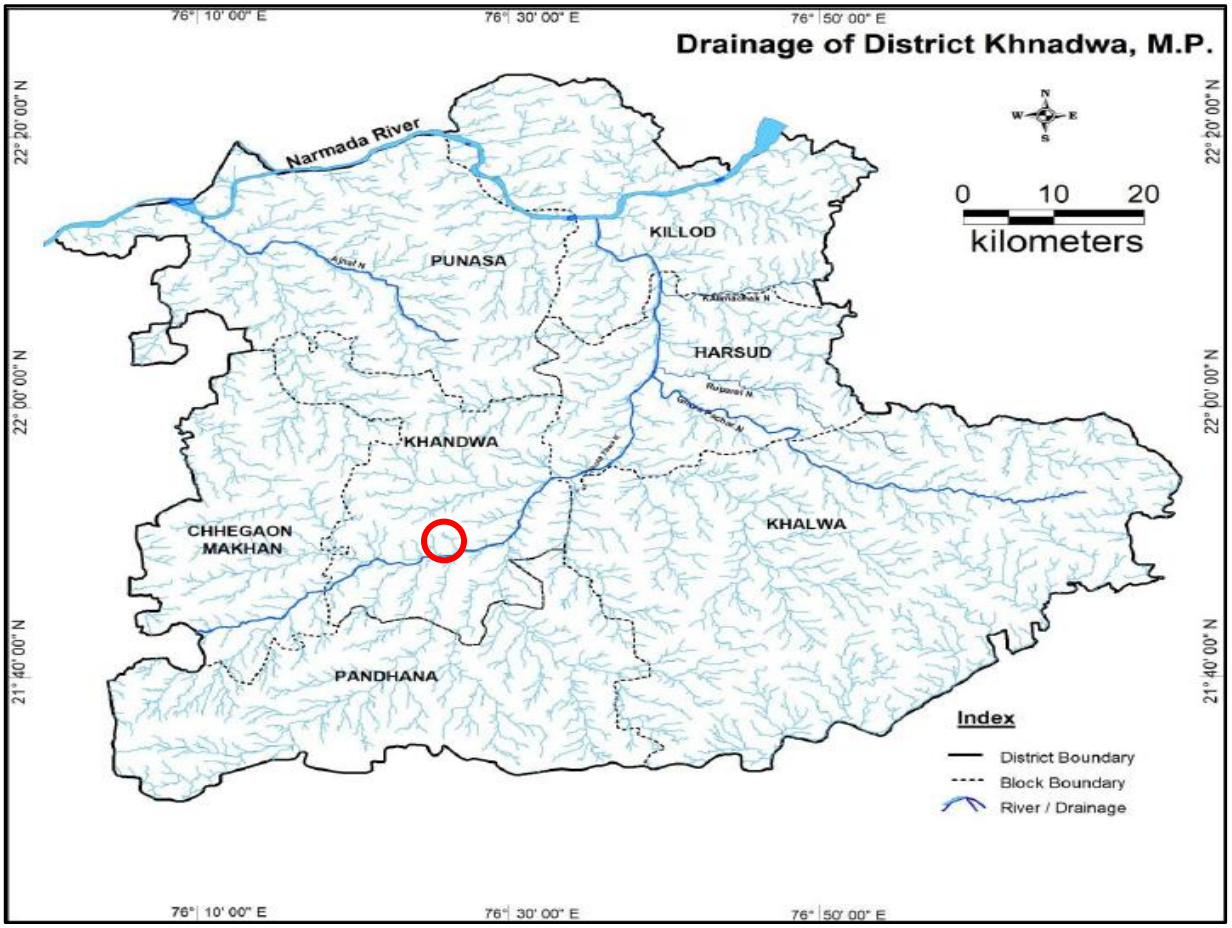
As indicated in **Figure 4-4** above, the project study area falls in *Piedmont Zone*.

4.6.3.2 Drainage

The drainage of the region is part of the Narmada and Tapti river systems. The water divide between these two systems follows the northern crest of the Satpura mountain range. Most of the district, located to the North of this divide (except for the low-lying areas of Chandgarh and Selani), drains northward toward the Narmada via the Chhota Tawa and Kaveri rivers, along with numerous small streams. The land north of the Narmada slopes southward, and the drainage in this area consists of smaller rills and rivulets that flow into the Narmada. The region between the northern and southern forks of the Satpura range, largely in the Burhanpur tehsil, is drained by numerous streams that flow into a valley occupied by the Tapti River. The district's southern boundary primarily follows the crest of the Hatti range, with its southern slopes draining into a left-bank tributary of the Tapti River in East Khandesh, Maharashtra. Unlike most other major rivers of the South Indian Plateau, both the Narmada and Tapti rivers flow westward, cutting through fault or rift valleys in the solid Deccan Plateau. As a result, the drainage of these rivers follows

the typical rift valley pattern. The narrow, straight alluvial valleys, steep bordering ranges, deep riverbeds, and numerous small tributaries meeting the main rivers at near right angles are all distinctive features of the Narmada and Tapti river systems once they enter the rift valleys.

Drainage Map of district indicating project study area has been depicted below in **Figure 4-6**.



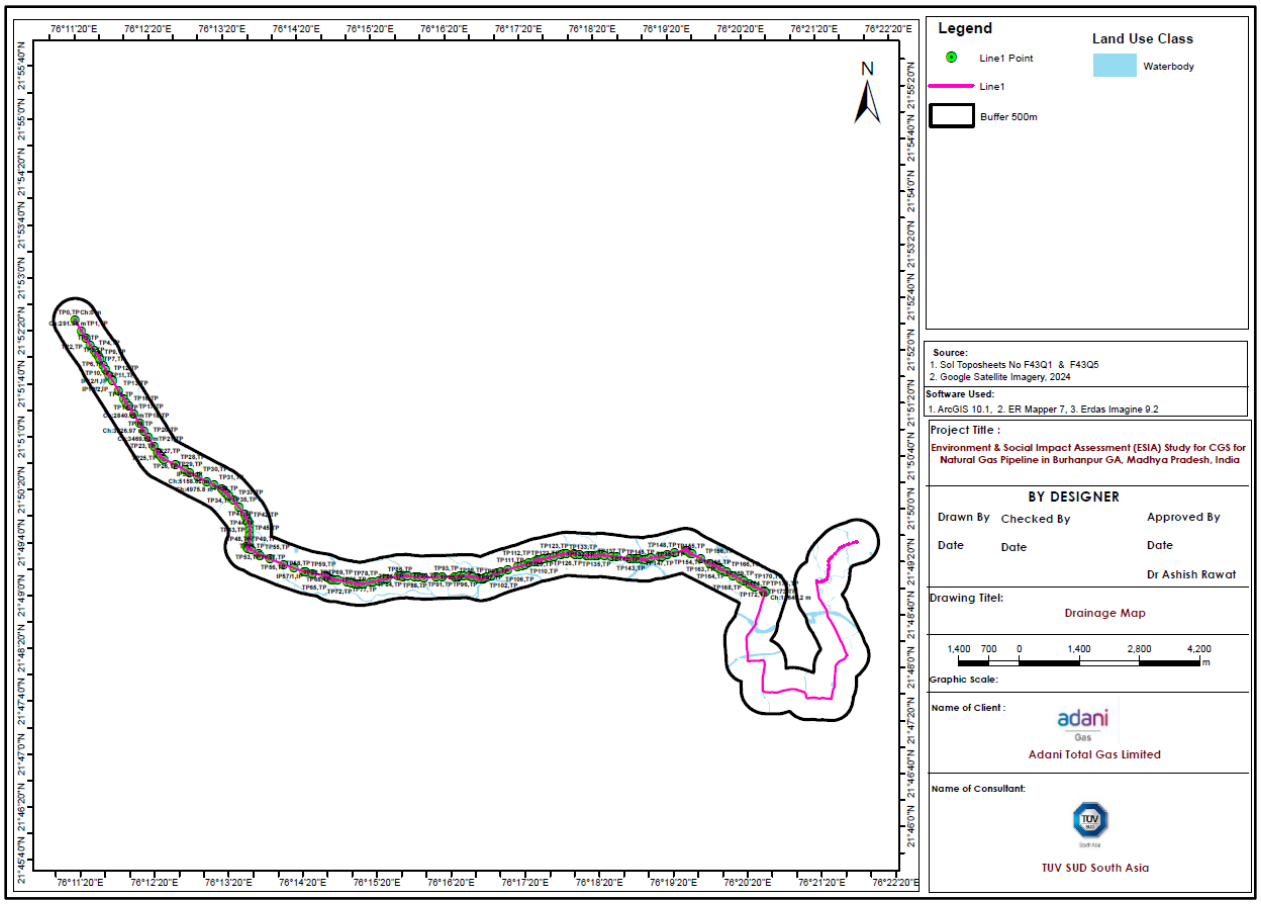
**Source: Aquifer Map and Management Plan- Khandwa District*

Figure 4-5:Drainage Map of Khandwa District (Red Circle- Project Study Area)

The pipeline crosses Aabna River. The project study area has the following drainage patterns/river systems as mentioned in **Table 4-4**.

Table 4-4: Details of Waterbodies in Project Study Area

Sl. No.	Name of Water Body	Chainage Number	Direction
1.	Aabna River	Ch: 16656.89; IP 143/1, TP	South-East to North-West



**Source: TUV SUD GIS Mapping Study (Toposheet No F43Q1 & F43Q5)*

Figure 4-6: Drainage Map of Project Study Area

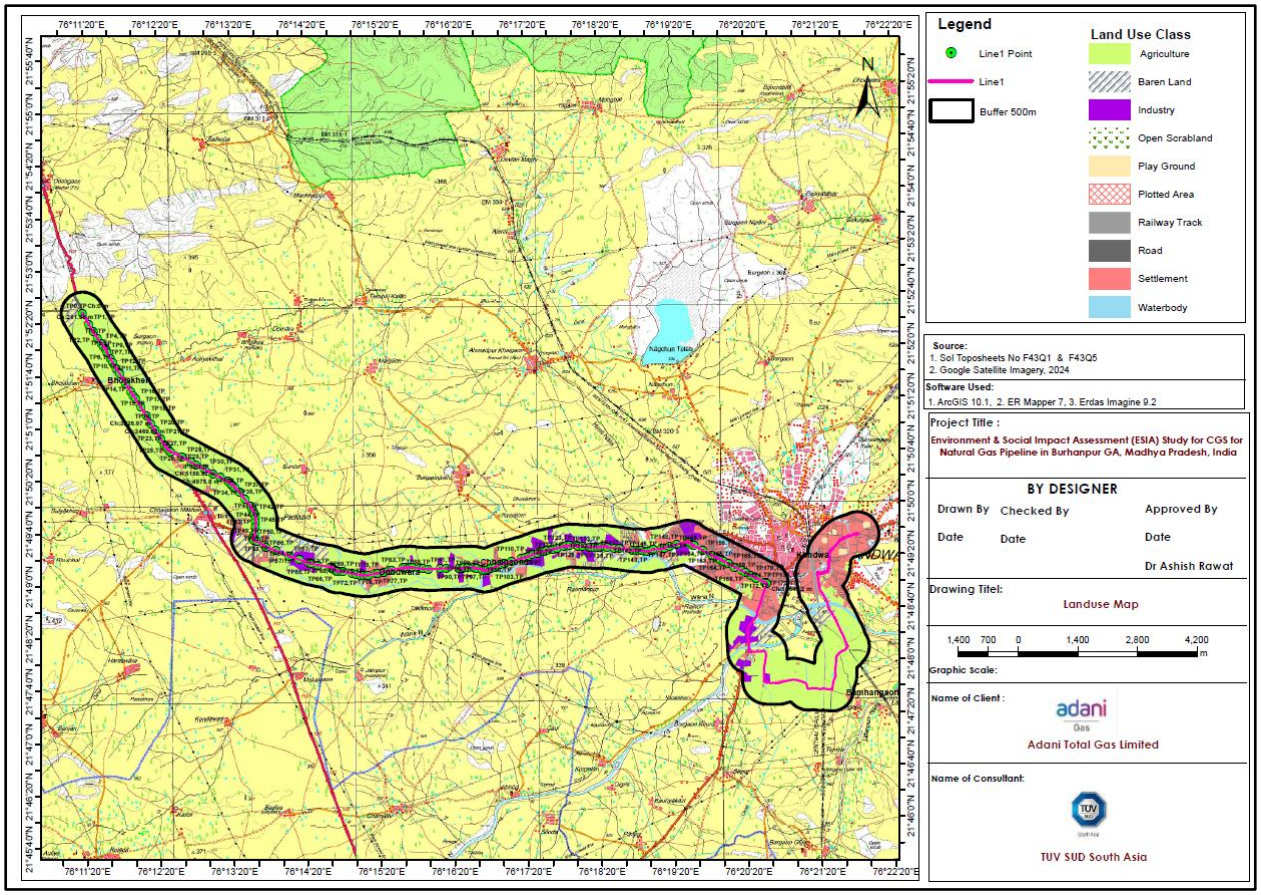
4.6.4 Land use and Land Cover

The total area of the district is 7352 km^2. The assessment of Land-use and land cover of project AOI reveals that the project study area predominantly consists of agricultural land (56.94%) followed by settlement (17.16%), barren land (8.19%), open scrubland (0.66%) respectively. Major settlement within the project study area is Khandwa town. The detailed land-use breakup of the study area is given in **Table 4-5** as follows:

Table 4-5: Land use Details of Project Study Area

S. No	Land Use	Area in Sq. Km	Area in %
1	Agriculture	16.529	56.942
2	Barren Land	2.378	8.191
3	Industry	1.613	5.556
4	Open Scrubland	0.193	0.664
5	Plantation	0.283	0.974
6	Play Ground	0.093	0.321
7	Plotted Area	0.416	1.432
8	Railway Line	0.147	0.507
9	Road	1.182	4.071

10	Settlement	4.979	17.155
11	Waterbody	1.215	4.187
Study Area		**29.027**	**100.000**



**Source: TUV SUD GIS Mapping Study (Toposheet No F43Q1 & F43Q5)*

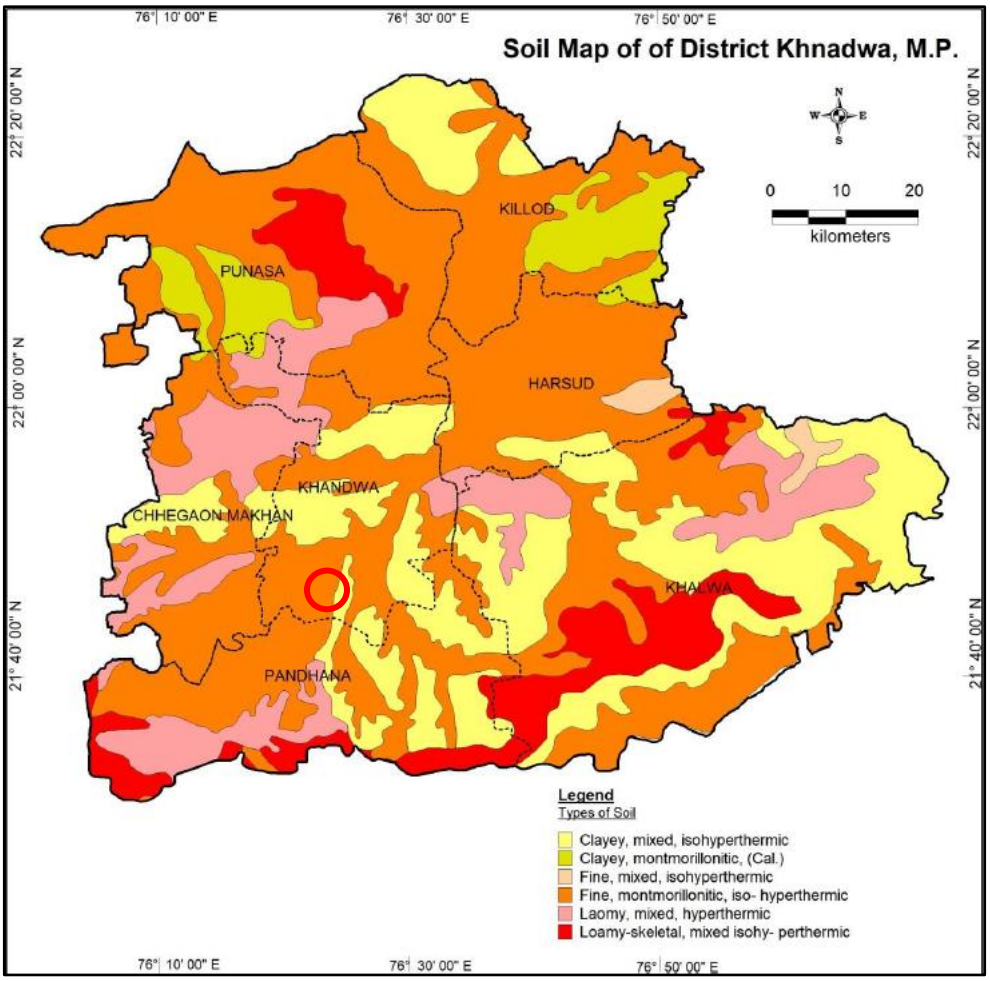
Figure 4-7:Land Use Map of Project Study Area

4.6.5 Soil Quality

The nature and characteristics of soils are primarily influenced by the relief of the area, which affects soil formation. The soils in Khandwa district are classified as medium black soils under India's broad soil classification and are considered low fertility soils. Additionally, alluvial deposits, consisting of gravel, sand, silt, or clay-sized unconsolidated material, are found along the narrow strips of rivers.

As indicated in the image above, the project area comprises of mixed clayey isohyperthermic soil and fine montmorillonitic, isohyperthermic soil.

The soil quality monitoring locations are provided in **Table 4-6 and Figure 4-9.**



**Source: Aquifer Map and Management of Groundwater Resources- Khandwa District*

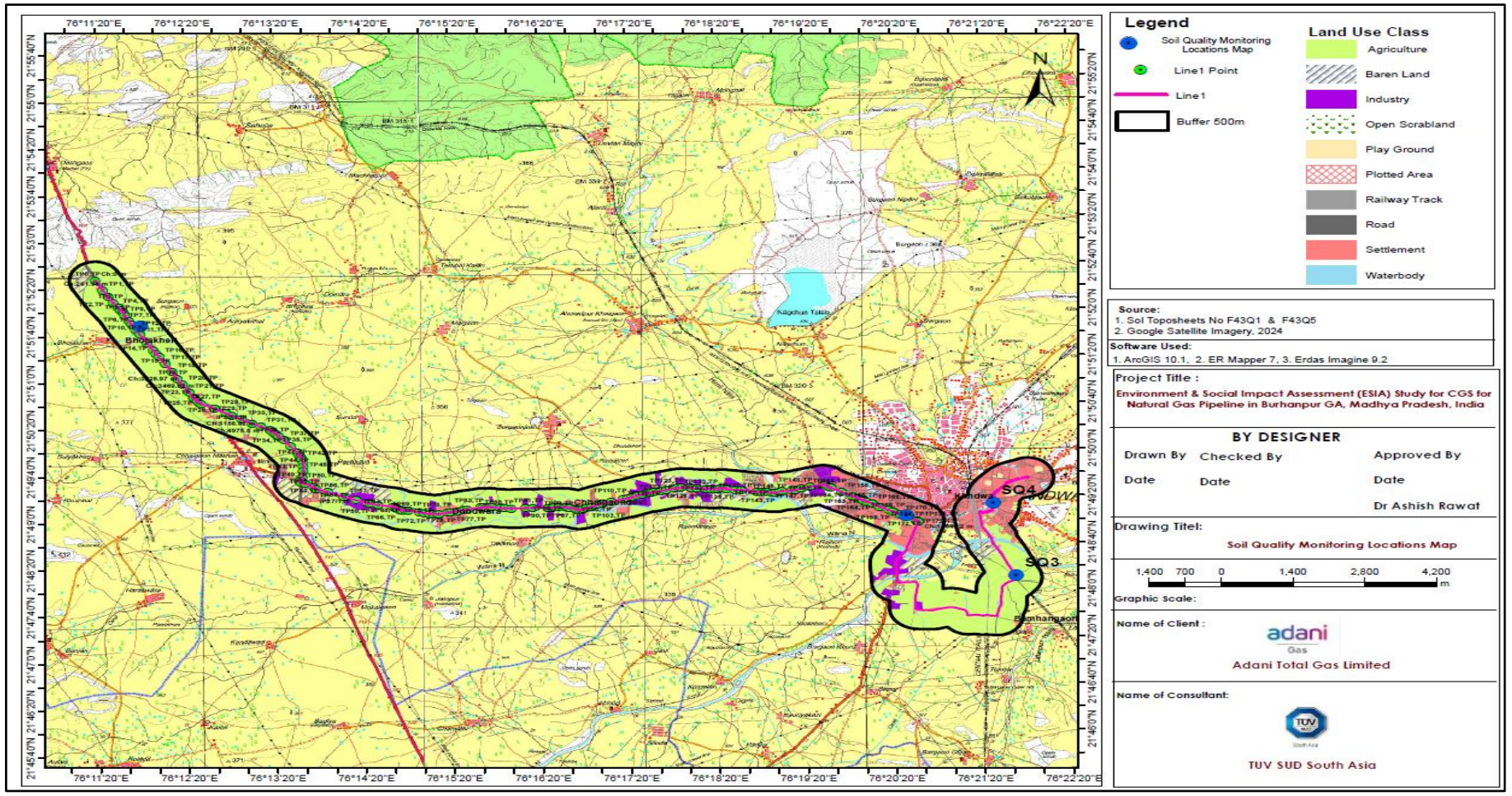
Figure 4-8: Soil Map of Khandwa District (Red Circle- Project Study Area)

The samples were collected by ramming a core-cutter into the soil from three different depths viz. 30 cm, 60 cm, and 90 cm below the surface and homogenized. The homogenized samples were analyzed for physical and chemical characteristics. The sealed samples then have been sent to the laboratory for analysis. The soil samples were analyzed for various physical and chemical parameters of soil and the results of the soil quality analysis are given in

Table 4-7, and **Figure** 4-10 and **Figure 4-11.**

Table 4-6: Soil Quality Monitoring Locations

Sl. No.	Sample code	Locations	Coordinates
1.	SQ1	Near Ch:1357.63 m	21°51'48.94"N, 76°11'49.03"E
2.	SQ2	Near Ch: 19326.34 m	21°49'3.64"N, 76°20'27.85"E
3.	SQ3	Near Railway crossing point	21°48'11.64"N, 76°21'42.16"E
4.	SQ4	Near Kanishka Restaurant	21°49'13.93"N, 76°21'26.81"E



**Source: TUV SUD GIS Mapping Study (Toposheets No F43Q1 & F43Q5)*

Figure 4-9: Soil Quality Monitoring Locations

Table 4-7 Soil Quality Monitoring Results

S. No.	Parameters	Unit	SQ1 21°51'48.94"N, 76°11'49.03"E	SQ2 21°49'3.64"N, 76°20'27.85"E	SQ3 21°48'11.64"N, 76°21'42.16"E	SQ4 21°49'13.93"N, 76°21'26.81"E	Test Method
1.	Texture		Sandy clay Loam	Sandy Loam	Sandy Loam	Sandy Loam	IS: 2720 (part-4), 1985 Reaff:2015)
2.	Sand		48.1	48.9	50.8	31.1	IS: 2720 (part-4), 1985,(Reaff:2015)
3.	Silt	%	27.8	26.1	27.2	28.0	IS: 2720 (part-4), 1985,(Reaff:2015)
4.	Clay		24.0	24.1	21.6	44.3	IS: 2720 (part-4),1985,(Reaff:2015)
5.	Porosity	%	48.4	41.2	40.1	41.7	STRL /STP/SOIL/01,
6.	Bulk Density	g/cc	1.2	1.24	1.22	1.31	STRL /STP/SOIL/01
7.	pH	....	7.76	7.23	7.43	7.45	STRL /STP/SOIL/01
8.	E. Conductivity	µs/cm	0.49	0.38	0.31	0.30	STRL /STP/SOIL/01
9.	Magnesium	mg/kg	37.8	40.2	37.5	32.9	STRL /STP/SOIL/01
10.	Calcium	mg/kg	190.7	170.6	179.0	174.4	STRL /STP/SOIL/01
11.	Chlorides	mg/kg	54.6	60.2	62.8	65.8	STRL /STP/SOIL/01
12.	Sodium	mg/kg	82.4	84.0	64.4	64.4	STRL /STP/SOIL/01
13.	Potassium	mg/kg	54.2	47.3	47.3	47.3	STRL /STP/SOIL/01
14.	Organic Carbon	%	0.25	0.33	0.25	0.22	IS : 2720 (Part-24)-1976(R- 2015)
15.	Organic matter	%	0.19	0.47	0.13	0.11	IS : 2720 (Part-24)-1976(R-2015)
16.	Phosphorous	mg/kg	70.3	68.7	64.7	62.6	IS: 2720 (part-26),1987.(R:2011)
17.	SAR	meq	1.37	1.30	1.29	1.42	STRL /STP/SOIL/01
18.	Nitrogen (as N)	mg/kg	0.10	0.34	0.39	0.32	STRL /STP/SOIL/01
19.	Salinity (as NaCl)	%	0.35	0.27	0.34	0.37	STRL /STP/SOIL/01

Porosity & Water Holding Capacity

Porosity of the soil in study area ranges between 40.1-48.4%. The soil textured as mainly Clayey Sandy Loam with sand percentage varies about 31.1-50.8% and clay percentage varies above 21.6-44.3%.

Organic Carbon & Organic Matter

Organic carbon content varies between 0.22-0.33% in the collected samples of the 4 Soil monitoring locations, whereas organic matter ranges between 0.11-0.47%.

N-P-K & and soil fertility

The Nitrogen content in the soil samples were found between 0.10 mg/kg. to 0.39 mg/kg., which is considered as low. Potassium content found with a range between 47.3 mg/kg to 54.2 mg/kg, which can be considered as low 'K' concentration. Phosphorus content ranged between 62.6 mg/kg. to 70.3 mg/kg, which would be considered as Low concentration of 'P.' Thus, 'NPK' concentration of the study area soil can be considered as 'NPK: low-low-low.' Considering, the overall soil quality of the project study area, the soils are found suitable/fertile for agricultural use. However, during public consultation, it was mentioned by the project affected families, that in recent past, rainfall intensity fluctuates year by year and cultivations are highly dependent on the rainfall frequency.

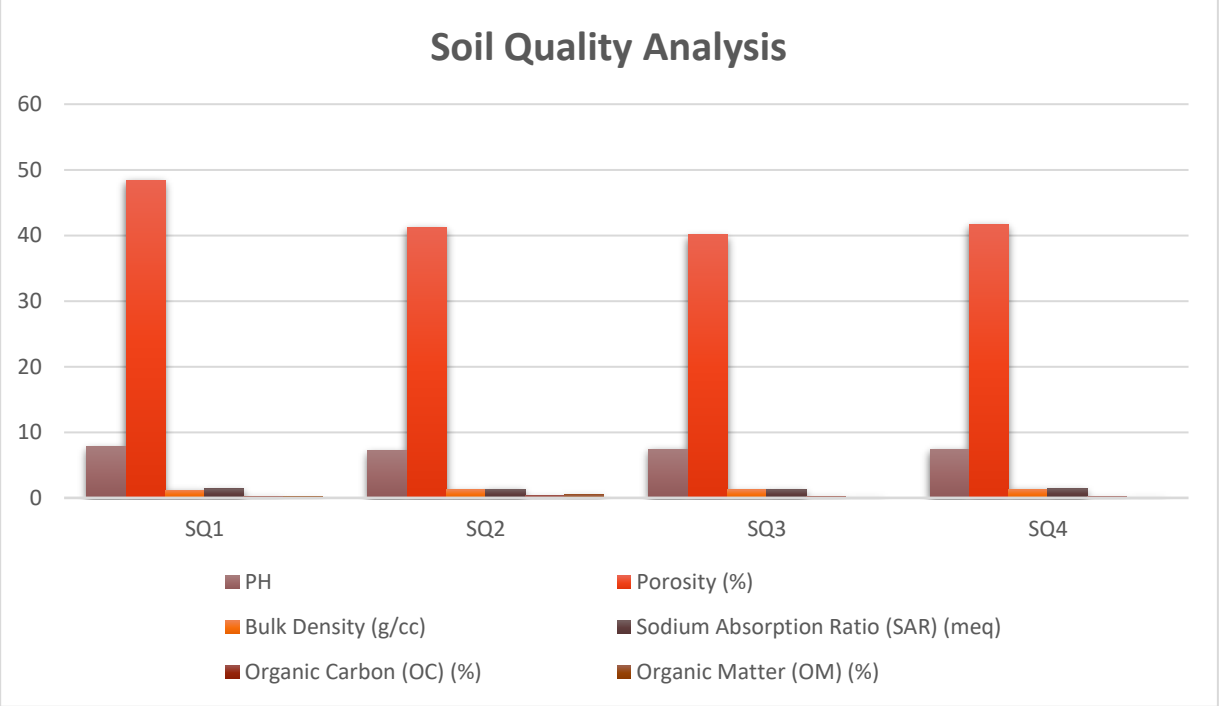


Figure 4-10 Soil Quality Analysis

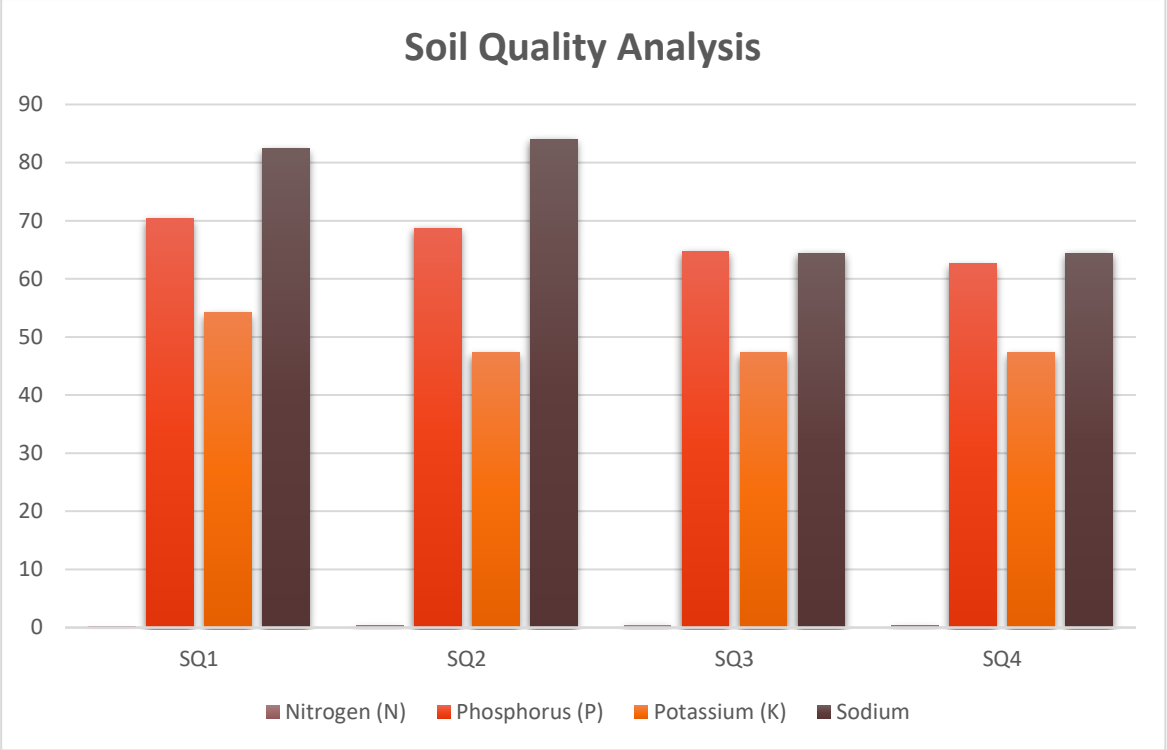


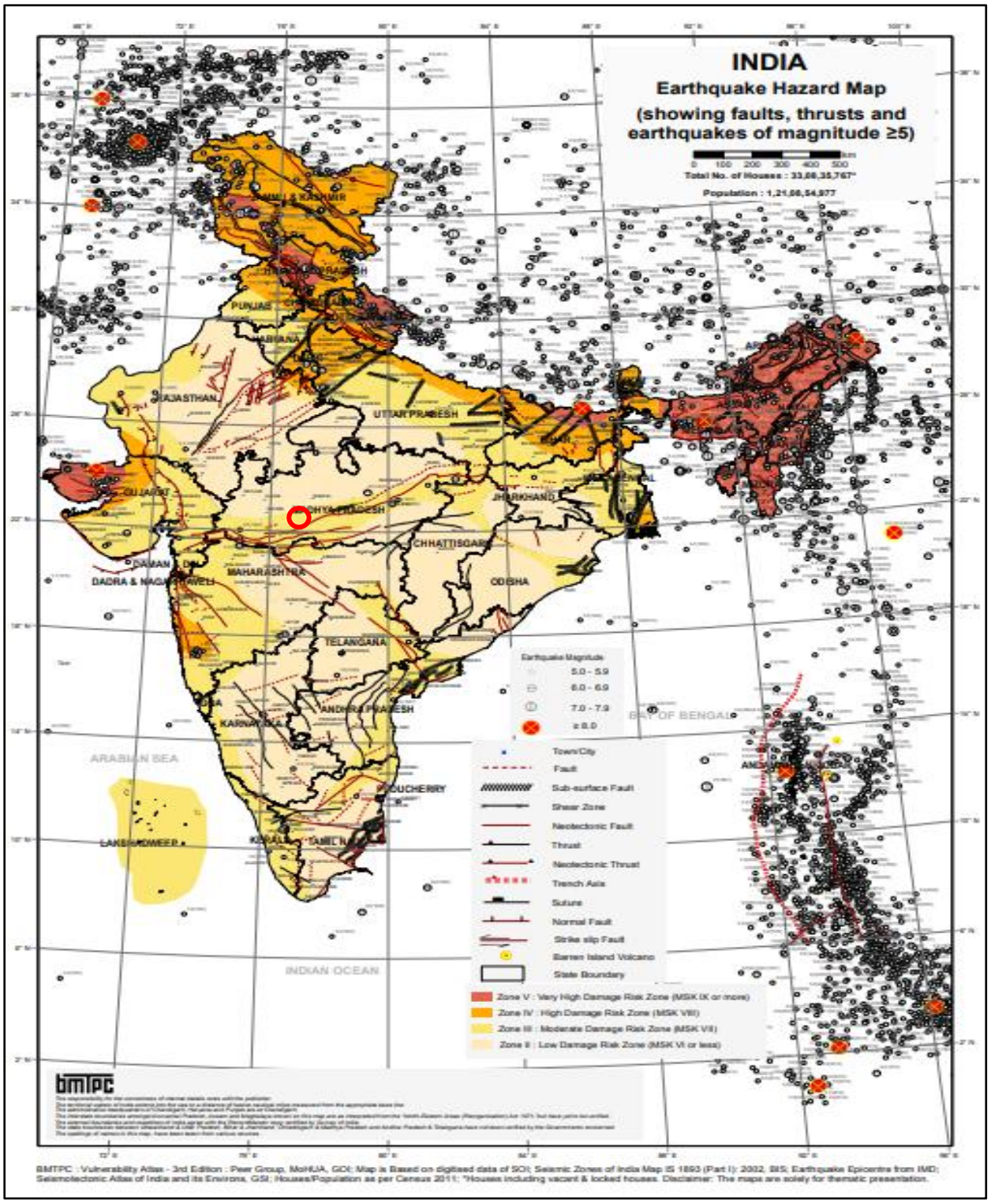
Figure 4-11 Soil Quality Analysis

4.6.6 Natural Hazards

Natural hazards naturally occur 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 development; hence assessment of the natural hazards in the area is important for any proposed development.

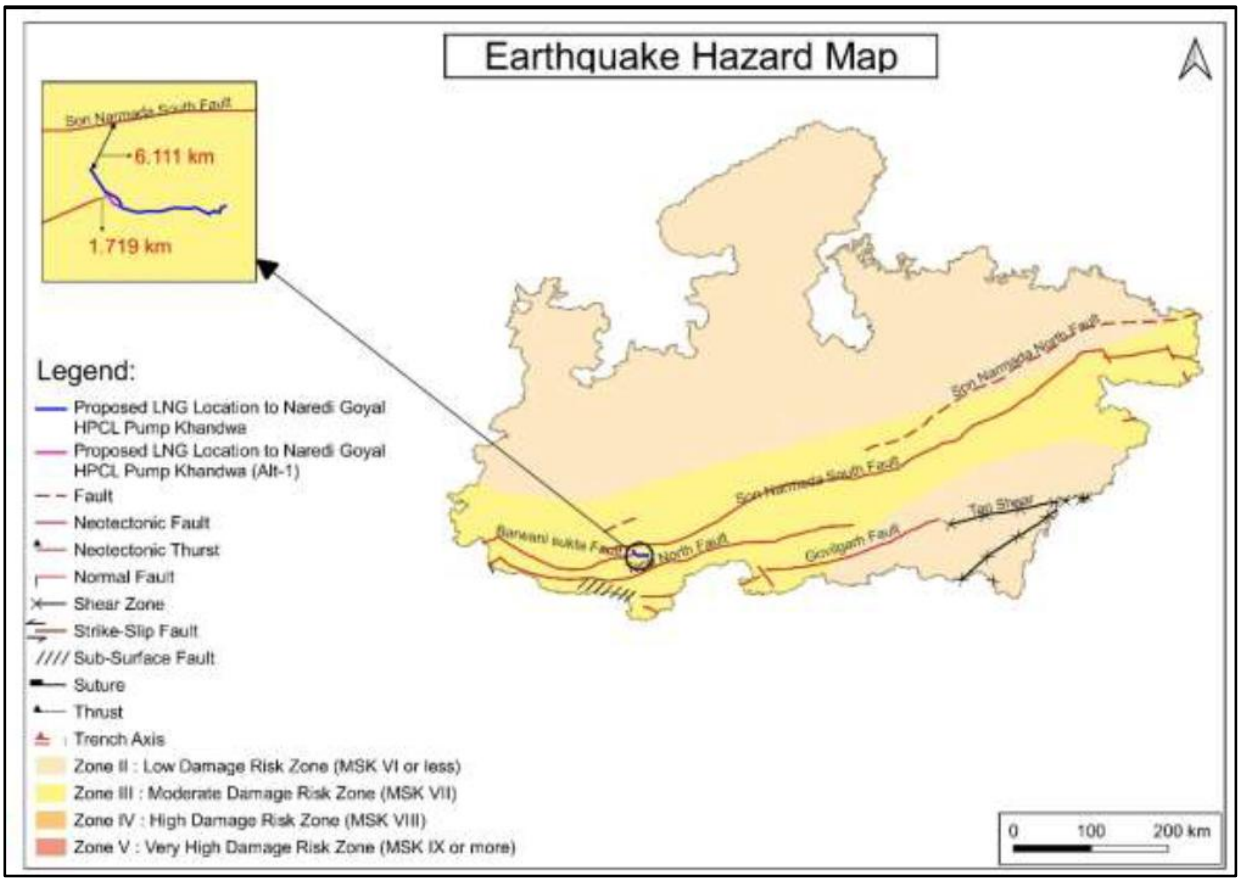
4.6.6.1 Seismicity

The study area falls in ***Zone III: Moderate Damage Risk Zone (MSK VII)*** in accordance with the Earthquake Hazard map of India, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. Hence, the threat of damage due to an earthquake is of moderate intensity. The seismic map is shown in **Figure 4-12**.



**Source: BMTPC Vulnerability Atlas*

Figure 4-12: Earthquake Hazard Map of India (Red Circle-Project Study Area)



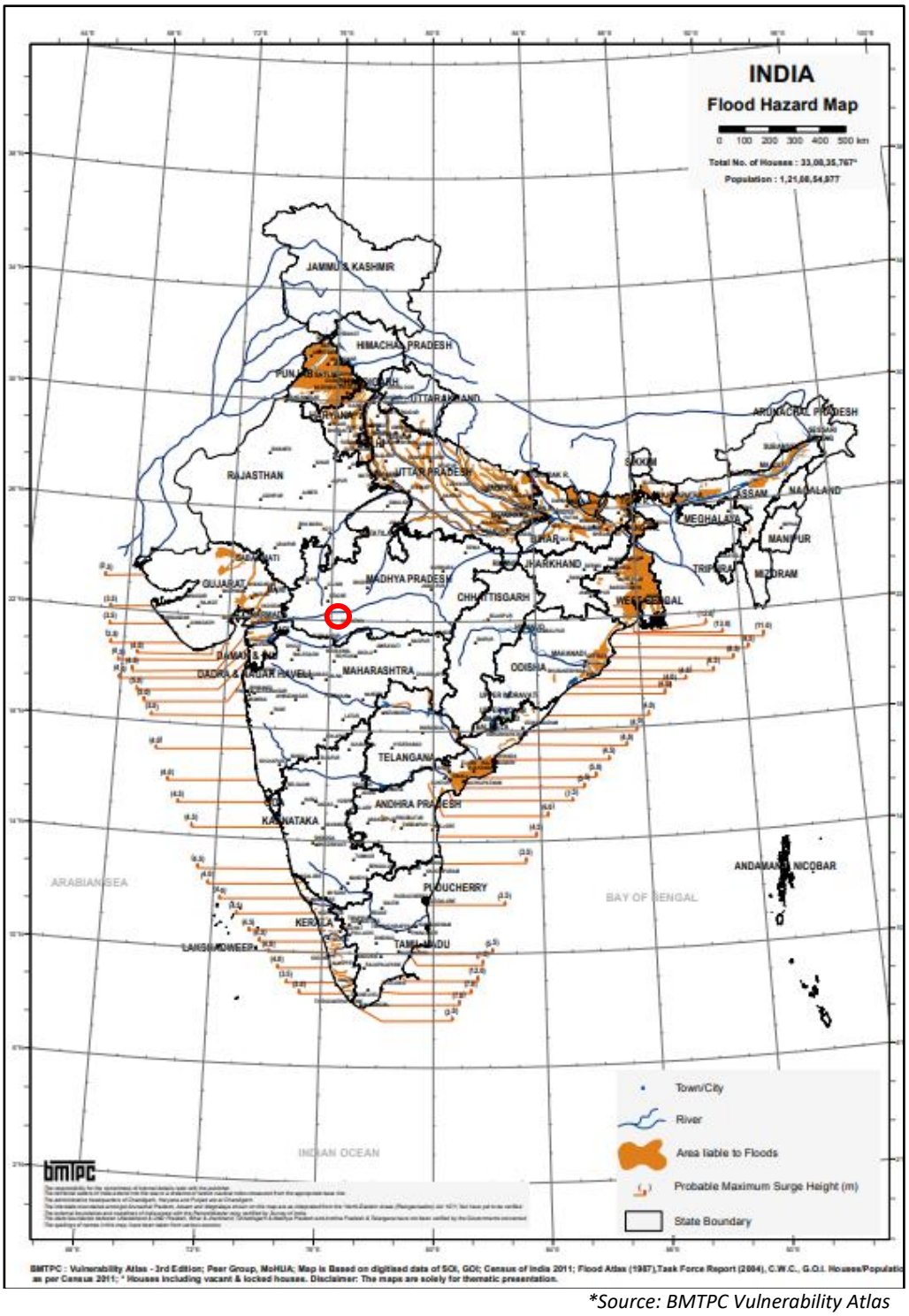
** Source: ATGL Detailed Engineering Survey Report*

Figure 4-13: Seismic Hazard Map of Khandwa for Pipeline Route

4.6.6.2 Flood

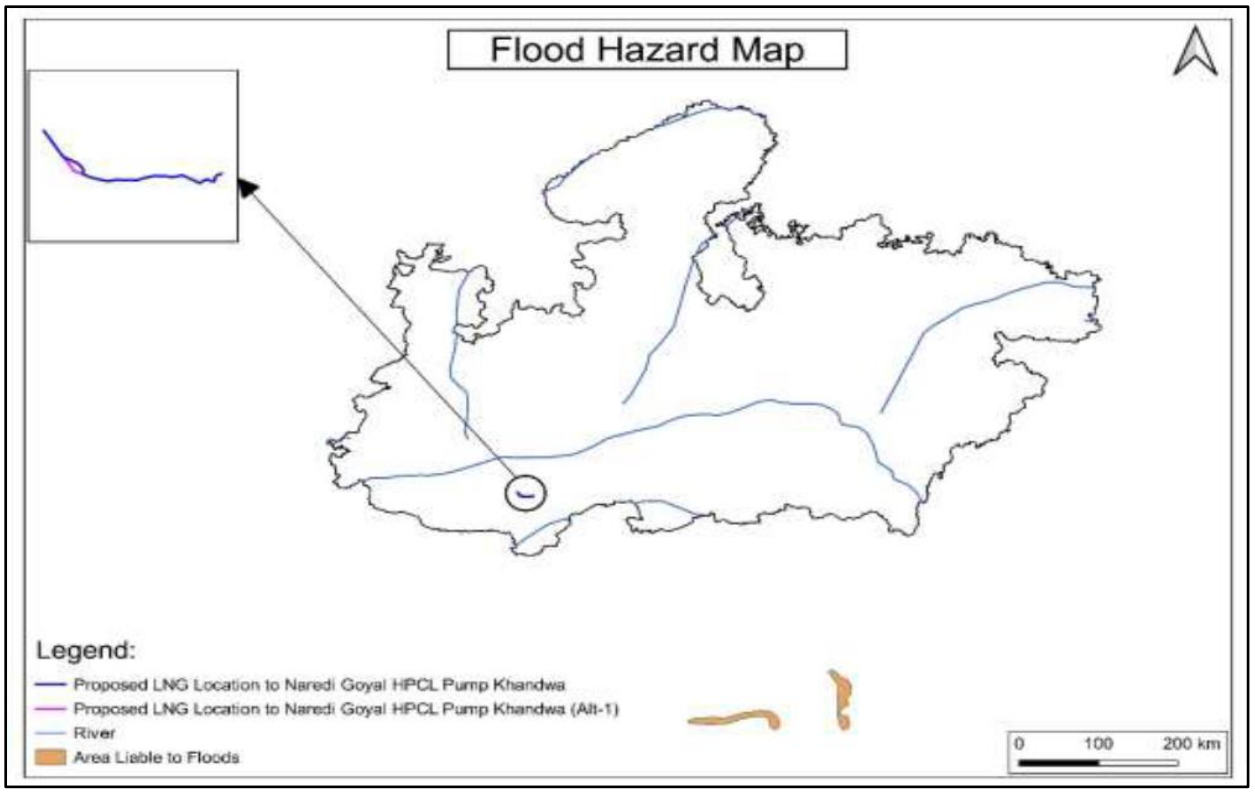
The project site does not have any major stream/ secondary surface water stream within the project AOI, in accordance with the Flood Hazard map of India, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC.

The Flood Hazard map of the India is provided in **Figure 4-14.**



**Source: BMTPC Vulnerability Atlas*

Figure 4-14: Flood Hazard Map (Project Area identified with "Red Circle")

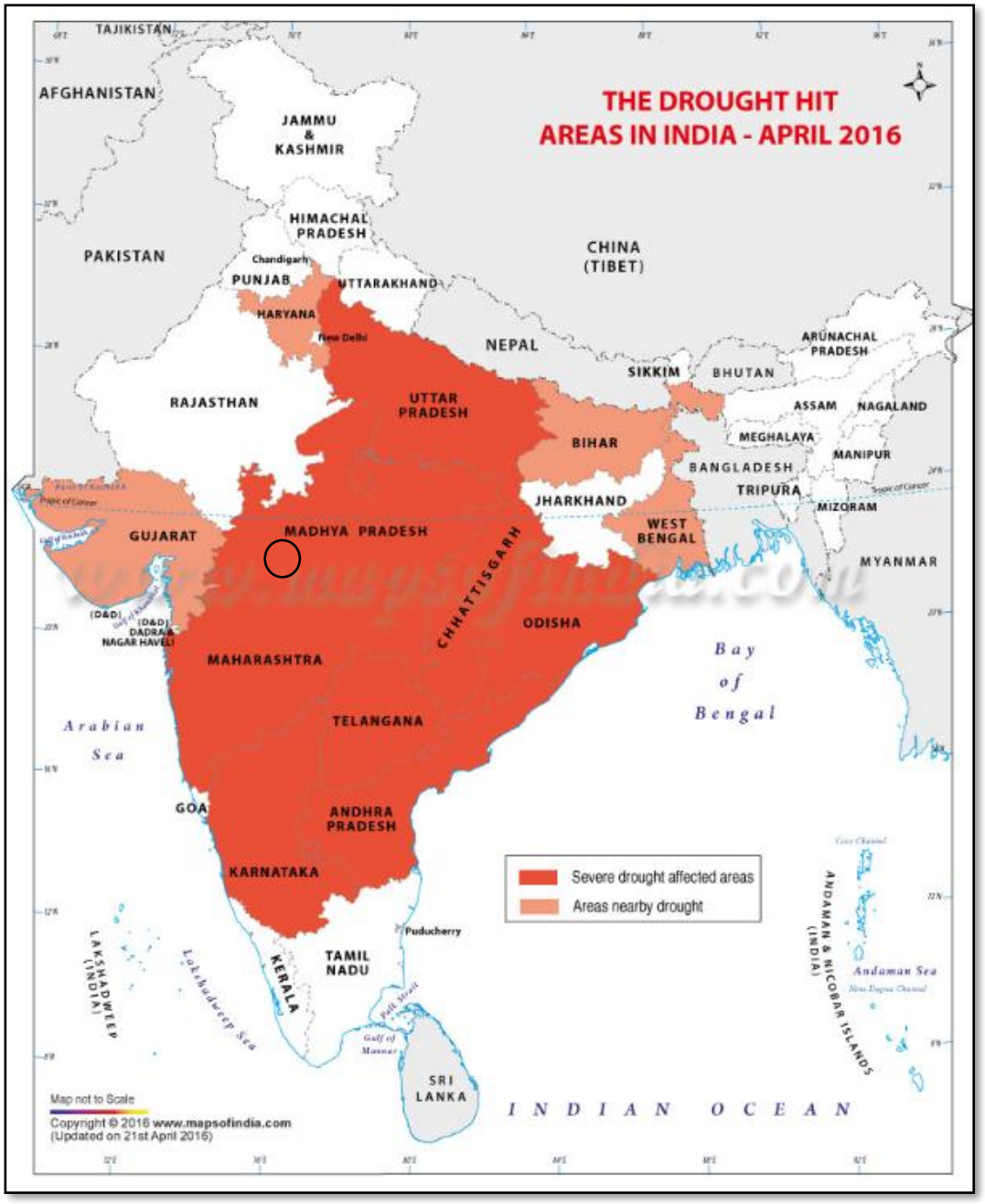


** Source: ATGL Detailed Engineering Survey Report*

Figure 4-15: Flood Hazard Map of Khandwa

4.6.6.3 Drought

Khandwa district in Madhya Pradesh has been experiencing significant drought conditions. The region's climate is mostly dry, with extreme temperatures during the summer months and limited rainfall. The drought conditions have impacted agriculture, water resources, and the overall livelihood of the residents. Efforts are being made to monitor and mitigate the effects of drought through better water management practices and the use of drought-resistant crops.



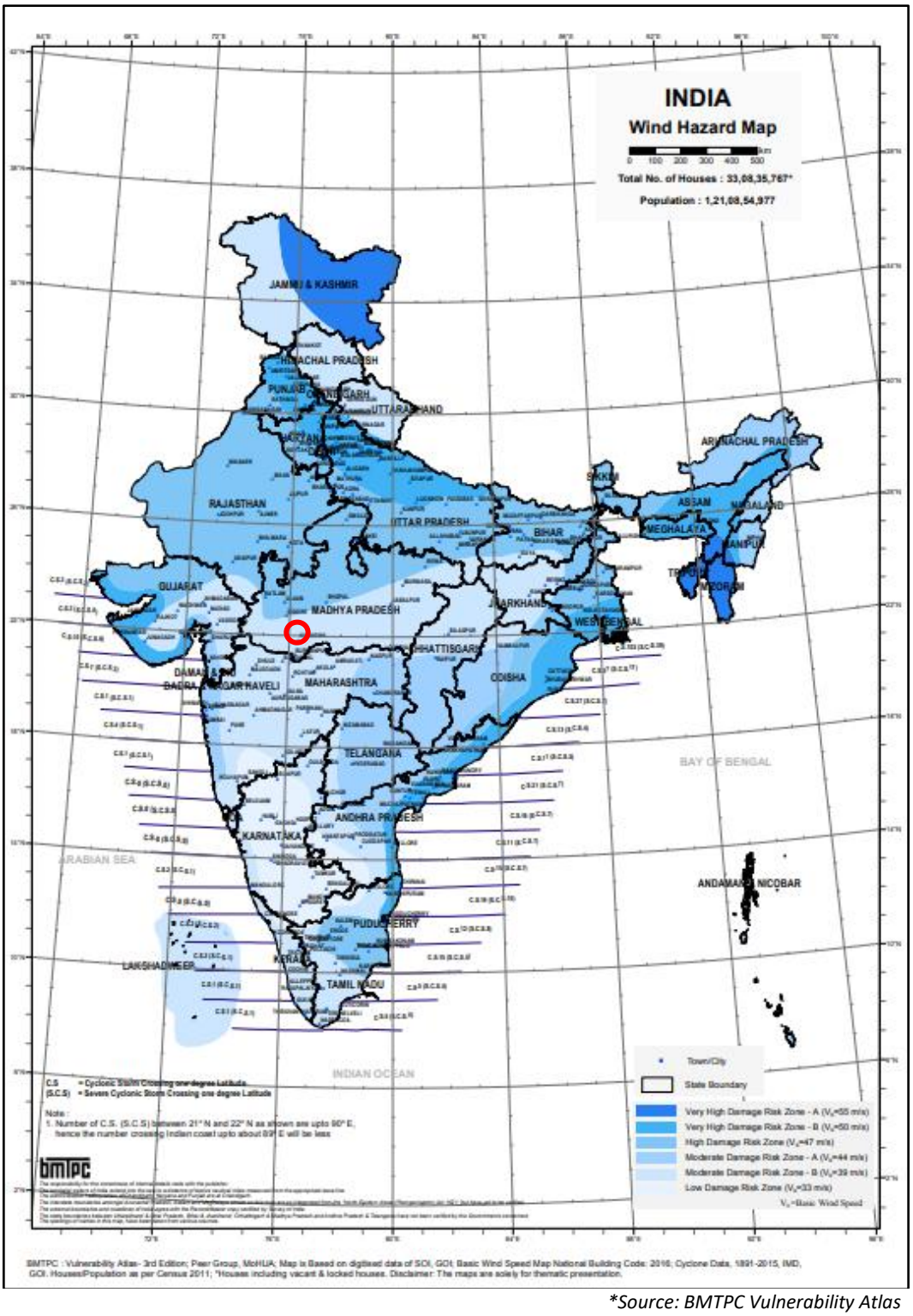
Source: Maps of India

Figure 4-16: Drought Prone Map of India (Black Circle indicating Project Area)

4.6.6.4 Wind Hazard

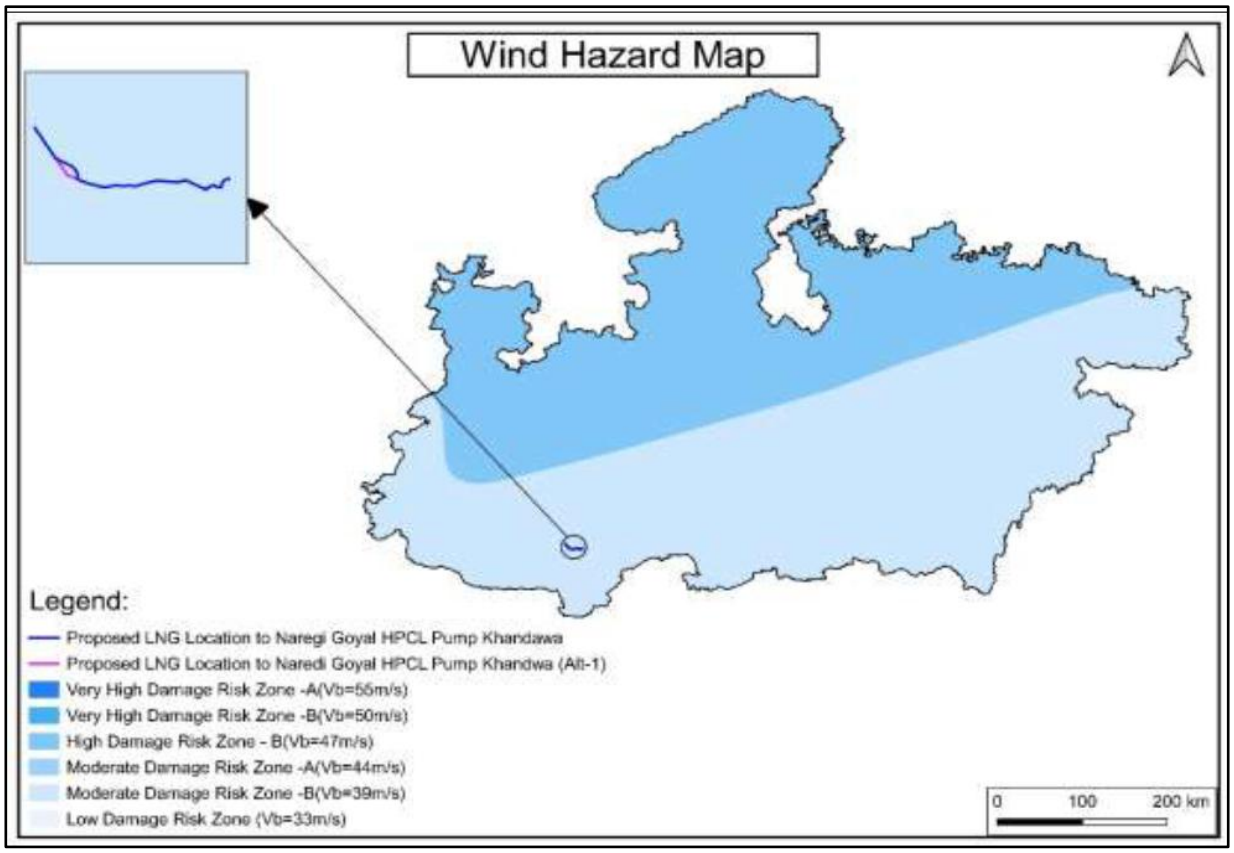
The project study area has been identified in ***Moderate Damage Risk Zone - B (V_b=39 m/s)*** according to the Wind Hazard map of India, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC.

Wind Hazard Map of India indicating project study area has been depicted in **Figure 4-17**.



**Source: BMTPC Vulnerability Atlas*

Figure 4-17: Wind Hazard Map, India (Project Area identified with "Red Circle")



** Source: ATGL Detailed Engineering Survey Report*

Figure 4-18: Flood Hazard Map of Khandwa

4.6.7 Climate and Meteorology

In accordance with [3]Köppen–Geiger Climate Classification system (**Figure 4-19**) the climate zone of project area is considered as to be [4]Aw, i.e., tropical savanna climate.

[3] Köppen-Geiger Climate Classification is one of the most widely used climate classification systems. The system is based on the concept that native vegetation is the best expression of climate. Thus, climate zone boundaries have been selected with vegetation distribution in mind. It combines average annual and monthly temperatures and precipitation, and the seasonality of precipitation.

[4] The letters 'Aw' indicates that the area has tropical savanna climate with dry winters climate i.e., receives 1000-1500 mm .

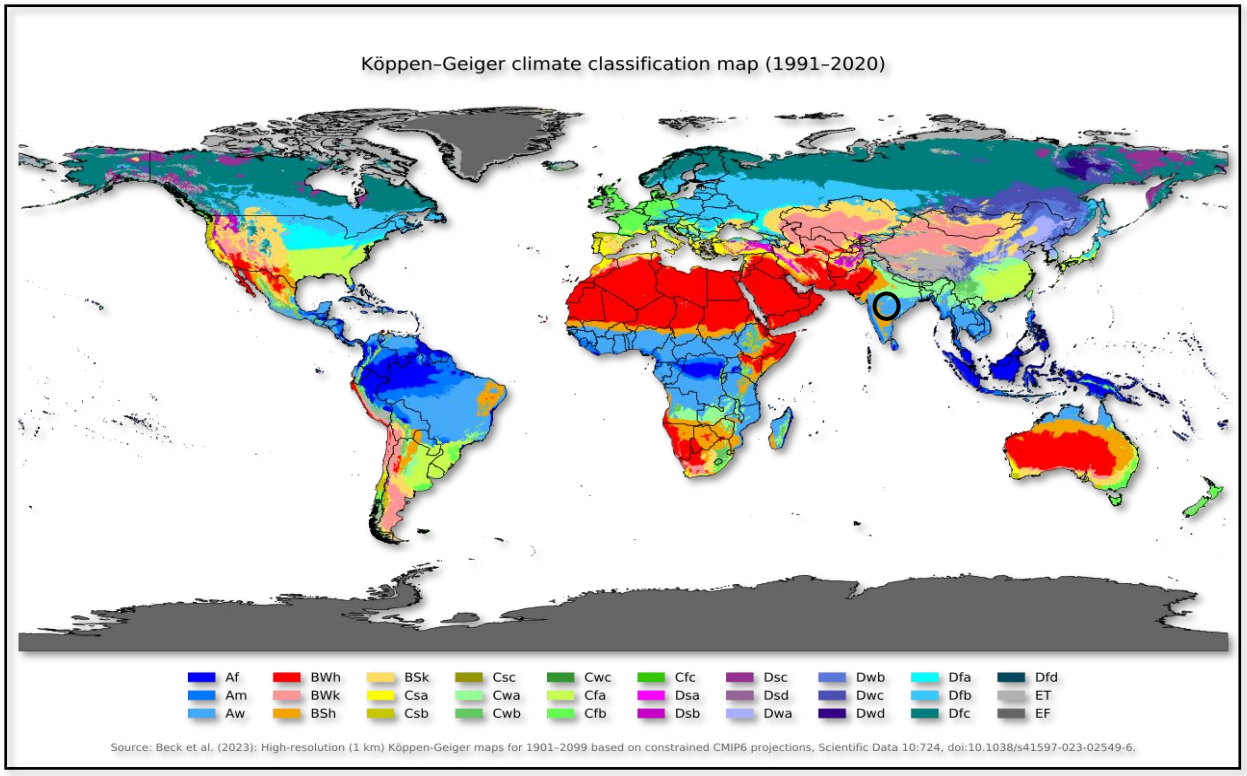


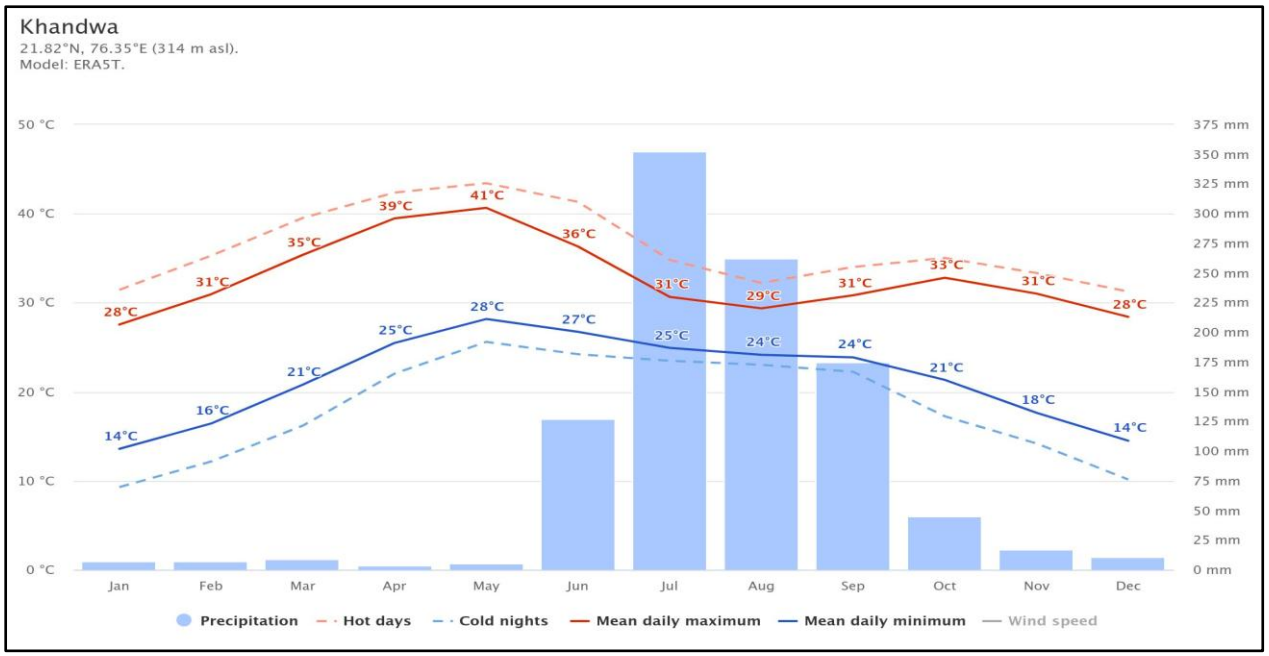
Figure 4-19: World Map of Köppen–Geiger Climate Classification (Project Area identified with "Black Circle")

The climate of Khandwa district, Madhya Pradesh, is marked by hot summers and general dryness, except during the southwest monsoon season. The year can be divided into four seasons: the cold season from December to February, the hot season from March to mid-June, the southwest monsoon season from mid-June to September, and the post-monsoon or transition period in October and November.

Khandwa receives an average annual rainfall of 777.60 mm, with the majority (about 90.5%) occurring during the monsoon season (June to September). Only 9.5% of the rainfall happens from October to May, meaning there is enough water for groundwater recharge primarily during the southwest monsoon.

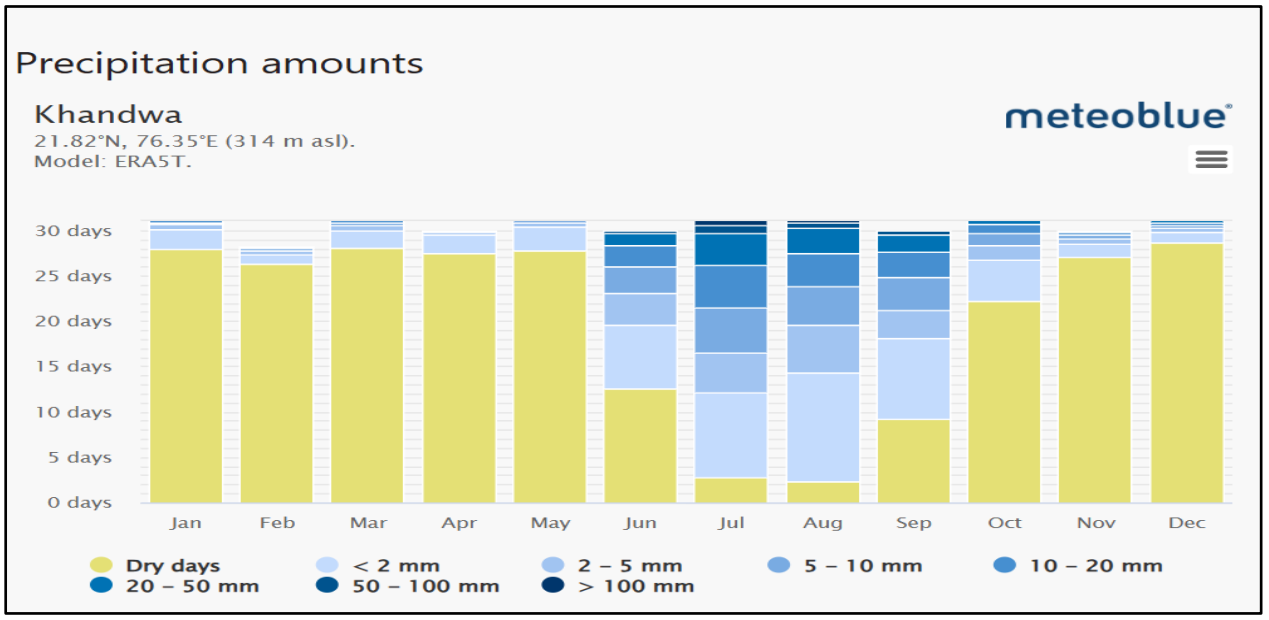
The maximum temperature typically reaches 41.8°C in May, while the minimum is 11.2°C in January. The average annual maximum and minimum temperatures are 34°C and 19.5°C, respectively. During the southwest monsoon season, relative humidity often exceeds 86% (in July and August), but the rest of the year tends to be drier, with the driest period occurring in summer when relative humidity drops below 33%. April is the driest month.

Wind speeds are higher in the pre-monsoon season compared to the post-monsoon period. The highest wind velocity, 15.6 km/h, occurs in June, while the lowest, 4.0 km/h, is recorded in November. The average annual wind velocity in Khandwa district is 8.7 km/h.



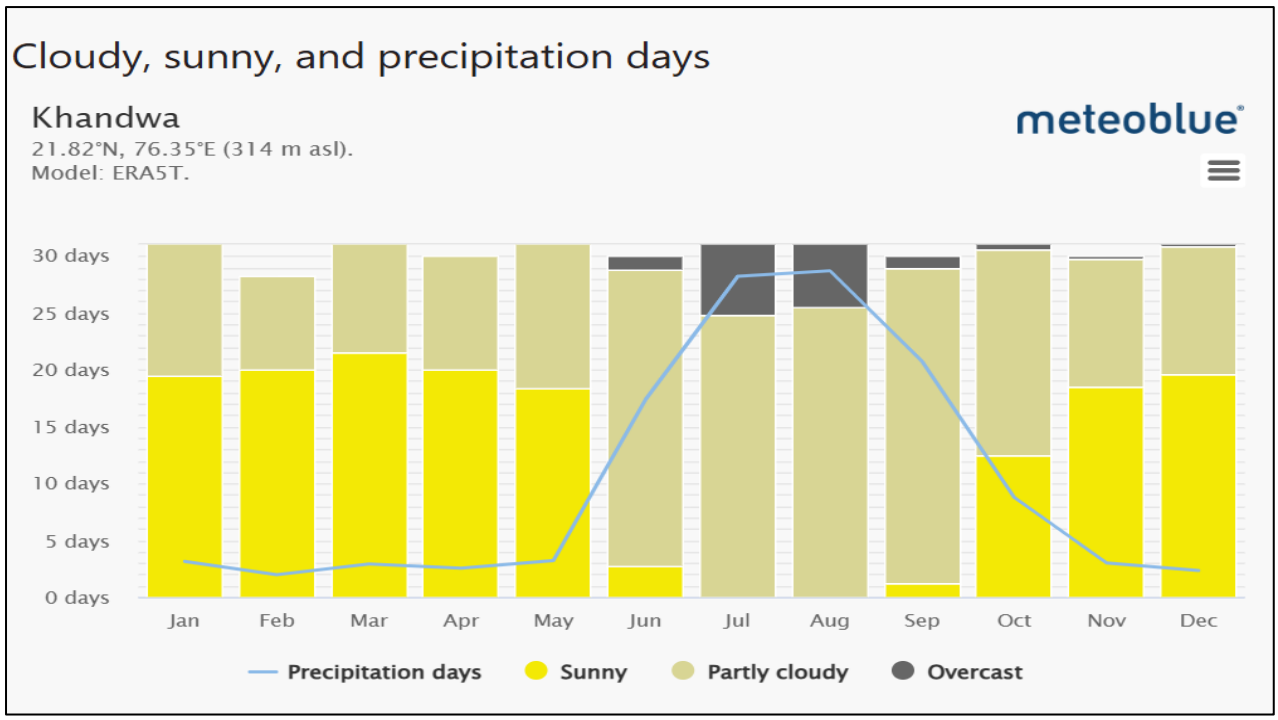
Source: Meteoblue.com

Figure 4-20: Climatological Trend in Study Area



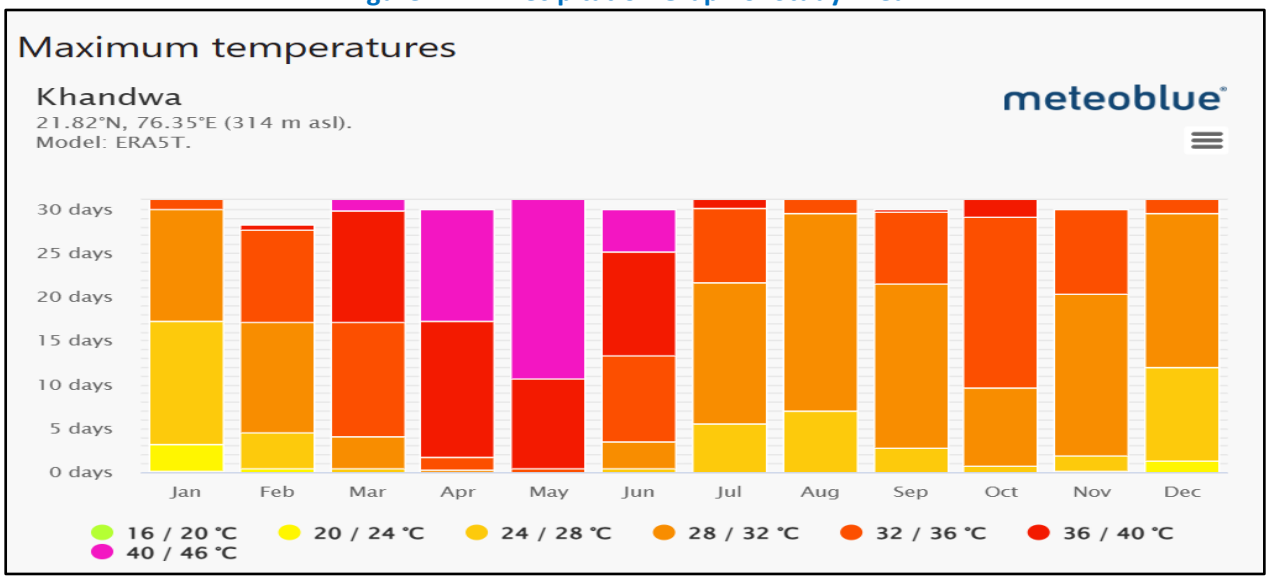
Source: Meteoblue.com

Figure 4-21: Precipitation Graph of Study Area



Source: Meteoblue.com

Figure 4-22: Precipitation Graph of Study Area

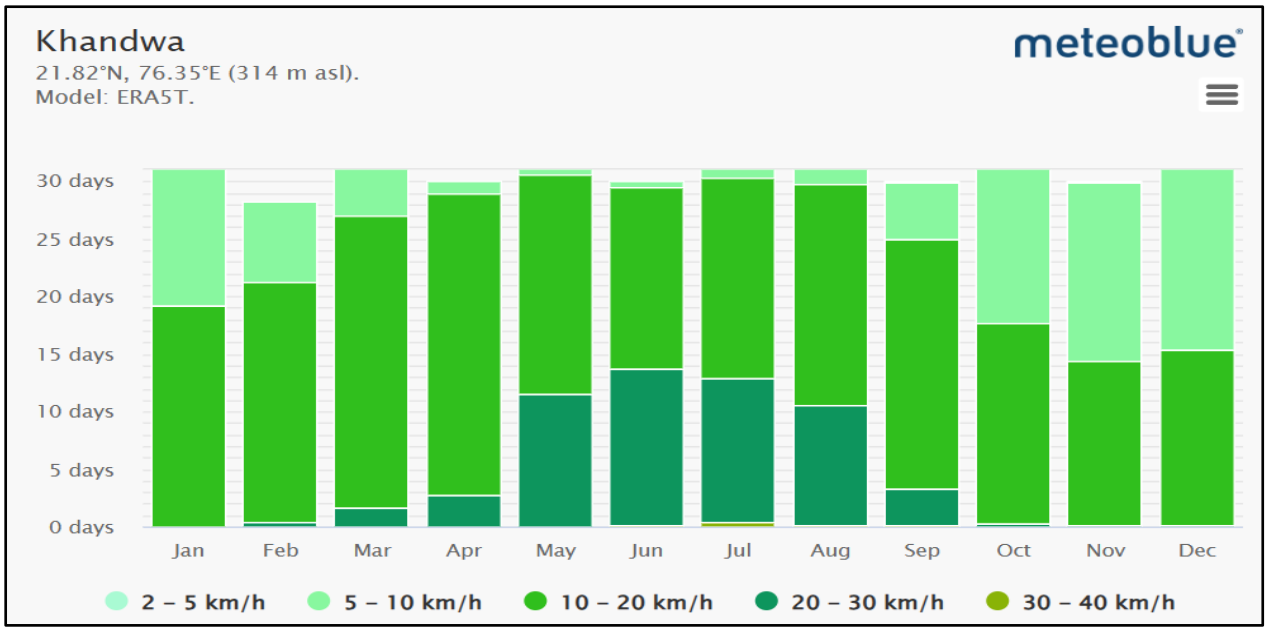


Source: Meteoblue.com

Figure 4-23: Temperature Trend in Study Area

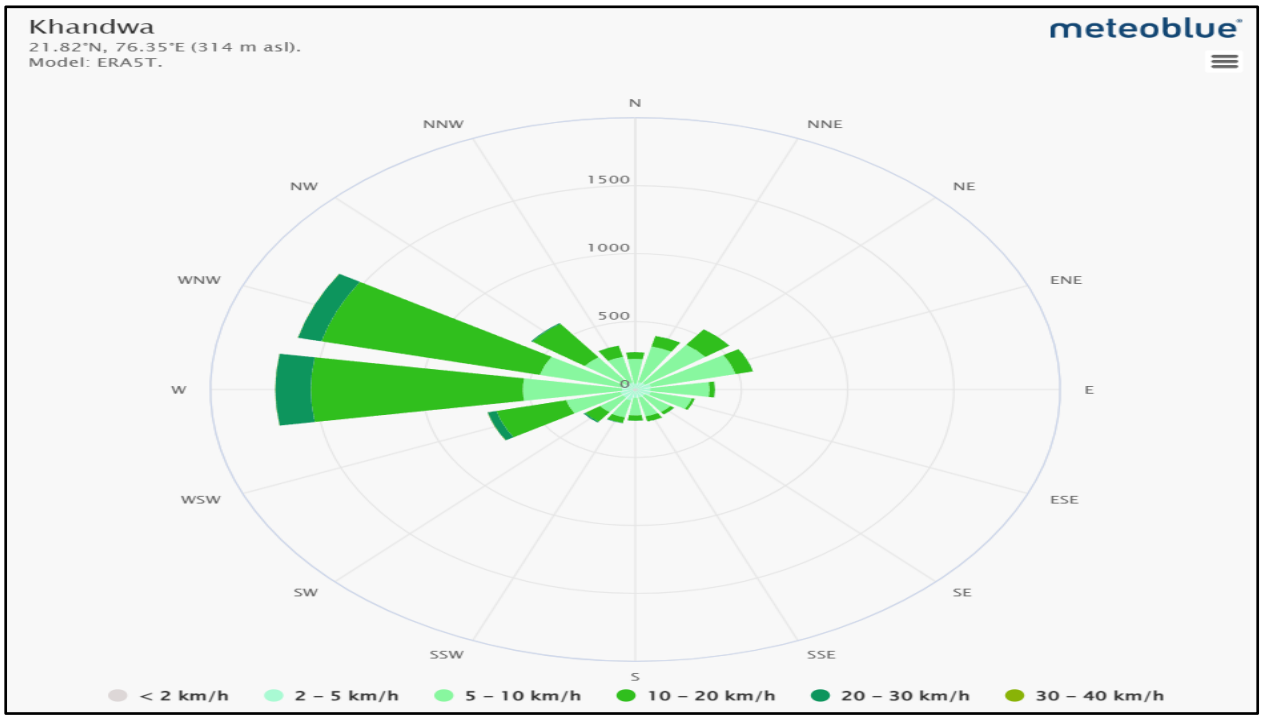
The predominant wind direction in the study area is primarily from the Western (W) and West North-Western (WNW) region. The wind intensity analysis and wind-rose diagram for study area is given in **Figure 4-24 and**

Figure 4-25 respectively.



Source: Meteoblue.com

Figure 4-24: Wind Intensity of Study Area



Source: Meteoblue.com

Figure 4-25: Windrose Diagram of Project Study Area

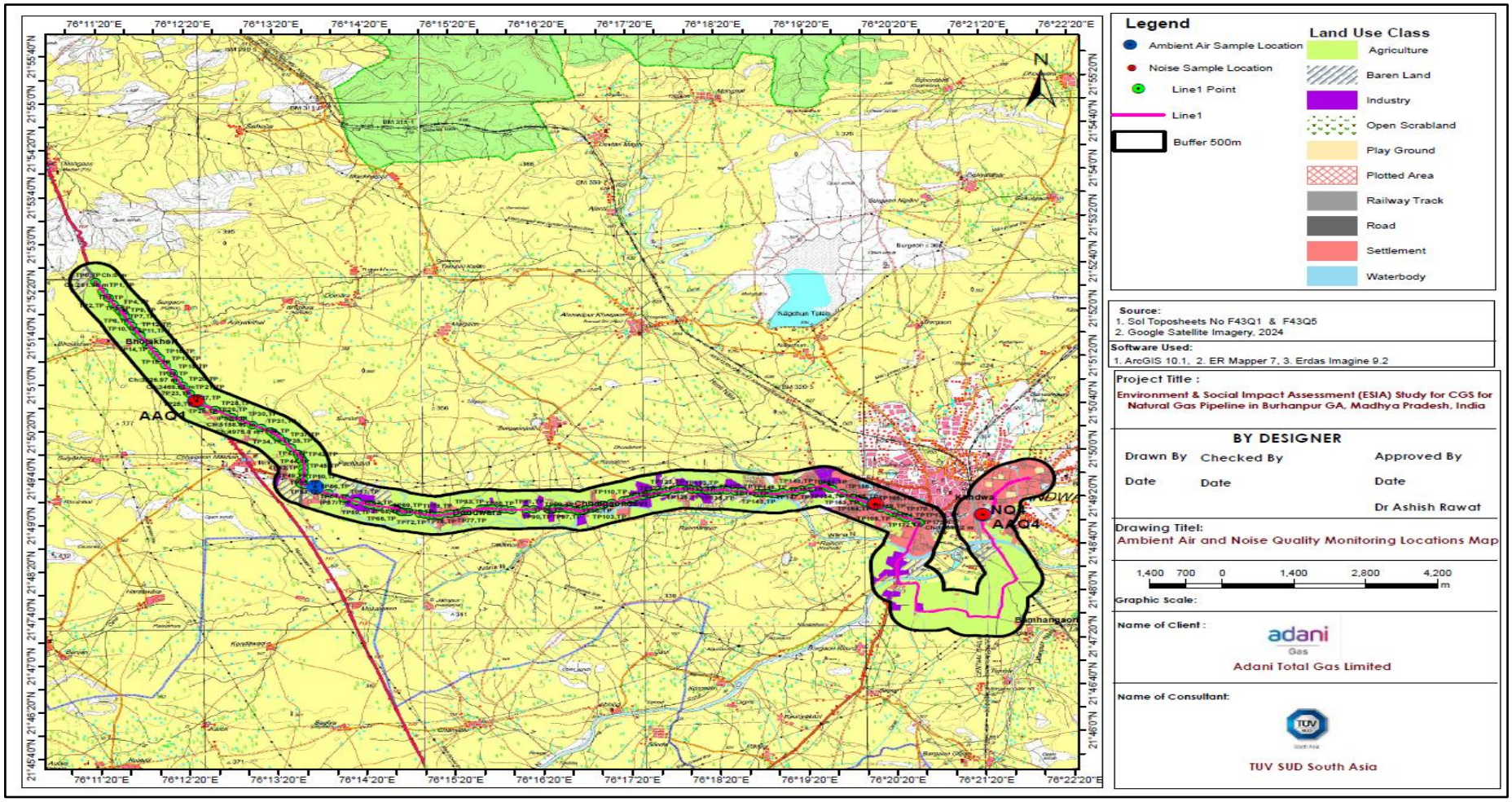
4.6.8 Ambient Air Quality

The ambient air quality monitoring was carried out at four (4) locations. The sampling locations for air and noise quality are based on certain meteorological conditions such as wind direction, wind speed, surrounding receptors and in accordance with that, the monitoring sites are identified close to the proposed project activity area. Ambient air quality monitoring locations are shown in **Table 4-8.** Ambient air quality monitoring results are shown in

Table 4-9 and **Figure 4-27.**

Table 4-8: Ambient Air Quality Monitoring Locations

Sl. No.	Sample code	Locations	Coordinates
1.	AAQ1	HP Petrol Pump-Shree Balaji Travels (Between Ch: 3666.57 m and Ch: 3732.93 m)	21°50'45.75"N, 76°12'26.42"E
2.	AAQ2	Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m)	21°49'32.16"N, 76°13'46.61"E
3.	AAQ3	New Bus Station, Khandwa (Near Ch: 18628.06 m)	21°49'14.74"N, 76°20'6.36"E
4.	AAQ4	Beside Railyard, Khandwa Station	21°49'4.70"N, 76°21'19.24"E



**Source: TUV SUD GIS Mapping Study (Toposheets No F43Q1 & F43Q5)*

Figure 4-26: Ambient Air and Noise Monitoring Locations within Project AOI

Table 4-9 Ambient Air Quality Monitoring Results

Client: **Adani Total Gas Limited**	**Assignment Name:** Environmental and Social Impact Assessment (ESIA) Study for Natural Gas Pipeline Project for Khandwa GA, District- Khandwa, Madhya Pradesh **Report No.:** 2025/ET-006496/AD/NA/NA/64187 **Version No and Date of Version:** Ver 01 dated 17.07.2025

S. No.	Test Parameters	Unit	AAQ1 21°50'45.75"N, 76°12'26.42"E	AAQ2 21°49'32.16"N, 76°13'46.61"E	AAQ3 21°49'14.74"N, 76°20'6.36"E	AAQ4 21°49'4.70"N, 76°21'19.24"E	Limits as per NAAQS (Max.)
1	Particulate Matter (PM10)	µg/m^3	58.6	61.3	58.3	59.2	**100**
2	Particulate Matter (PM2.5)	µg/m^3	36.7	38.5	42.5	40.8	**60**
3	Sulphur Dioxide (as SO_2)	µg/m^3	7.27	7.39	7.40	7.81	**80**
4	Nitrogen Dioxide (as NO_2)	µg/m^3	8.29	7.01	7.23	8.88	**80**
5	Ozone (O3)	µg/m^3	12.1	11.8	13.7	12.9	**100**
6	Lead (Pb)	µg/m^3	<1.0	<1.0	<1.0	<1.0	**1.0**
7	Carbon Monoxide (CO)-1.0	mg/m^3	0.20	0.21	0.36	0.37	**4.0**
8	Ammonia (NH3)	µg/m^3	< 10	< 10	< 10	< 10	**400**
9	Arsenic (As)	ng/ m^3	<1.0	<1.0	<1.0	<1.0	**6**
10	Nickel (Ni)	ng/m^3	0.15	0.18	0.20	0.25	**20**
AQI of the Locations			**61 (SATISFACTORY)**	**64 (SATISFACTORY)**	**71 (SATISFACTORY)**	**67 (SATISFACTORY)**	

The ambient air quality monitoring at the project study area indicates that air quality of the area '**Satisfactory**' in terms of AQI index, which is less than 100 in all the sampled locations. The gaseous pollutant's concentration was observed as low; however, particulate matter concentration was observed in the higher side in comparison to low pollution zones like villages, where no industrial activities carried out and vehicular movements are also low in comparison to any busy major roads. Predominant/determining pollutants are identified as PM_{10} and $PM_{2.5}$; However, all air pollutants' concentration were observed below the standard limit set by NAAQS.

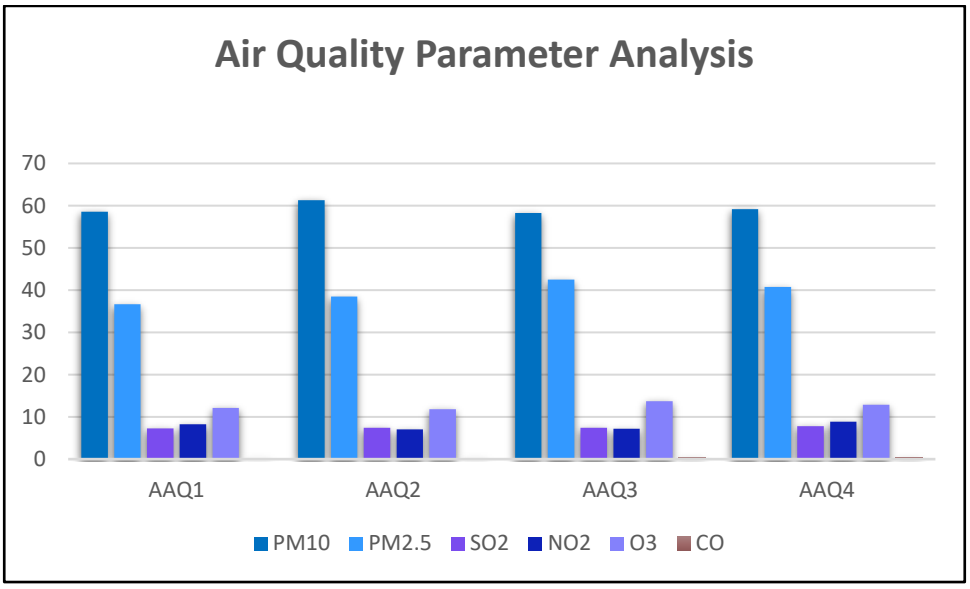


Figure 4-27 Ambient Air Quality Parameter Analysis

4.6.9 Ambient Noise Quality

In the present study, sound pressure levels (SPL) were measured by a sound level meter. Since loudness of sound is important for its effects on people, the dependence of loudness upon frequency must be considered in noise impact assessment. This has been achieved using A-weighting filters in the noise measuring instrument which gives a direct reading of approximate loudness. A-weighted equivalent continuous sound pressure level (Leq) values have been computed from the values of A-weighted sound pressure level measured with the help of noise meter. Noise monitoring was carried out at Four (04) locations to identify the baseline noise level of the project surrounding areas, so that noise pollution during construction phase can be predicted and cumulative effect of ambient noise can be identified. These locations have been given in **Table 4-10.** The ambient noise quality monitoring results have been shown in **Table 4-11** and **Figure 4-28.**

Table 4-10: Ambient Noise Quality Monitoring Stations

Sl. No.	Sample code	Locations	Coordinates
1.	NQ1	HP Petrol Pump-Shree Balaji Travels (Between Ch: 3666.57 m and Ch: 3732.93 m)	21°50'45.75"N, 76°12'26.42"E
2.	NQ2	Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m)	21°49'32.16"N, 76°13'46.61"E
3.	NQ3	New Bus Station, Khandwa (Near Ch: 18628.06 m)	21°49'14.74"N, 76°20'6.36"E
4.	NQ4	Beside Railyard, Khandwa Station	21°49'4.70"N, 76°21'19.24"E

Noise quality monitoring has been conducted in areas close to the proposed project. At each location, noise monitoring has been carried out over a period of twenty-four hours (once) to obtain Leq values at uniform time intervals of 1 hour. In each hourly time interval Leq values were computed from SPL readings taken at uniform time intervals of 15 minutes. For each location, day and night-time Leq values have been then computed from the hourly Leq values so that comparison could be made with the national ambient noise standards. Day time Leq has been computed from the hourly Leq values between 6.00 a.m. - 10.00 p.m. and night-time Leq from the hourly Leq values between 10.00 p.m. - 6.00 a.m.

Table 4-11 Ambient Noise Quality Monitoring Results

S. No.	Locations	Location Code	Results in Db(A) Leq		Limits in Db(A) Leq Noise Regulation, 2000	
			Average Day Noise Level	Average Night Noise Level	Day Time	Night-Time
1	HP Petrol Pump-Shree Balaji Travels	NQ1	49.8	40.6	55	45
2	Hotel Maa Bhagwati Palace	NQ2	50.1	44.5	65	55
3	New Bus Station, Khandwa	NQ3	49.8	42.1	75	70
4	Beside Railyard, Khandwa Station	NQ4	56.1	44.2	50	40

It has been observed that in all the locations, where ambient noise quality was monitored during baseline survey, are having ambient noise level around 50.1 to 56.1 Db(A) during daytime and 40.6 to 44.5 Db(A) during night-time. It is found that daytime and night-time noise levels are well within CPCB limits specified for Residential area as per Noise Pollution (Regulation and Control) Rules, 2000.

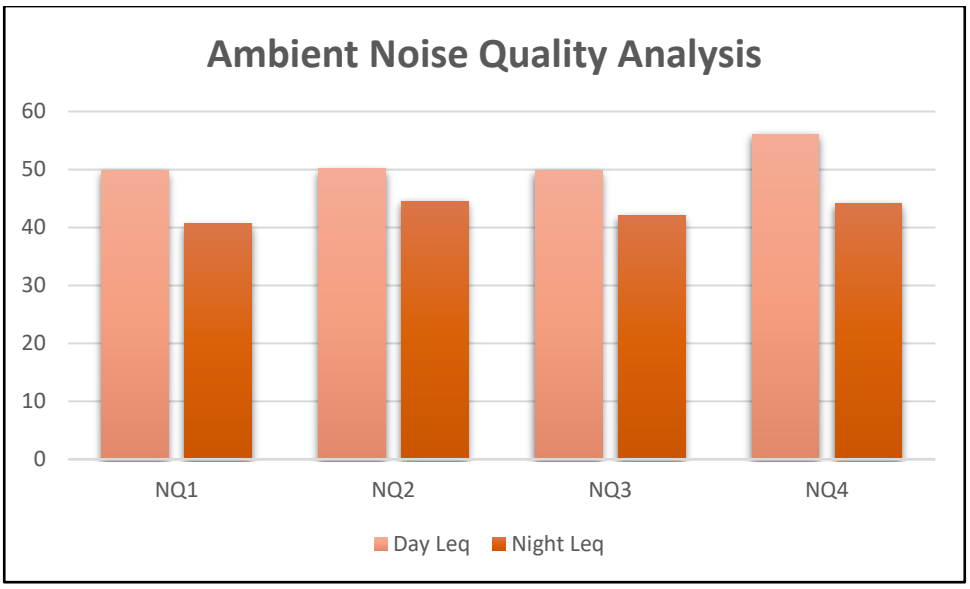


Figure 4-28 Ambient Noise Quality Analysis

4.6.10 Hydrogeology and Ground Water Quality

4.6.10.1 Hydrogeology

Khandwa district is situated on various geological formations, which create different types of aquifers in the area. The primary geological units in the region include Archaean, Upper Vindhyan, Bagh beds, Deccan traps, and alluvium. In hard rocks, groundwater occurrence and movement are largely influenced by secondary porosity through joints and fractures. Primary porosity in the Bagh sandstone and vesicular basalts of the Deccan traps also plays a significant role in groundwater occurrence and movement. The Bagh beds, consisting of relatively loose and friable shale and sandstone, may also form a potential aquifer. Groundwater generally occurs in unconfined to semi-confined conditions. The occurrence and movement of groundwater in these various geological formations are described below:

- **Archaeans:** Weathered and fractured zones of granite and gneisses, when saturated, form moderate aquifers. The yield of wells in these formations typically ranges from 1 to 3 liters per second (lps). These rocks are primarily found in the northeastern part of the district, specifically in the Baldi block.
- **Bijawars:** The Bijawar formations are found in the northeastern part of the district, within the Baldi block. Bijawar sandstone and shale breccia cover an area of 85 square kilometers in this block. Typically, the yield of wells in this formation is less than 1 liter per second (lps). However, if the formation includes limestone with well-developed solution openings, the yield can range from 2 to 5 lps.
- **Vindhyan:** The Upper Vindhyan sandstone and shale formations are exposed in the northern part of the district, along the Narmada River, within the Punasa block. These Vindhyan formations cover an area of approximately 1,115 square kilometers, including part of the Baldi block. The sandstone and shale of these formations are compact and have poor permeability. Groundwater occurrence and movement in these areas are primarily influenced by joints, fractures, and bedding planes in the sandstone and shale, particularly in favorable geomorphic and topographic conditions. The soil and

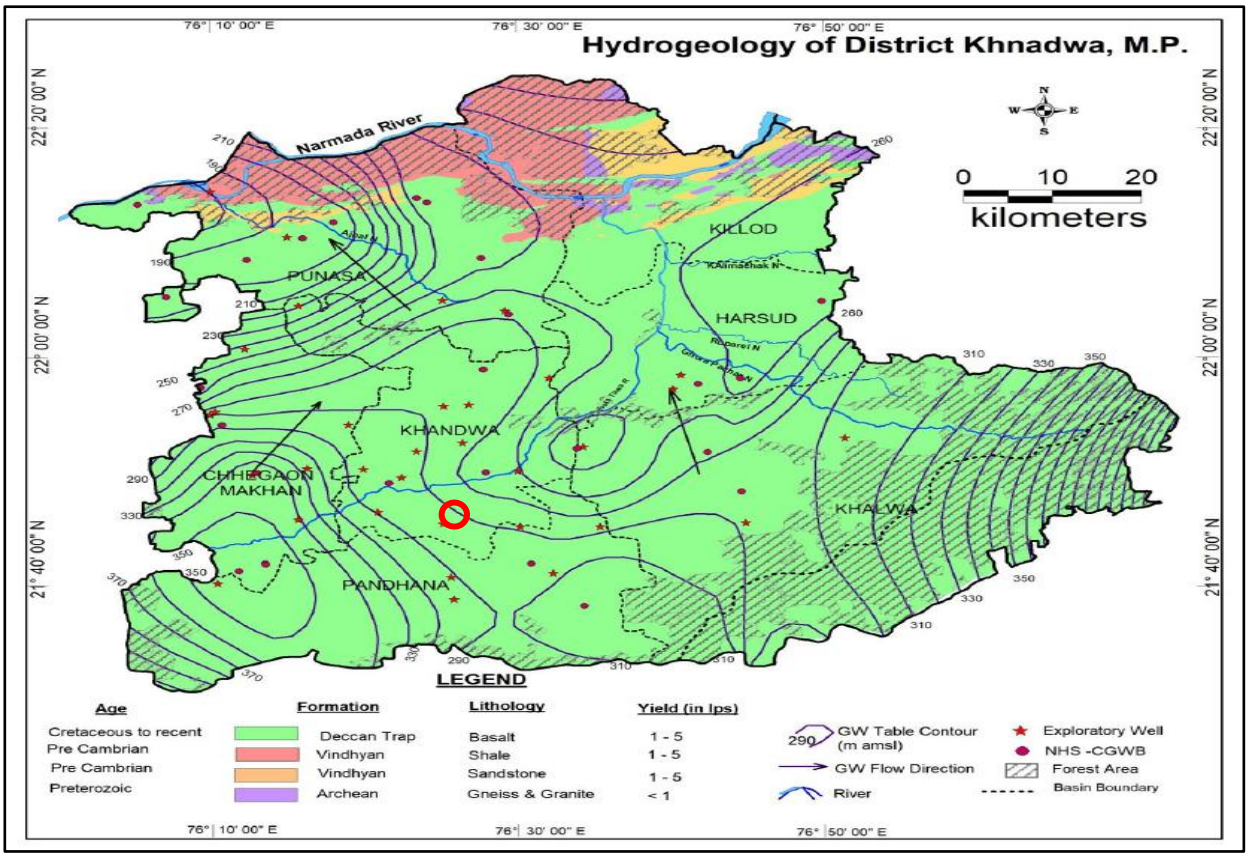
weathered profiles in this formation are generally thin, which results in groundwater occurring at shallow depths under unconfined conditions. The yield of wells in this formation typically ranges from 1 to 3 liters per second (lps). An exploratory well drilled at Bir Bad Nimarkheda, tapping both basalt and Vindhyan sandstone, yielded discharges of 3.28 and 8.16 lps.

- **Bagh Beds:** The Bagh beds are exposed in the north-central part of the district, within the Punasa block. These beds consist of sandstone and shale, which are sedimentary formations, but they have a limited extent and range from poor to moderate permeability. When limestone and calcareous clay are present, they form productive aquifers.
- **Deccan Traps:** Khandwa district is underlain by 13 basaltic flows, each distinguished by the presence of red bole, vesicular zones, or breaks in slope. Most of these lava flows are of the Aa type, with flow thickness ranging from 7 to 35 meters. These flows are confined between 265 and 698 meters above mean sea level (amsl). The Deccan trap flow, basic intrusions, and calcite veins in some areas contribute to the basaltic terrain. Groundwater typically occurs under phreatic conditions in shallow, weathered, jointed, and fractured horizons.

  The basalt does not exhibit uniform characteristics both vertically and laterally. Factors such as the physiographic location, the thickness of the weathered mantle, the degree of jointing, fractures or sheared zones, the properties of vesicular horizons, and their interconnections are crucial in determining the yield capacity of open wells tapping shallow aquifers. Deeper aquifer systems appear to be under semi-confined conditions, primarily governed by secondary porosity. The jointed or fractured portions of massive basalt units can act as confining beds, creating semi-confined conditions for water-bearing vesicular units below them. Conversely, compact, non-fractured massive units can act as confining beds for the vesicular horizons beneath, leading to confined conditions.

  Dug wells in the basaltic flows of the Deccan traps typically range in depth from 6 to 15 meters below ground level (mbgl). The Central Ground Water Board (CGWB) has drilled several tube wells in the Deccan traps of Khandwa district, with water-bearing capacities varying from flow to flow. Groundwater in this formation is found in the weathered, vesicular, and fractured basalt.
- **Alluvium:** Alluvium in the area consists of coarse-grained sand, silty material, gravel, and hard brownish soil and clay. The alluvium layers are generally horizontal to sub-horizontal and consist of thin horizons. Groundwater is found in the granular zones of sand and gravel. The yield of wells in this formation depends on the percentage of sand and clay, as well as the thickness of the alluvium. The yield typically ranges from 5 to 20 liters per second (lps).

Hydrogeological Map of district indicating project study area has been depicted in **Figure 4-29**.



**Source: Aquifer Map and Management Plan, Khandwa District*

Figure 4-29: Hydrogeological Map, Khandwa (Project Area identified with "Red Circle")

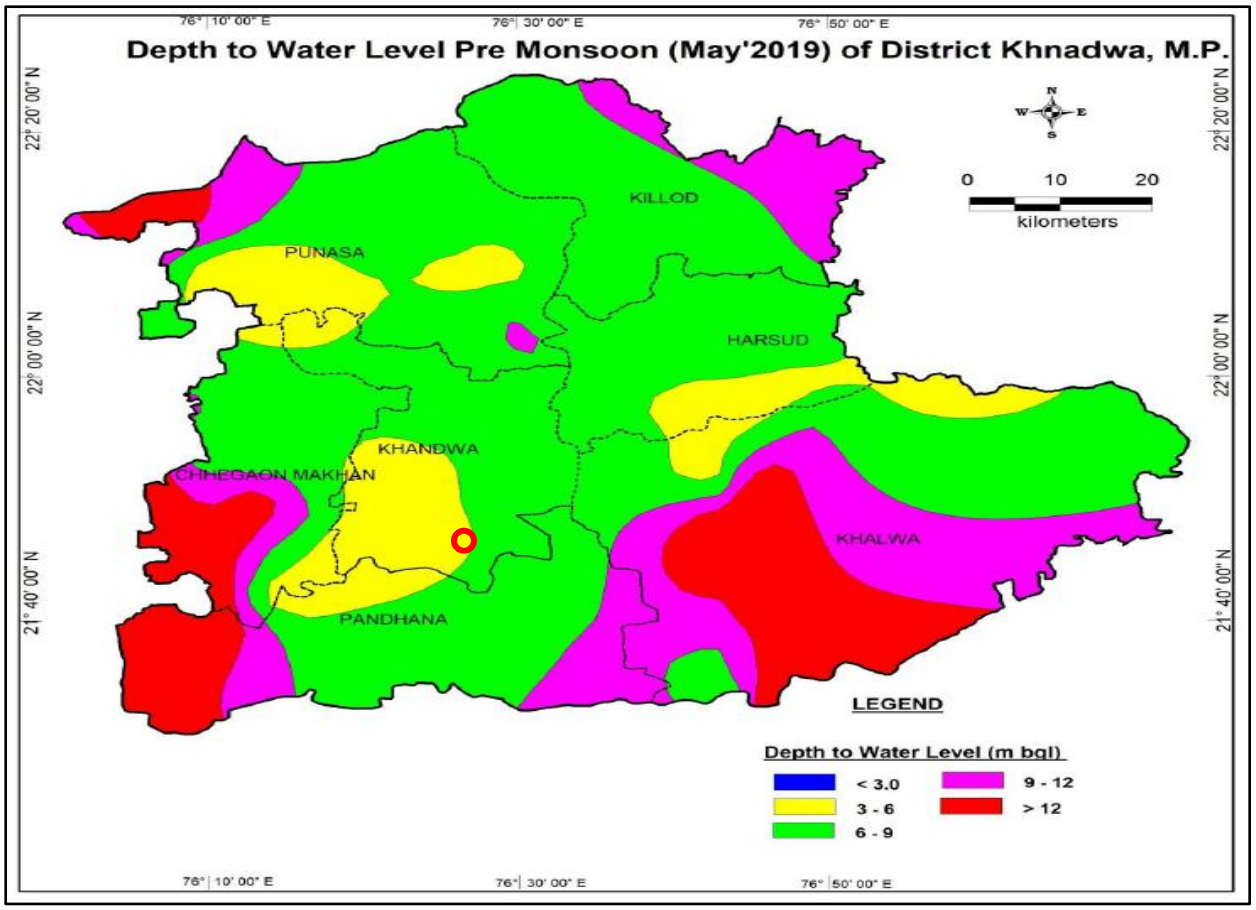
As depicted in **Figure 4-29**, the project study area falls under Deccan Trap area (Cretaceous to recent age).

DEPTH TO WATER LEVEL

Pre-monsoon water level (May 2019):

In Khandwa district, the pre-monsoon depth to water levels ranges from a minimum of 2.7 meters below ground level (mbgl) in the Punasa block to a maximum of 15.5 mbgl in the Chhegoan Maakkan block. Approximately 10% of the monitoring wells in the northern and central parts of the district show very shallow water levels, ranging from 3 to 6 meters below ground level (bgl). Around 60% of wells recorded water levels in the 6–9-meter bgl range, mainly in patches and major pockets in the northwestern and eastern parts. About 15% of wells recorded water levels between 9 and 12 meters bgl, spread across broad patches throughout the district. Deeper groundwater levels, ranging from 12 to 15 meters bgl, were observed in only 15% of wells, typically in small pockets in the northern and southwestern parts of the district. Water levels exceeding 15.5 meters bgl were recorded in the eastern part of the area.

Maps indicating depth to water level during pre-monsoon & post-monsoon have been depicted in **Figure 4-30**:



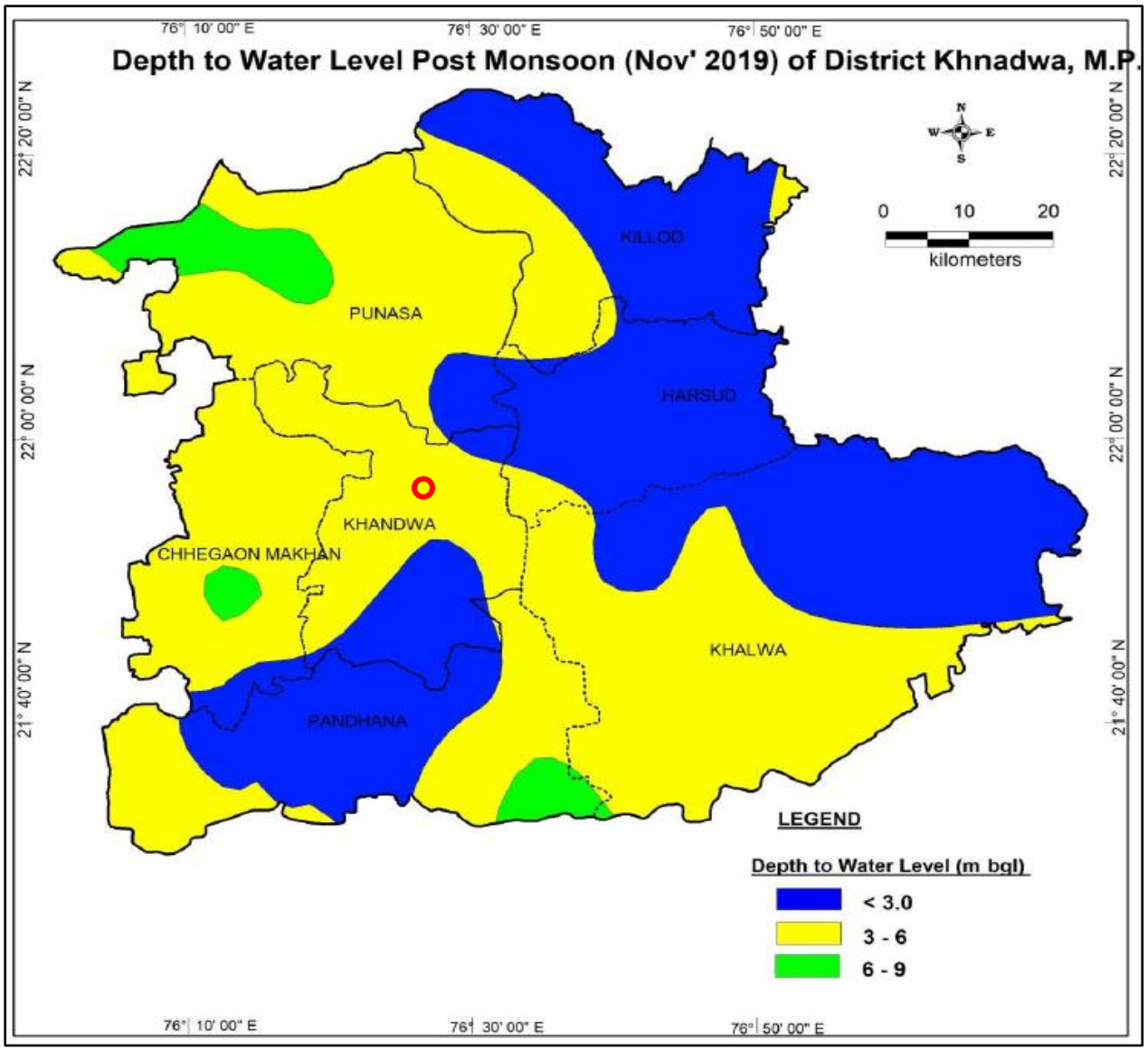
**Source: Aquifer Map and Management Plan, Khandwa District*

Figure 4-30: Pre-Monsoon Water Level, Khandwa District (Project Study Area demarcated with "Red Circle")

Post-monsoon water level (Nov 2019):

In Khandwa district, the post-monsoon depth to water levels ranges from a minimum of 1.1 meters below ground level (mbgl) in the Punasa block to a maximum of 7.6 meters bgl in the Chhegaon Makhan block. Very shallow water levels, up to 3 meters bgl, have been recorded in scattered patches across the district, accounting for about 41.46% of the total monitoring wells. Approximately 40% of the wells recorded water levels in the less than 3 meters bgl category, mainly in the central portion and patches in the northeastern and southern parts of the district. About 50% of monitoring wells showed water levels in the 3-6 meters bgl range, found in pockets throughout the region. Around 10% of wells recorded water levels ranging from 6 to 9 meters bgl, primarily in the northern and western parts. Groundwater levels deeper than 9 meters bgl have not been observed in the district.

Maps indicating depth to water level during pre-monsoon & post-monsoon have been depicted in **Figure 4-31**:



Source: Aquifer Map and Management Plan, Khandwa District

Figure 4-31: Pre-Monsoon Water Level, Khandwa District (Project Study Area demarcated with "Red Circle")

GROUND WATER RESOURCES

With approx. 85.71% of ground water extraction, the district falls in **"Safe"** category. [5]

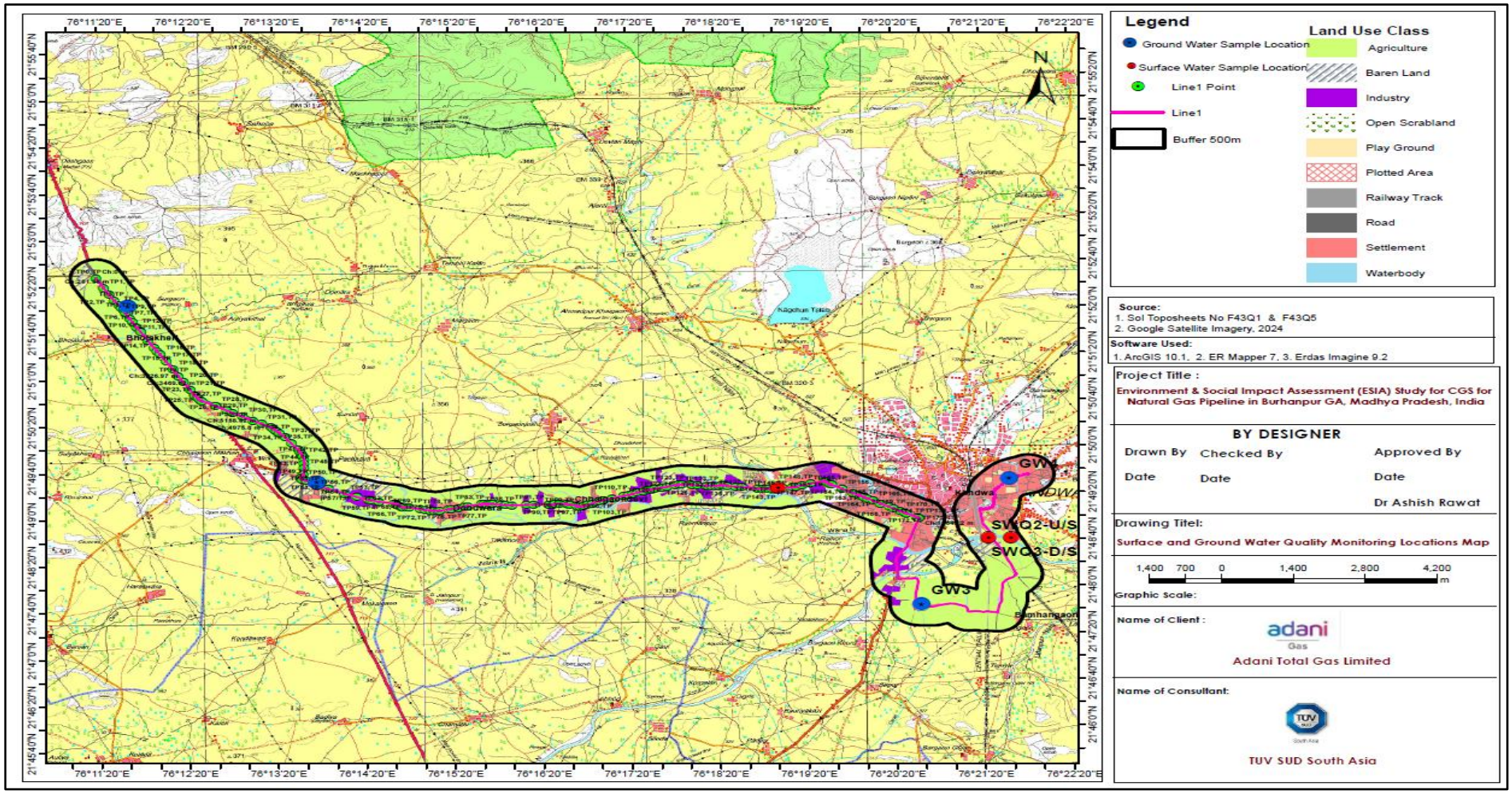
4.6.10.2 Ground Water Quality

To conduct the ground water monitoring in project study area, three (03) locations have been identified as mentioned in the **Table 4-12** and depicted in **Figure 4-32** below. The ground water quality and ground water situation of the area has been studied during baseline monitoring. The Ground water quality monitoring results have been shown in **Table 4-13,**Error! Reference source not found. **Figure 4-33,** and **Figure 4-34.**

Table 4-12: Ground Water Quality Monitoring Locations

Sl. No.	Sample code	Locations	Coordinates
1.	GWQ1	Near Ch: 920.86 m	21°52'4.05"N, 76°11'40.36"E
2.	GWQ2	Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m)	21°49'32.04"N, 76°13'47.37"E
3.	GWQ3	M G Oils	21°47'44.40"N, 76°20'37.10"E
4.	GWQ4	Tagore Park	21°49'32.29"N, 76°21'37.67"E

[5] *National Compilation on Dynamic Ground Water Resources of India, 2023 by CGWB.*



**Source: TUV SUD GIS Mapping Study (Toposheets No F43Q1 & F43Q5)*

Figure 4-32: Surface and Groundwater Quality Monitoring Locations

Table 4-13 Ground Water Quality Monitoring Results

S. No.	Test Parameters	Unit	GWQ1 21°52'4.05"N, 76°11'40.36"E	GWQ2 21°49'32.04"N, 76°13'47.37"E	GWQ3 21°47'44.40"N, 76°20'37.10"E	GWQ4 21°49'32.29"N, 76°21'37.67"E	Requirements As per	
							Acceptable Limit	Permissible Limit
1	Color	--	0.1	0.1	0.1	0.1	--	--
2	Odor	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Temperature	°C	20.5	20.3	18.8	20.3	-	-
5	pH	-	7.40	7.34	7.46	7.29	6.5-8.5	No Relaxation
6	Electric	µhos/cm	810	965	812	924	-	-
7	Total Hardness (as	mg/l	232	310.1	238.0	306.1	200	600
8	Iron (as Fe)	mg/l	0.12	0.12	0.13	0.13	0.3	No Relaxation
9	Chlorides (as Cl)	mg/l	136.6	149.6	134.4	145.7	250	1000
10	Fluoride (as F)	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	1	1.5
11	TDS	mg/l	489	548.3	486.1	556.6	500	2000
12	Calcium (as Ca^{2+})	mg/l	46.1	50.9	46.8	52.8	75	200
13	Magnesium (as	mg/l	28.2	42.0	29.5	42.4	30	100
14	Sulphate (as SO_4)	mg/l	30.4	32.1	32.1	32.1	200	400
15	Nitrate(as NO_3)	mg/l	24.3	25.7	24.3	26.1	45	No Relaxation
16	Alkalinity (as	mg/l	310	319.9	299.2	320.2	200	600
17	Total Coliform	Cfu/100gm	Not Detected	Not Detected	Not Detected (<2)	Not Detected (<2)	MPN/100ml	Not Detectable
18	E Coli	Cfu/100g	Absent	Absent	Absent	Absent	E.coli/100ml	Not Detectable

Ground water quality monitoring revealed that project study area has overall higher concentration of Total Hardness, which is ranging between 232 mg/l to 310 mg/l. Total Dissolved Solid concentration found between the range of 486 mg/l to 556 mg/l. Alkalinity concentration found around 299-320 mg/l. pH of the groundwater samples were found to be within the range of 7.29-7.46. All the other major parameters were found within the desirable limits for drinking use.

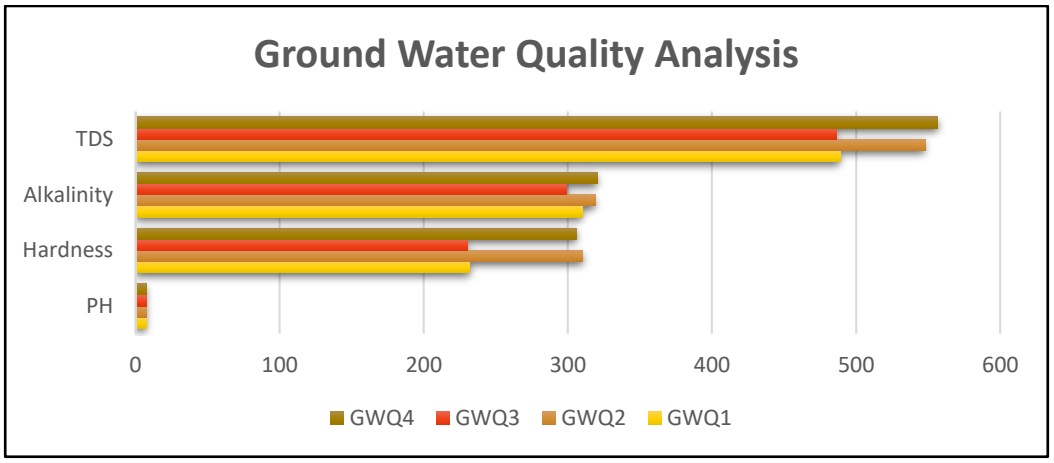


Figure 4-33 Ground Water Quality Analysis

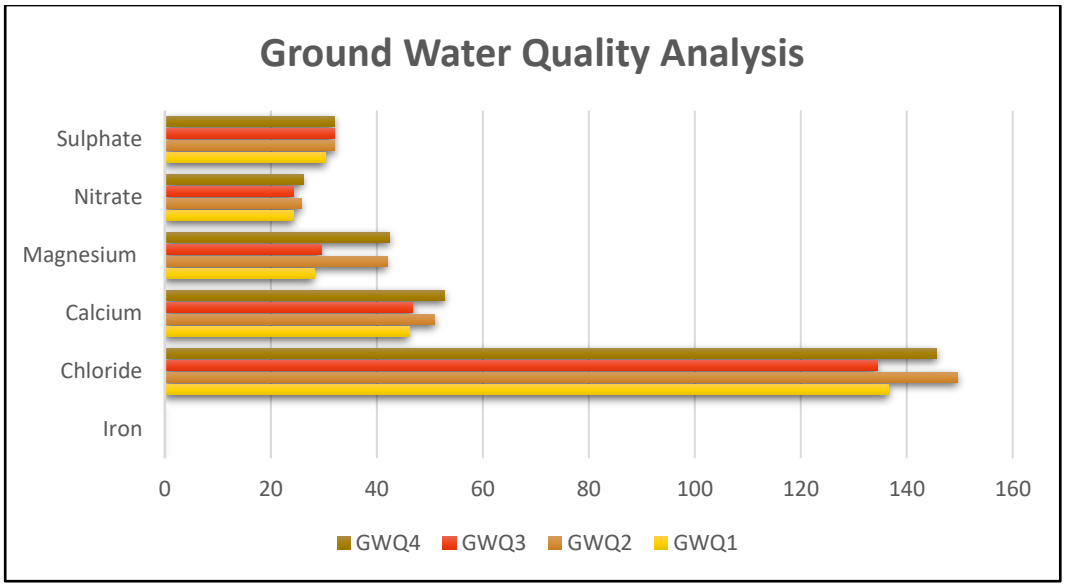


Figure 4-34 Ground Water Quality Analysis

4.6.11 Surface Water Quality

Three samples have been collected from surface water bodies within the project study area. The details of monitoring locations are provided below in **Table 4-14.** The Surface water quality monitoring results have been shown in **Table 4-15, Figure 4-35** and **Figure 4-36.**

Table 4-14: Surface Water Quality Monitoring Locations

Sl. No.	Sample code	Locations	Coordinates
1.	SWQ1	Near Ch: 16656.89 m	21°49'24.64"N, 76°19'0.36"E
2.	SWQ2	Stream (upstream)	21°48'40.57"N, 76°21'38.43"E
3.	SWQ3	Stream (downstream)	21°48'40.87"N, 76°21'23.00"E

Analysis of the samples were carried out as per established standard methods and procedures prescribed by CPCB, IS3025, IS 10500:2012 and APHA 22nd edition, 2012. The quality of water has been determined with respect to the standard values provided by the Central Pollution Control Board (CPCB).

Table 4-15 Surface Water Quality Monitoring Results

S. No.	Parameter	Unit	Result SWQ1 21°49'24.64"N, 76°19'0.36"E	Result SWQ2 21°48'40.57"N, 76°21'38.43"E	Result SWQ3 21°48'40.87"N, 76°21'23.00"E
1	Turbidity	NTU	3.42	2.94	3.0
2	pH (at 25°C)	-	7.48	7.56	7.32
3	Conductivity,	µS/cm	886	907	851
4	Total Dissolve Solids	mg/l	376	410	320.1
5	Total Hardness as $CaCO_3$	mg/l	217	243	218.7
6	Calcium as Ca	mg/l	44.7	38.3	39.2
7	Magnesium as Mg	mg/l	23.9	35.7	29.3
8	Sodium as Na	mg/l	78	80.1	87
9	Potassium as K	mg/l	48	62.1	50
10	Chloride as Cl	mg/l	166.4	190.3	140.1
11	Sulphate as SO_4	mg/l	75.0	77.1	68.8
12	Nitrate as NO_3	mg/l	36.7	36.2	30.2
13	Total Alkalinity as $CaCO_3$	mg/l	199.8	258.8	198.5
14	Fluoride	mg/l	0.12	0.11	0.13
15	Cyanide	mg/l	<0.05	<0.05	<0.05
16	Arsenic	mg/l	<0.01	<0.01	<0.01
17	Boron as B	mg/l	<0.01	<0.01	<0.01
18	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01
19	Chromium, Total	mg/l	<0.01	<0.01	<0.01
20	Copper as Cu	mg/l	<0.05	<0.05	<0.05
21	Lead as Pb	mg/l	<0.05	<0.05	<0.05
22	Manganese as Mn	mg/l	<0.05	<0.05	<0.05
23	Mercury	mg/l	<0.01	<0.01	<0.01
24	Nickel as Ni	mg/l	<0.01	<0.01	<0.01
25	Selenium as Se	mg/l	<0.01	<0.01	<0.01
26	Zinc	mg/l	0.013	0.022	0.013
27	Dissolved Oxygen	mg/l	5.71	5.75	5.71
28	Total Suspended Solid	mg/l	14.4	28.2	26.1

S. No.	Parameter	Unit	Result SWQ1 21°49'24.64"N, 76°19'0.36"E	Result SWQ2 21°48'40.57"N, 76°21'38.43"E	Result SWQ3 21°48'40.87"N, 76°21'23.00"E
29	Total Solid	mg/l	457.7	464.2	486.1
30	Chemical Oxygen Demand as O_2	mg/l	26.6	28.8	30.2
31	BOD, 3 days @27°C as O_2	mg/l	5.7	5.9	6.2
32	Oil & Grease	mg/l	<0.01	<0.01	<0.01
33	Total Coliform	MPN /100 ml	42	30	20

The surface water monitoring of the project study area reveals that COD concentration ranges between 26.6-30.2 mg/l, whereas BOD concentration was found between 5.7-6.2 mg/l. Dissolved Oxygen level found between 5.71-5.75. Thus, overall, the surface water quality of the area is well below the desired limit of surface water and wastewater parameters' standards.

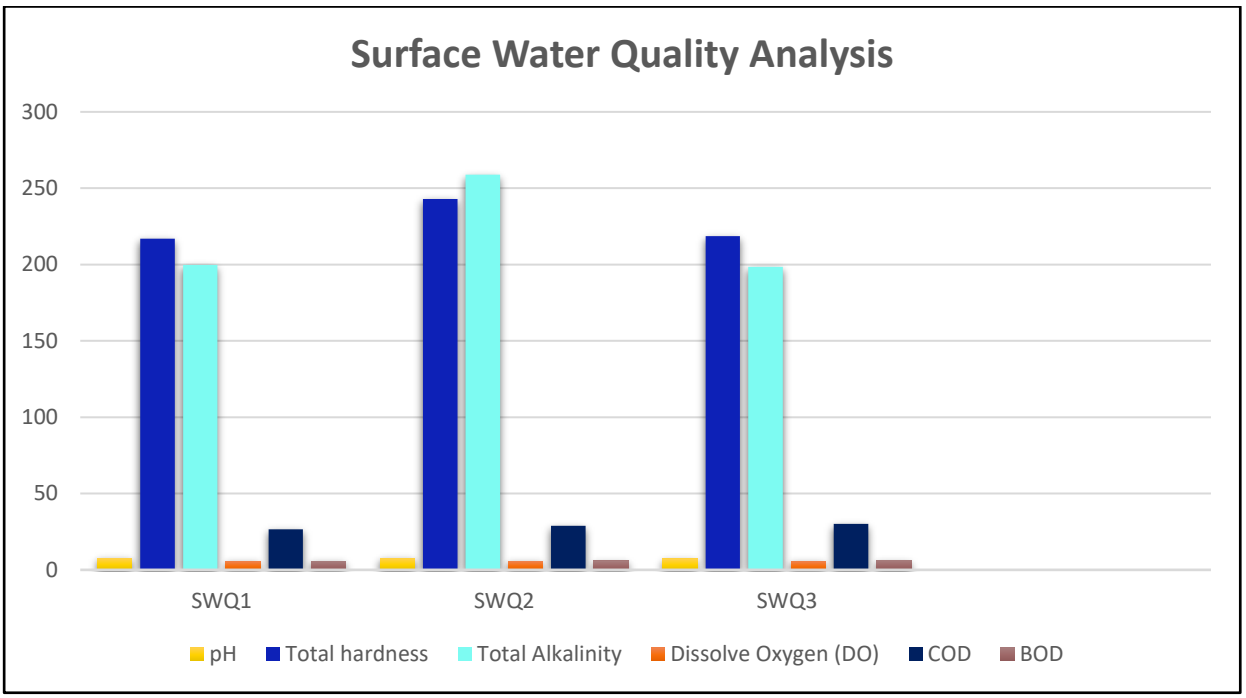


Figure 4-35 Surface Water Quality Analysis

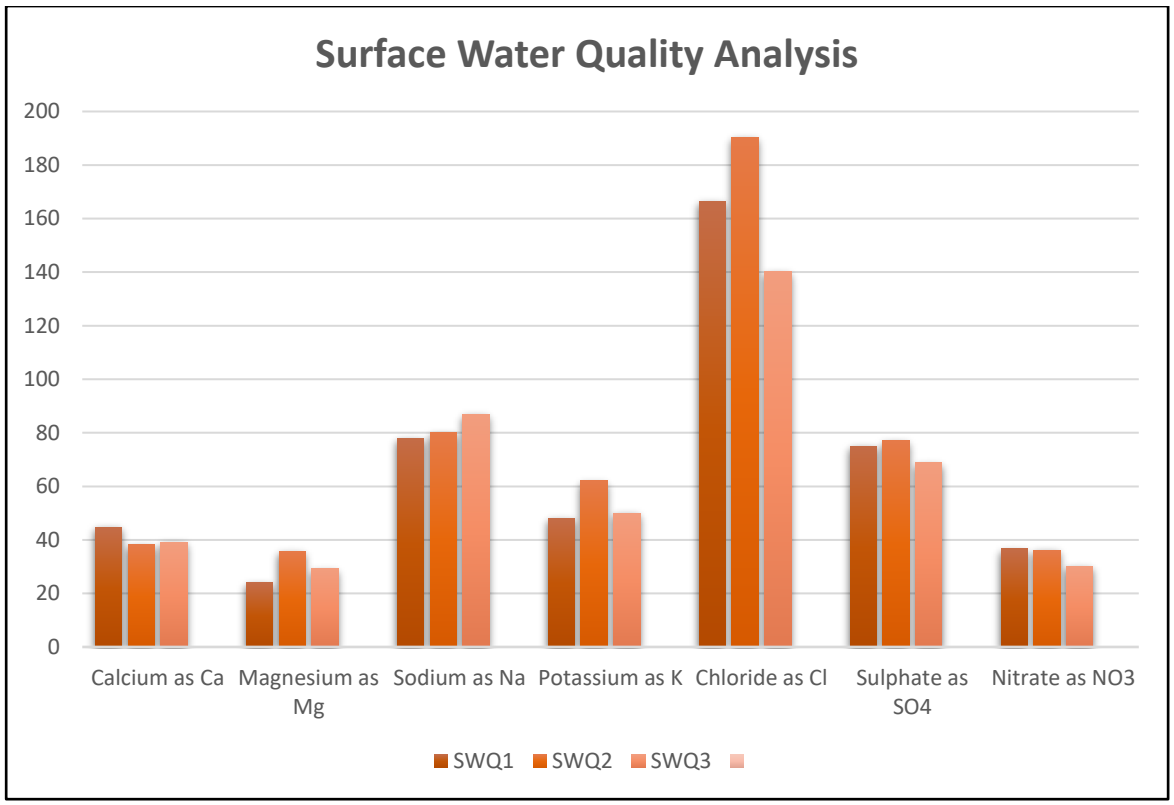


Figure 4-36 Surface Water Quality Analysis

4.7 ARCHEOLOGICAL MONUMENT AND HERITAGE SITE

As per Archaeological Survey of India, no monuments or heritage sites were observed in the project area along the pipeline route. However, during the site visit, a tourist attraction spot, namely, Kishore Kumar Memorial, is located at an aerial distance of around 56 meters from the pipeline route towards the right side of the route, near Ch: 16908.64 m; TP 145.

Figure 4-37: Kishore Kumar Memorial
(located along the pipeline route in Khandwa-Indore Road)

4.8 BIOLOGICAL ENVIRONMENT

Ecological studies are one of the important aspects of Environmental Impact Assessment (EIA) with a view to conserving biodiversity. Ecological systems show complex inter-relationships between biotic and abiotic components including dependence, competition, and mutualism. Biotic components comprise of both plant and animal communities, which interact not only within and between themselves but also with the biotic components viz. physical and chemical components of the environment. Generally, biological communities are good indicators of climatic and edaphic factors. Studies on biological aspects of ecosystems are important for the safety of flora and fauna. The biological environment includes terrestrial and aquatic ecosystems.

The observations and assessments of overall ecological scenario presented in this chapter include details of flora, fauna, natural habitats, protected areas, wildlife species and their migration corridors etc. Such baseline information provides a better understanding of the situation and overall ecological importance of the area. This baseline information viewed against industrial activities help in predicting their impact on the wildlife and their habitats in the region.

This report describes, the methodology adopted for secondary data collection, diversity of higher flora and fauna recorded through primary field studies and the secondary data sourced from published scientific literature, habitat profile and ecosystem services profile and nearest designated areas of the project site.

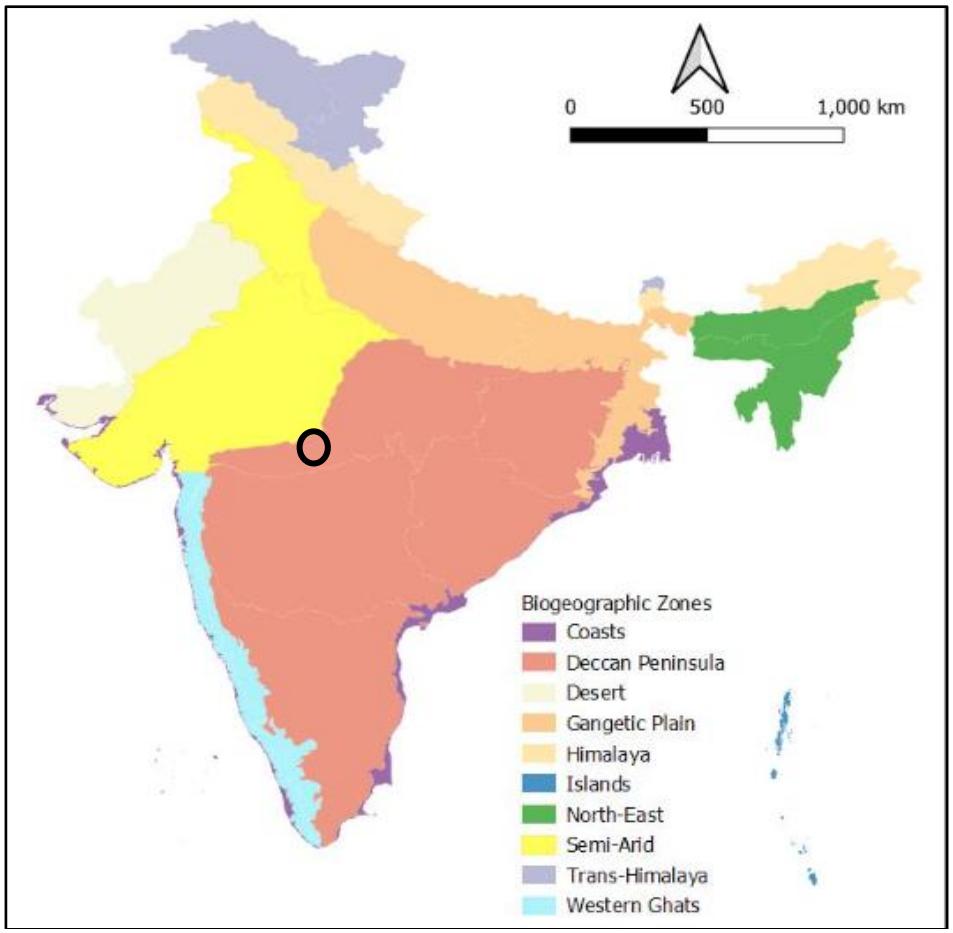
4.8.1 Scope and Objectives

The ecology & biodiversity study carried out at the project study area i.e., includes Project Footprint Area (Pipeline) and surrounding 05 km radius area of buffer zone. Based upon the study and findings, impacts were assessed and subsequently mitigation measures were recommended. Thus, further primary objectives for ecological surveys are elaborated as follows:

- Review and analyze the available literature data related to habitats, flora, and fauna of the site around proposed project and surrounding areas of 05 km radius (Buffer Zone).
- Identification of critical habitats, wildlife corridors, national parks, wildlife sanctuary, any other areas of ecological significance.
- Identification of native, alien, exotic, rare, threatened, and endangered species (if any).
- Assessment of impacts of the project on ecology during construction and operation phase.
- Identification of any notified area under international conventions, national or local legislation for their ecological, landscape, cultural or other related values within the study site.
- Suggestion of mitigation measures to minimize/avoid adverse impacts on ecology during construction and operation phase.

4.8.2 Biogeographic Description of Study Area

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province: Deccan Peninsula (**Figure 4-38**).



Source: https://indiaflora-ces.iisc.ac.in/bio_zones.php

Figure 4-38: Biogeographic Regions of India

4.8.3 Methodology for Ecological Survey

4.8.3.1 Desktop Review

A desktop review was conducted to determine the land use and land cover (Toposheet, Satellite imagery), Forest type (Champion and Seth, 1962), Bio-geographic provinces and zones (Rodgers, Panwar and Mathur 2000) and floral & faunal assemblage in the study area from published documents/papers etc. To provide representative ecological status for the project, existing critical habitats, scrubs/vegetative cover and water bodies around the project area and other factors were searched/collected and selected for ecological survey in and around of such habitats. To conduct the survey, a core and buffer zone was delineated, so that ecological receptors and impacts on them can be established during the EIA process. The core and buffer zone are as follows:

- Project Footprint Area
- Area of Influence and the buffer zone

4.8.3.2 Baseline Survey

Secondary data collection and primary on-site survey were two components of the baseline survey. The primary baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project impacts upon local ecology

and the development of appropriate mitigation measures. Prior to that, secondary data regarding sensitive ecological habitat (national park, sanctuary, ecological sensitive area, migratory corridor, habitat of endangered, vulnerable and range restricted species etc.) has been reviewed from desktop study and further flora & fauna in the project area was recorded through undertaking primary baseline phytosociological analysis, public consultation and through referring other authentic published documents to understand the major flora & fauna in the study area, assemblage of birds in the water bodies during peak winter in India, pressure on the local natural resources, presence of any Schedule-I species in the project area.

Primary survey was done at site & surrounding areas. Based on primary survey and secondary analysis of authenticated documents, inventory of floral and faunal species was made.

4.8.3.3 Study of Ecological Habitat

4.8.3.3.1 Forests

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the survey area represents the "Tropical Moist Deciduous Forests" and is subdivided into "Northern Tropical Moist Deciduous Forests". These types of forests occur in the region between 100 cm to 200 cm rainfall. These forests contain spare and stunted growth of species like Pitsal (*Pterocarpus marsupium*), axlewood (*Anogeissus latifolia*), Indian Blackberry *(Syzygium cumini),* dwarf date palm (*Phoenix acaulis)* etc. The forest area of the district is 2089.12 hectares as per India State Forest data 2019.

4.8.3.3.2 Scrubland

This type of vegetation is extensively found in non-cultivated lands, particularly revenue lands/grazing land located within the study area. Mainly species of Acacia, Zizyphus, and Capparis can be found around the project area.

4.8.3.3.3 Cropping Pattern of Study Area

The Khandwa district covers its maximum area in the production of four major crops, i.e. wheat, corn, green gram and pulses like "toor daal".

4.8.3.3.4 Water Bodies

The main pipeline route passes over the bridge constructed above the Aabna river which flows from east to west of the area.

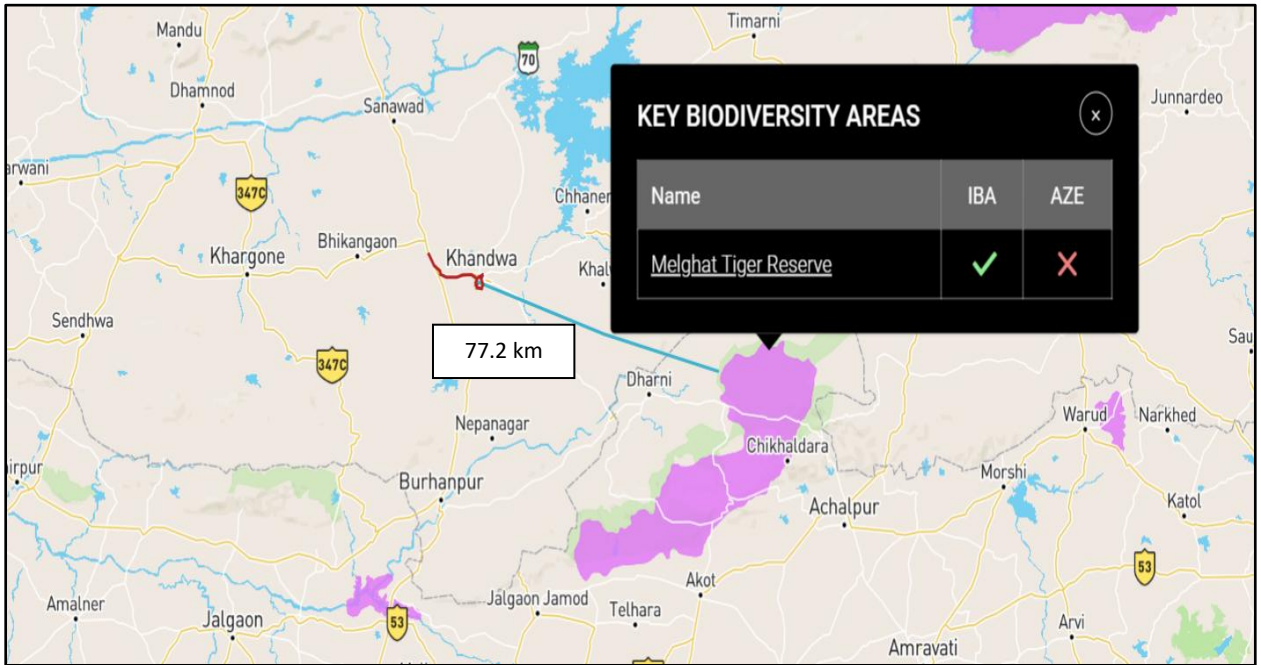
4.8.3.3.5 Protected Area and Eco-sensitive Areas

The study area comprising of core and buffer zone was assessed for the presence of important wildlife habitats and protected areas, breeding and nesting habitats of fauna, important wetlands, and grassland area from project locations and pipeline' core and buffer zones. These important areas such as Protected areas (National Park, Wildlife Sanctuaries, Conservation Reserves etc.), Wetlands of national importance, Ramsar sites, Important Bird Areas (IBAs), classified by the Birdlife International and Bombay Natural History Society etc. Data collected and information gathered from primary and secondary sources on flora, fauna, protected area, natural habitats, wildlife species etc., were analyzed and results are presented below in **Table 4-16**.

Table 4-16: Details of Eco-sensitive Areas of Project Study Area

Ecological Sensitive Habitat	Description
National Parks/ Wildlife Sanctuary/ Biosphere reserves/ Elephant Reserve/ Any Other Reserves	None within 10 km radius Study Area • Nearest Protected area is Yawal Wildlife Sanctuary located at an aerial distance of 25 km towards south of the project area.
Important Bird Areas (IBAs)	None within 10 km radius study area • Nearest Important Bird Area (IBA) is Melghat Tiger Reserve located at an aerial distance of 77.2 km towards SE of the project area.
Ramsar Wetland Site	None within 10 km radius study area
Wildlife Corridors & Routes	Nil
Breeding/nesting areas of endangered species	Nil

**Source: BirdLife International (2022) Country profile: India (http://datazone.birdlife.org/country/india)*
https://wiienvis.nic.in/Database/ramsar_wetland_sites_8224.aspx
https://wiienvis.nic.in/Database/IBA_8463.aspx



**Source: Google Earth*

Figure 4-39: Distance between Project Site and nearest Protected Areas

4.8.3.3.6 Migratory Birds and Migratory Pathway

No Important Bird Area (IBA) is located within 10 km radius of the project site. India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway, travel south to the Indian subcontinent between October-early December depending on the end of the monsoon season and remain in the country till February-March. Bird species travelling along the Central Asian Flyway, utilize several large water bodies across India as congregation sites or rest stops. The nearest Important Bird Area (IBA) is Melghat Tiger Reserve located at an aerial distance of 77.2 km towards SE of the project area.

4.8.4 Floral Diversity

The present study revealed that 23 tree species, 12 shrub species, 11 herb species, 11 grass species and 11 climber species were present in both core zone and buffer zone area up to 10 km radius of study area. Secondary data was also considered while listing the species for validation. Since open bare lands and Agri ecosystem is predominant in study area, this region supports low plant diversity and therefore, not many large trees with sizable canopies were observed.

CORE ZONE HABITAT

The core zone of the pipeline project consists of *Acacia sp.*, *Prosopis sp.*, *Azadirachta sp.*, etc. Jatropha and Calotropis are also observed growing along roadsides. Tabulated details of flora recorded in study area have been provided below in **Table 4-17** below:

Table 4-17: List of Floral species in Study Area

Sl. No.	Scientific Name	Local Name	Family
TREES			
1	*Acacia auriculiformis A. Cunn.*	Northern Black Wattle	Fabaceae
2	*Acacia catachu (L.f.) Willd.*	Khair, Katha Tree	Fabaceae
3	*Acacia farnesiana (L.) illd.*	Huizache	Fabaceae
4	*Acacia jacquemontii Benth.*	Bu-Banvali	Fabaceae
5	*Acacia nilotica ssp. indica (Bth.)*	Gum Arabic Tree	Fabaceae
6	*Acacia polyacantha Willd.*	Hook Thorn	Fabaceae
7	*Ailanthus excelsa Roxb*	Tree Of Heaven	Simarubiaceae
8	*Alangiumsalvifolium (L.f.) Wangerin*	Sage Leaved Alangium	Alangiaceae
9	*Alastoniascholaris (L) R. Br.*	Blackboard Tree	Apocynaceae
10	*Albizia amara Roxb.*	Bitter Albizia	Fabaceae
11	*Albizia lobbeck (L.) Bth.*	Indian Walnut	Fabaceae
12	*Albizia odoratissima (L.f.) Bth.*	Ceylone Rose Wood,	Fabaceae
13	*Albizia procera (Roxb.) Bth.*	White Siris	Fabaceae
14	*Annona reticulata L.*	Custard Apple	Annonaceae
15	*Annona squamosa L.*	Sugar Apple	Annonaceae
16	*Anogeissus latifolia (Roxb. ex-DC.)*	Axlewood	Combretaceae
17	*Antidesmaacidum Retz.*	Sour Currant Shrub.	Euphorbiaceae
18	*Artocarpus heterophyllus Lam.*	Jackfruit	Moraceae
19	*Azadirachta indica A. Juss*	Neem	Meliaceae
20	*Balanites aegyptiaca (L.) Del.*	Desert Date	Balanitaceae
21	*Bauhinia purpurea L.*	Rakta - Kanchan,	Caesalpiniaceae
22	*Bombax ceiba L*	Red Silk Cotton Tree	Bombacaceae
23	*Borassus flabellifer L*	Palmyra Fruit Quick Facts	Arecaceae
SHRUBS			
1	*Abutilon indicum (1.) Sweet*	Monkey Bush	Caesalpiniaceae
2	*Acacia famesiana (L.) Willd.*	Vachellia Farnesiana	Mimosaceae
3	*Acacia jacquemonti Benth*	Banwali	Miomosaceae
4	*Agave sisalana Perr. ex. Engelm.*	Sisal Hemp	Agavaceae
5	*Cadabafructicosa (L.) Druce*	Rigid Wiry Shrubs	Capparaceae

Sl. No.	Scientific Name	Local Name	Family
6	*Caesalpinia decapetala (Roth.)*	Shoofly	Caesalpiniaceae
7	*Caesalpinia pulchemima (L.) Swartz.*	Peacock Flower	Caesalpiniaceae
8	*Capparis sepiaria L.*	Wild Caper Bush	Capparaceae
9	*Capparis zeylanica L.*	Ceylon Caper	Capparaceae
10	*Carissa spinarumauct.*	Bush Plum	Apocynaceae
11	*Clerodendromserratum (L) Moon*	Bharangi	Varbenaceae
12	*Colebrookiaoppositifolia Sm.*	Indian Squirrel Tail	Lamiaceae
HERBS			
1	*Amaranthus spinosus L*	Spiny Amaranth	Amaranthaceae
2	*Andrographis paniculata (Burm.f.)*	Bitterweed	Acanthaceae
3	*Bacopa monnieri (L.) Wettst.*	Water Hyssop	Scrophulariaceae
4	*Barleriagibsoni Dalz.Burm.f.*	Neel Koranti	Acanthaceae
5	*Biophytumsensitivum (L.)*	Little Tree Plant	Oxalidaceae
6	*Boerha viadiffusa L.*	Red Spiderling	Nyctaginaceae
7	*Catharanthus roseus (L.) G. Don.*	Bright Eyes	Asteraceae
8	*Chenopodium murale L*	Nettleleaf Goosefoot	Chenopodiaceae
9	*Cleome gynandra L.*	Shona Cabbage	Cleomaceae
10	*Cleome viscosa L.*	Wild Or Dog Mustard	Cleomaceae
11	*Crotalaria spectabilis Roth.*	Showy Rattlebox	Fabaceae
GRASSES			
1	*Arthraxon lancifolius (Trin.) Hochst*	Lanceleaf Carpetgrass	Poaceae
2	*Brachiaria formis (J.E.Sm.) Griseb.*	Sweet Signal Grass	Poaceae
3	*Brachiaria ramosa (Linn.) in*	Browntop Millet	Poaceae
4	*Chrysopogon fulvus (Spreng.) Chiov.*	Golden False Beardgrass	Poaceae
5	*Cymbopogon martinii (Roxb) Wats*	Palmarosa	Poaceae
6	*Cynodon dactylon (Linn)*	Bermuda Grass	Poaceae
7	*Dichanthium anstatum (Poir.)C E*	Angleton's Bluestem	Poaceae
8	*Eleusine indica (Linn.) Gaertn.*	Indian Goosegrass	Poaceae
9	*Eragrostis pilosa (Linn.) P*	India Lovegrass	Poaceae
10	*Eragrostis tenella (Linn.) P*	Japanese Lovegrass	Poaceae
11	*Eragrostis unioloides (Retz*	Lovegrass	Poaceae
CLIMBERS			
1	*Abrusprecatorius L.*	Rosary Pea	Fabaceae
2	*Acacia pinnta (L.) Willd*	Rusty Mimosa	Mimosaceae
3	*Acacia torta (Roxb.) Craib*	Katnar	Mimosaceae
4	*Ampelocissus latifolia (Roxb.)*	Wild Grape	Vitaceae
5	*Argyreia sericea Dalzell*	Silky Morning Glory	Convolvulaceae
6	*Bahuniavahli Wt. &Arn*	Adda Leaf	Caesalpiniaceae
7	*Basella alba L.*	Malabar Spinach	Basellaceae
8	*Butea superba Roxb.*	Butea Gum Tree	Fabaceae
9	*Canavalia gladiate (Jacq.) DC.*	Sword Bean	Fabaceae
10	*Cardiospermum helicacabum L.*	Lesser Balloon Vine	Sapindaceae
11	*Cissampelos pareira L.*	Pereira Brava	Menispermaceae

4.8.5 Faunal Diversity

Diversity of faunal distribution shows the health of ecosystem. In this study area a total of 24 types of faunal species were reported, in which 12 species of mammals, 61 birds, 19 reptiles were recorded.

4.8.5.1 Mammals

The mammals are occupying higher tropic levels in many ecosystems and respond quickly to the changes in their habitats, therefore, serves as best indicators of the ecosystem health. Hence, the baseline information on distribution and abundance of mammals is prepared. A qualitative check list of mammals based on their presences and absence using indirect evidence and signs such as footprints, dens, droppings, diggings, scrap marks, etc. in the study area was prepared. Following list of mammal species as presented in **Table 4-18** were predominantly recorded in the project study area.

Table 4-18: List of Mammals Species in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1	Spotted deer	*Axis axis*	II	LC
2	Nilgai	*Boselaphus tragocamelus*	II	LC
3	Golden Jackal	*Canis aureus*	II	LC
4	Jungle Cat	*Felis chaus*	I	LC
5	Five Striped Palm Squirrel	*Funambulus pennanti*	_	LC
6	Indian grey mongoose	*Herpestes edwardsi*	_	LC
7	Indian Porcupine	*Hystrix indica*	I	LC
8	Indian hare	*Lepus nigricollis*	II	LC
9	Rhesus Macaque	*Macaca mulutta*	_	LC
10	Asian palm civet	*Paradoxurus hermaphroditus*	I	LC
11	Common langur	*Presbytis entellus*	_	_
12	**Indian Flying Fox**	***Pteropus giganteus***	**II**	**NT**

**Sources: TUV SUD Primary Survey and secondary data Study*
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.8.5.2 Herpetofauna

The diversity of amphibian and reptilian species in an ecosystem is cumulatively called Herpetofaunal diversity. Amphibians are fauna which can survive on land as well as in water. They inhabit a wide variety of habitats with most species living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Their presence witness's richness of ecosystem. They are omnivorous in feeding habit. The following **(Table 4-19)** species of herpetofauna were observed in the study area.

Table 4-19: Herpetofaunal Species recorded in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1	Common Vine Snake	*Ahaetulla nasuta*	_	_
2	Garden Lizard	*Calotes versicolor*	_	_

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
3	Indian Chamaleon	*Chamaeleo zeylanicus*	_	_
4	**Red Sand Boa**	***Eryx johnii***	**I**	**NT**
5	Common Trinket	*Coelognathus helena*	_	_
6	Rat Snake	*Ptyas mucosa*	I	_
7	Common Wolf Snake	*Lycodon aulicus*	_	LC
8	Barred Wolf Snake	*Lycodon striatus*	_	LC
9	Checkered Keelback	*Fowlea piscator*	I	_
10	Green Keelback	*Rhabdophis plumbicolor*	_	LC
11	Common Cat Snake	*Boiga trigonata*	_	LC
12	Common Krait	*Bungarus caeruleus*	I	LC
13	Indian Cobra	*Naja naja*	I	LC
14	Russell's Viper	*Daboia russelii*	I	LC
15	Indian Rat Snake	*Ptyar muucosa NV*	I	_
16	**Indian Rock Python**	***Python molurus molurus***	**_**	**NT**
17	Common Indian Toad	*Bufo melanosticus*	_	LC
18	Common Tree Frog	*Polypedates maculatus*	_	LC
19	Indian Bull Frog	*Hoplobatrachus tigerinus*	II	_

**Sources: TUV SUD Primary Survey and secondary data Study*
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.8.5.3 Avifauna

A total of 126 bird species were reported in Khandwa district. Also, there is no Important Bird Area (IBA), Bird migratory paths and congregatory birds' locations were observed in study area. The list of avifauna observed or reported in study area is presented in **Table 4-20**[6].

Table 4-20: List of Avifaunal species in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1	White-throathed Kingfisher	*Halcyon smyrnensis*	_	LC
2	Brown-capped Pygmy Woodpecker	*Yungipicus nanus*	II	LC
3	Yellow-crowned Woodpecker	*Leiopicus mahrattensis*	I	LC
4	Black-rumped Flameback	*Dinopium benghalense*	II	LC
5	Gray-breasted Prinia	*Prinia hodgsonii*	_	LC
6	Purple Sunbird	*Cinnyris asiaticus*	II	LC
7	Gray Wagtail	*Motacilla cinerea*	_	LC
8	Tree Pipit	*Anthus trivialis*	II	LC
9	Spotted Dove	*Spilopelia chinensis*	II	LC

[6] Diversity and conservation status of avifauna in the Khandwa region, Madhya Pradesh, India

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
10	Red-wattled Lapwing	*Vanellus indicus*	II	LC
11	Eastern Cattle-Egret	*Ardea coromanda*	_	LC
12	Black-winged Kite	*Elanus caeruleus*	II	LC
13	Oriental Honey-buzzard	*Pernis ptilorhynchus*	_	LC
14	Indian Roller	*Coracias benghalensis*	II	LC
15	Coppersmith Barbet	*Psilopogon haemacephalus*	II	LC
16	Rose-ringed Parakeet	*Psittacula krameri*	II	LC
17	Common woodshrike	*Tephrodornis pondicerianus*	II	LC
18	White-browed Fantail	*Rhipidura aureola*	II	LC
19	Black Drongo	*Dicrurus macrocercus*	II	LC
20	Common Tailorbird	*Orthotomus sutorius*	II	LC
21	Ashy Prinia	*Prinia socialis*	II	LC
22	Eastern Red-rumped Swallow	*Cecropis daurica*	_	LC
23	Red-vented Bulbul	*Pycnonotus cafer*	II	LC
24	Greenish Warbler	*Phylloscopus trochiloides*	II	LC
25	Jungle Babbler	*Argya striata*	II	LC
26	Common Babbler	*Argya caudata*	II	LC
27	Indian Nuthatch	*Sitta castanea*	II	LC
28	Brahminy Starling	*Sturnia pagodarum*	II	LC
29	Common Myna	*Acridotheres tristis*	II	LC
30	Indian Robin	*Copsychus fulicatus*	II	LC
31	Oriental Magpie-Robin	*Copsychus saularis*	_	LC
32	Black Redstart	*Phoenicurus ochruros*	II	LC
33	Siberian Stonechat	*Saxicola maurus*	II	LC
34	Pied Bushchat	*Saxicola caprata*	II	LC
35	Brown Rockchat	*Oenanthe fusca*	_	LC
36	Yellow-throated Sparrow	*Gymnoris xanthocollis*	II	LC
37	Greater Coucal	*Centropus sinensis*	II	LC
38	Rufous treepie	*Dendrocitta vagabunda*	II	LC
39	Hume's Warbler	*Phylloscopus humei*	II	LC
40	Taiga Flycatcher	*Ficedula albicilla*	II	LC
41	Red-breasted Flycatcher	*Ficedula parva*	II	LC
42	Rock Pigeon	*Columba livia*	_	LC
43	White-breasted Waterhen	*Amaurornis phoenicurus*	II	LC
44	Asian Green Bee-eater	*Merops orientalis*	_	LC
45	Common Iora	*Aegithina tiphia*	II	LC
46	Long-tailed shrike	*Lanius schach*	II	LC
47	Indian Yellow Tit	*Machlolophus aplonotus*	_	LC
48	Plain Prinia	*Prinia inornata*	II	LC
49	Jungle Nightjar	*Caprimulgus indicus*	II	LC
50	Savanna Nightjar	*Caprimulgus affinis*	II	LC

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
51	Bonelli's Eagle	*Aquila fasciata*	I	LC
52	White-eyed Buzzard	*Butastur teesa*	I	LC
53	Spotted Owlet	*Athene brama*	II	LC
54	Verditer Flycatcher	*Eumyias thalassinus*	II	LC
55	Indian Gray Hornbill	*Ocyceros birostris*	_	LC
56	Knob-billed Duck	*Sarkidiornis melanotos*	II	LC
57	Indian Spot-billed Duck	*Anas poecilorhyncha*	II	LC
58	Laughing Dove	*Spilopelia senegalensis*	II	LC
59	Common Sandpiper	*Actitis hypoleucos*	II	LC
60	Little Cormorant	*Microcarbo niger*	II	LC
61	Great Cormorant	*Phalacrocorax carbo*	II	LC

**Sources: TUV SUD Primary Survey and secondary data Study*
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.8.5.4 Aquatic Ecology

FISH SPECIES: The following fish species have been recorded within the study area (**Table 4-21).**

Table 4-21: Details of Fish Species recorded in Study Area

Sl. No.	Scientific Name	Common Name/English Name
Fish Species		
1	*Catla catla*	Indian Major Carp
2	*Labeo rohita*	Rohu fish
3	*Labeo calbasu*	Orangefin labeo
4	*Labeo bata*	Bata fish
5	*Cirrhinus mrigla*	Mrigel fish
6	*Labeo fimbriatus*	Fringe lipped carp
7	*Cyprinus carpio*	Common carp
8	*Cyprinocarpius communis*	Common carp
9	*Labeo boga*	Bangum batta
10	*Rasbora daniconius*	Slender rasbora
11	*Mystus vitatus*	Striped dwarf catfish
12	*Ophiocephalus gachua*	Dwarf Snakehead
13	*Ophiocephalus punctatus*	Spotted Snakehead
14	*Ophiocephalus striatus*	Common Snakehead/Mudfish
15	*Hypothalamicthyes molitrix*	Silver Carp
16	*Channa striata*	Stripped Snakehead

4.9 SOCIO-ECONOMIC ENVIRONMENT

The primary objective of socio-economic study is to assess the current socio-economic status of the villages and community within the project area and to assess the potential impact of the project on the community in terms of livelihood, health, education, and others. The study is also used to understand the existing issues and concerns of the community based on which mitigation measures and other community development activities are designed.

This section envisages to present the socio-economic baseline of the project influence area and the project footprint area along with the synopsis of the stakeholder consultations conducted on the site.

4.9.1 Methodology

A mixture of both quantitative and qualitative approach has been adopted in the current socio-economic study. The study has been conducted based on primary and secondary data. While primary data has been collected through reconnaissance survey and public consultations/focused group discussions/individual interviews within the villages/towns/district headquarters falling on the proposed project alignment, secondary data has been collected from the Census of India 2011 and district statistical handbook, state and district portal. The details regarding population composition, number of literates, working population and access to basic facilities and others have been collected from secondary sources and analyzed. The analysis of secondary data has been done in two sections:

Villages located within a 500 metres aerial distance from the proposed pipeline project has been considered as project impact areas. The pipeline route passes along Bhojakhedi, Sulyakhedi, Chhaigaon Makhan, Balkhand Sura, Chhaigaon Devi, Dodwada, Takali Mori and Borgaon Khurd villages and Khandwa Municipal Corporation area.

4.9.2 Concept and Definition of Terms Used

a) **Household:** A group of persons who normally live together and take their meals from a common kitchen are called a household. Persons living in a household may be related or unrelated or a mix of both. However, if a group of related or unrelated persons live in a house but do not take their meals from the common kitchen, then they are not part of a common household. Each such person is treated as a separate household. There may be one member households, two member households or multi-member households.

b) **Density:** is a statistic that tells you how many people live in a certain geographical area. This type of measurement is called arithmetic density and is reported as the total number of people per land area.

d) **Sex Ratio:** Sex ratio is the ratio of females to males in each population. It is expressed as 'number of females per 1000 males.

e) **Literates:** All persons aged up to 7 years and above who can both read and write with understanding in any language are taken as literate. It is not necessary for a person to have received any formal education or passed any minimum educational standard for being treated as literate. People who are blind but can read in Braille are also treated as literates.

f) **Literacy Rate:** Literacy rate of population is defined as the percentage of literates to the total population aged 7 years and above.

h) **Work:** Work is defined as participation in any economically productive activity with or without compensation, wages, or profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. The

work may be part time or full time or unpaid work in a farm, family enterprise or in any other economic activity.

i) **Worker:** All persons engaged in 'work' are defined as workers. Persons who are engaged in cultivation of land or milk production even solely for domestic consumption are also treated as workers.

j) **Main Workers:** Those workers who had worked for a major part of the reference period (i.e., 6 months or more in the case of a year) are termed as Main Workers.

k) **Marginal Workers:** Those workers who did not work for a major part of the reference period (i.e., less than 6 months) are termed as Marginal Workers.

l) **Work Participation rate (WPR):** The work participation rate is the ratio between the labour force and the overall size of their cohort (national population of the same age range). In the present study the work participation rate is defined as the percentage of total workers (main and marginal) to total population.

4.10 State Profile-Madhya Pradesh

Madhya Pradesh, the second-largest state in India by area (308,252 sq. km) and the fifth-largest by population is administratively divided into 10 divisions and 52 districts. It shares borders with the Ganga-Yamuna Plains in the north, the Aravalli Range in the west, Chhattisgarh in the east, and the Tapti Valley and Maharashtra Plateau in the south. The state comprises 51,929 inhabited villages and 476 towns. The sex ratio stands at 931 females per 1,000 males, slightly below the national average of 943. Scheduled Castes (SC) constitute approximately 15.6% of the population, while Scheduled Tribes (ST) make up about 21.1%.

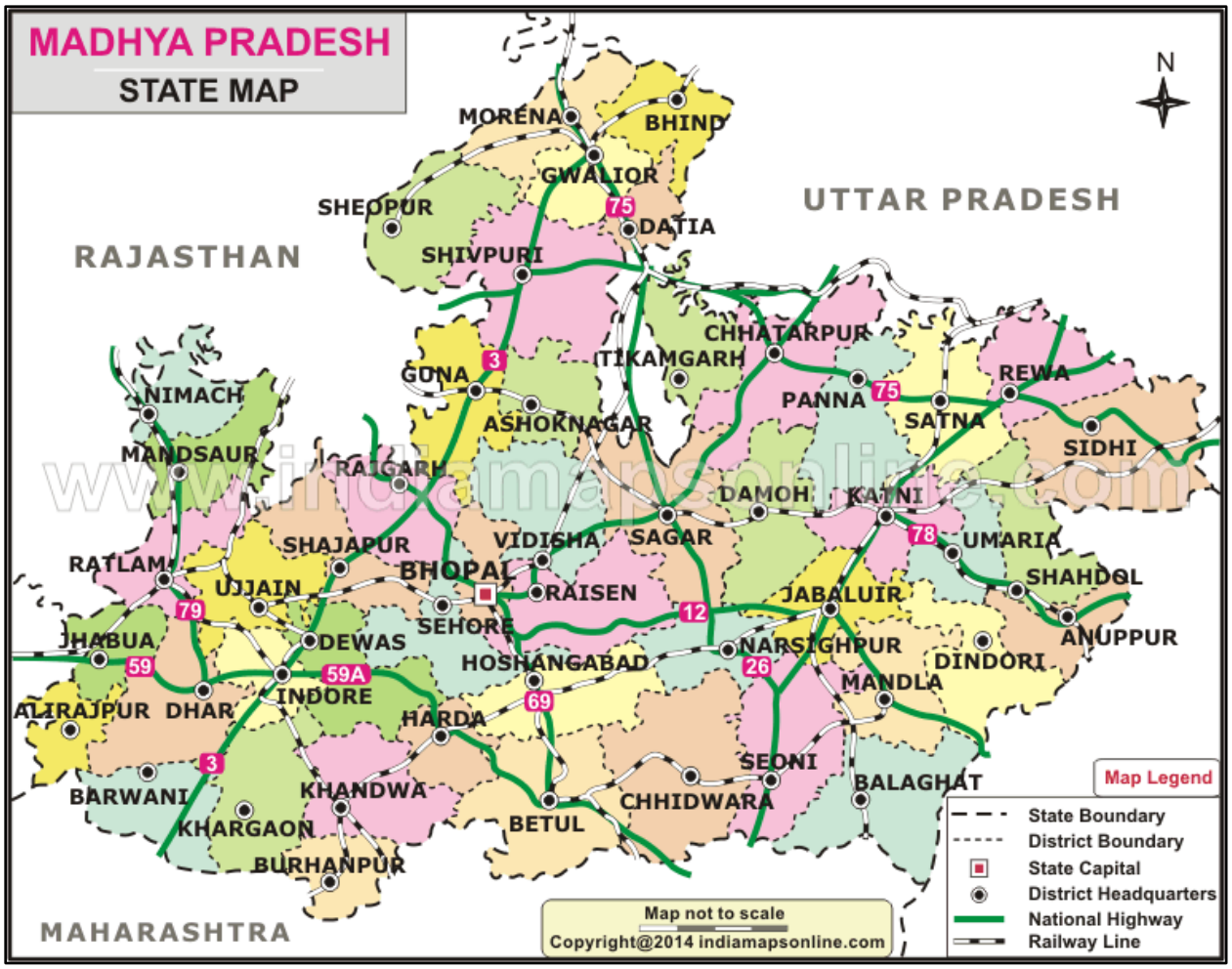


Figure 4-40: State Map of Madhya Pradesh

4.10.1 District Profile (Khandwa)

Khandwa district, located in the southwestern part of Madhya Pradesh within the Indore Division, lies between 21°22’ & 22°35’ North latitude and 75°57’ & 77°13’ East longitude, covering an area of 7,352 sq. km, which accounts for approximately 2.39% of the state's total geographical area. It is bordered by Harda and Betul districts to the east, Khargone and Burhanpur to the west, Dewas to the north, and Maharashtra to the south. The district is administratively divided into four tehsils—Khandwa, Pandhana, Punasa, and Harsud—and further subdivided into seven developmental blocks. As per the 2011 Census, Khandwa has a population of 1,310,061 persons with approximately 80.02% residing in rural areas. Population density of the district has been recorded as 178 and the sex ratio was reportedly 943 females per 1,000 males. The literacy rate has been recorded at 66.4 percent. While Scheduled Castes make up 12 percent of the district’s population, Scheduled Tribes account for 35%, indicating a significant tribal presence. The district’s economy is primarily agrarian, with key crops including soybeans, wheat, and pulses, along with small-scale industries contributing to economic growth.

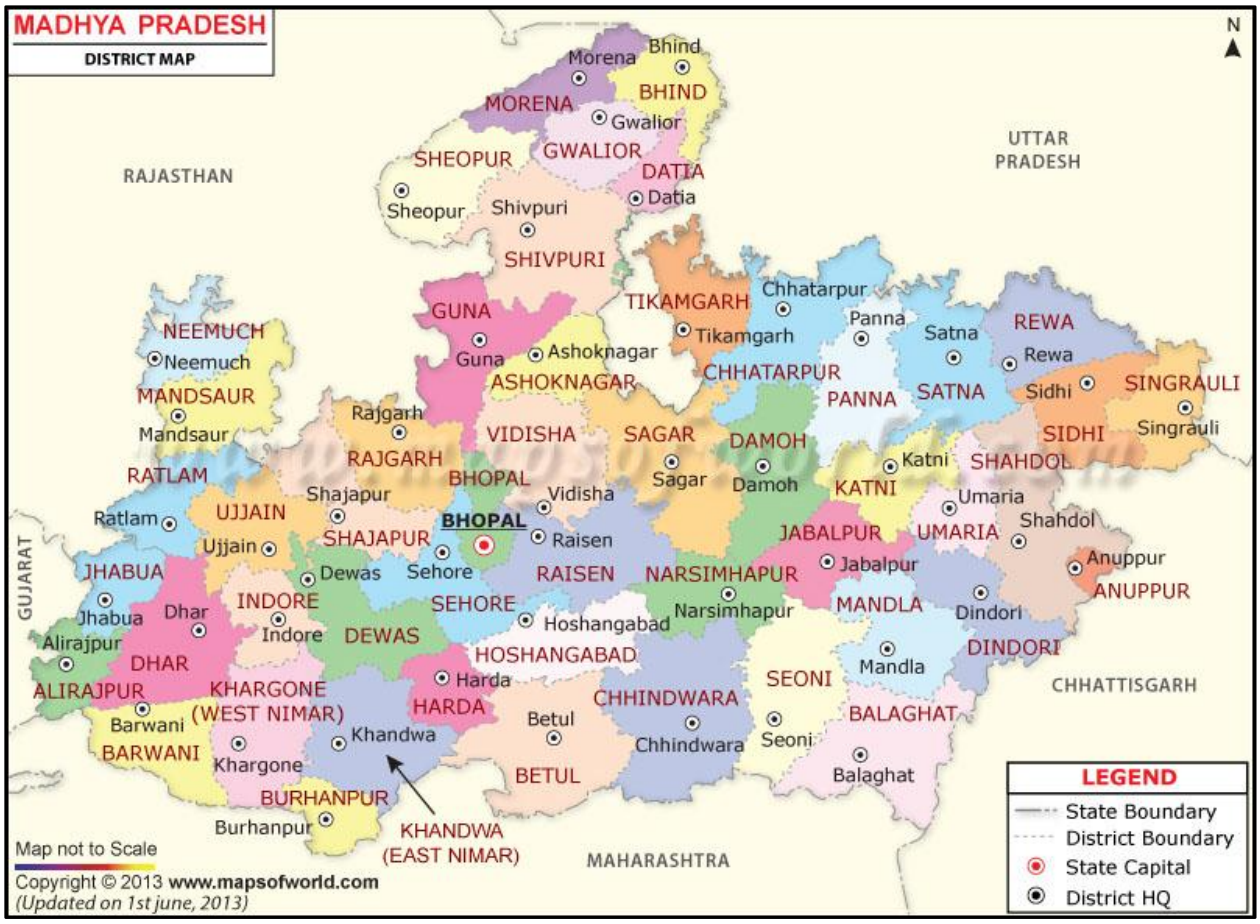


Figure 4-41: District Map of Khandwa

4.10.2 Block Profile

The land designated for the proposed project traverses through three blocks which are Chhegaon Makhan, Khandwa and Pandhana, covering both rural and urban regions, the details of which are provided in the subsequent sections.

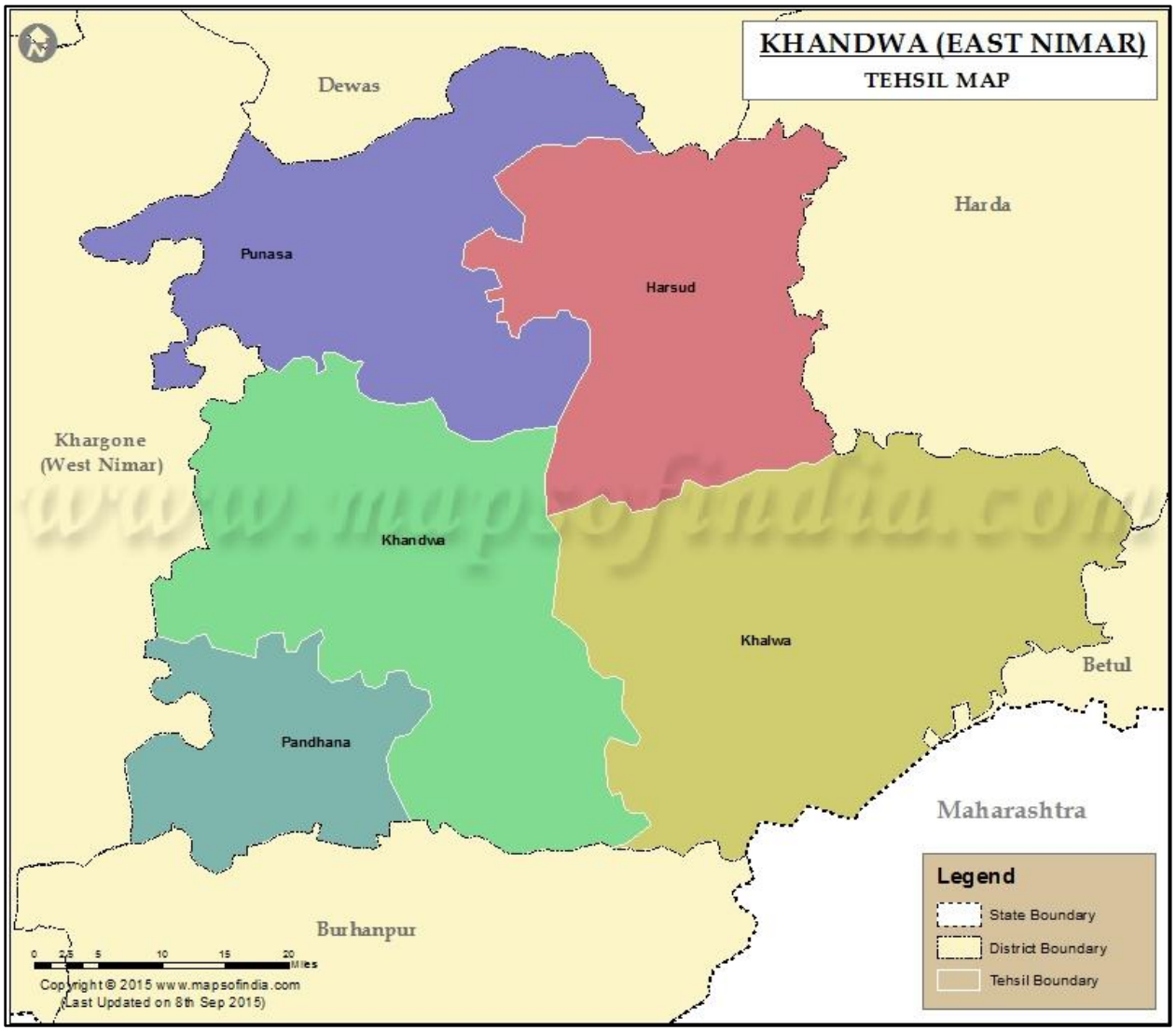


Figure 4-42: Tehsil Map of Khandwa (East Nimar)

4.10.3 Demography

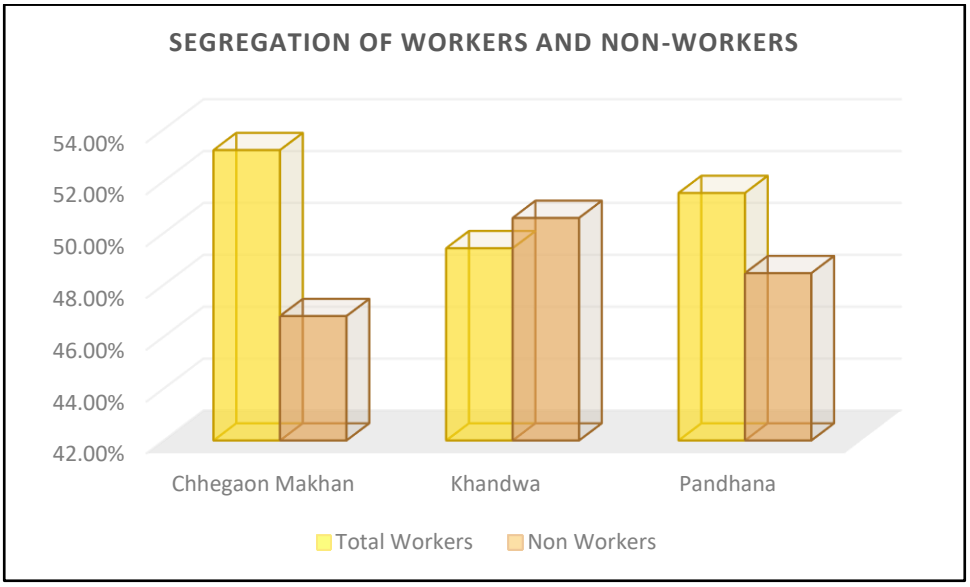
Table 4-22 provides an overview of the area and demographic characteristics of three blocks—Chhegaon Makhan, Khandwa, and Pandhana—covering both rural and urban areas as per Census 2011. Pandhana is the largest amongst the three blocks, both in terms of both geographical area and population. All of the blocks recorded similar proportions male and female populations. Pandhana also recorded the highest ST population amongst all three blocks accounting for approximately 50 percent of its total population. Literacy Rates for all the blocks were recorded to be low, with Pandhana recording literacy rate of only about 47.54 percent.

Table 4-22: Demographic Details-Block Profile

Sl. No	Block Name	Area (in sq. kms)	No. of HH	Total Pop	Percent Male	Percent Female	Percent SC	Percent ST	Literacy Rate
1	Chhegaon Makhan	626.17	29737	140216	51.57	48.44	17.84	25.23	58.01
2	Khandwa	623.97	30111	139766	51.71	48.29	17.54	24.67	57.83
3	Pandhana	1006.35	46934	229130	51.21	48.79	8.07	50.35	47.54

4.10.4 Working Population

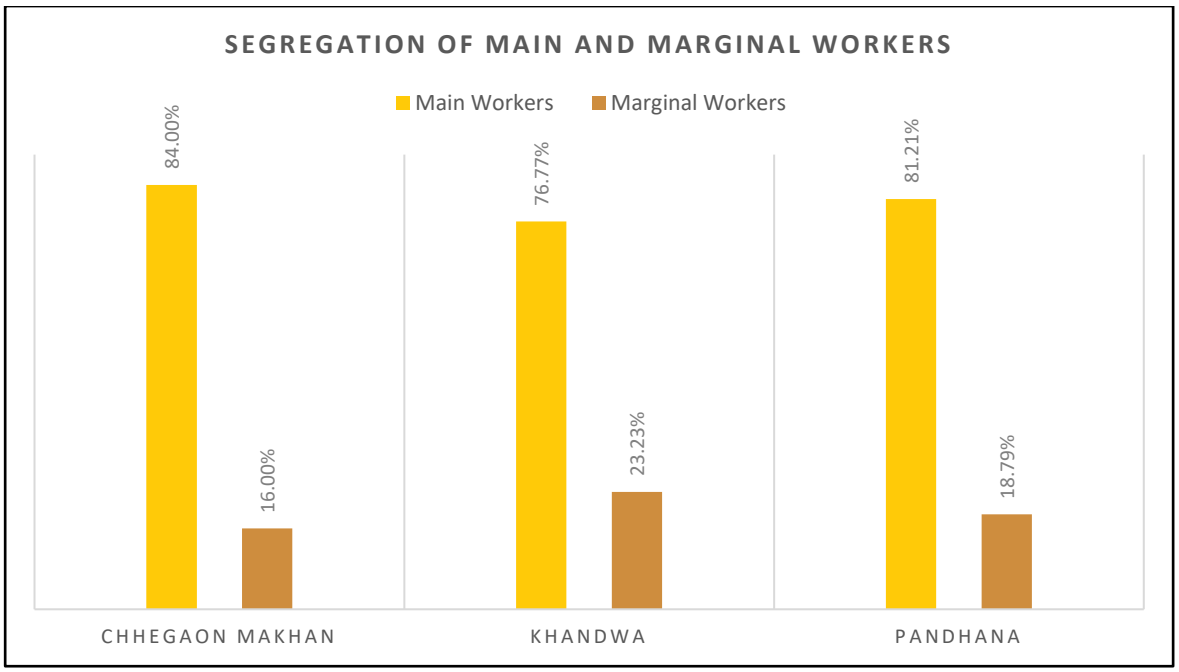
According to the Census 2011 data, Chhegaon Makhan recorded the highest working population of 53.20 percent while Khandwa recorded lowest working population of 49.42 percent of the total population. as depicted in **Figure 4-43.**



Source: Census,2011

Figure 4-43: Segregation of Workers and Non-Workers-Block Profile

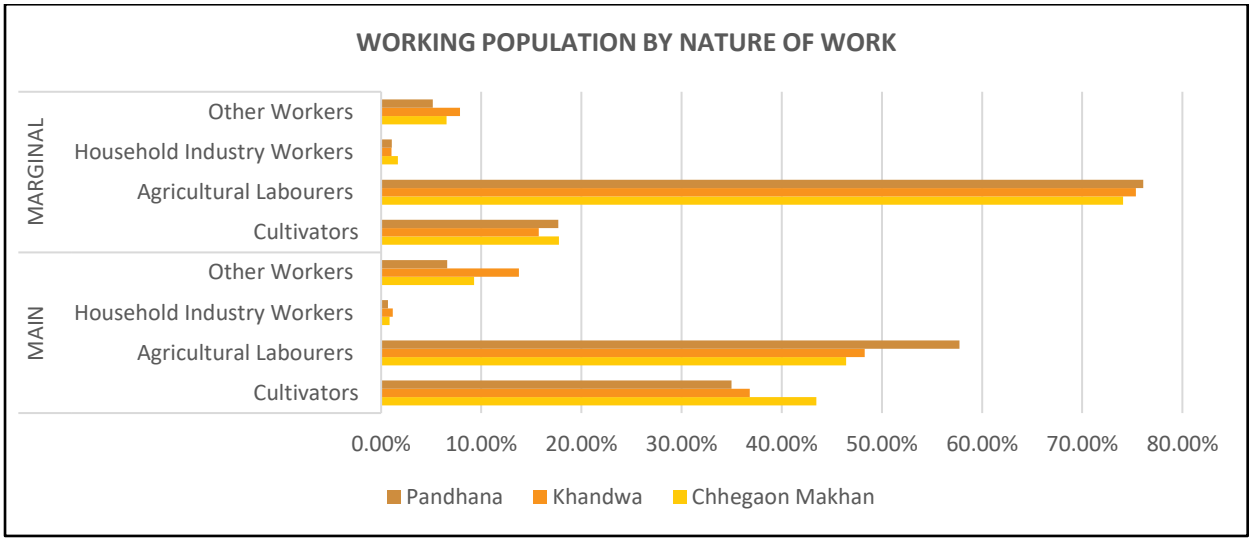
Figure 4-44 provides graphical representation of the proportion of main and marginal workers for each block. Analysis of data suggests that all the blocks reportedly have more main workers than marginal workers. Chhegaon Makhan recorded the highest proportion of main workers accounting for approximately 84 percent of the working population followed by Pandhana and Khandwa accounting for approximately 81 percent and 77 percent of the working population of the respective village.



Source: Census,2011

Figure 4-44: Working Population: Main and Marginal Workers

Further segregation of the working and non-working population suggests larger proportion of working population engaged in agriculture and cultivation. **Figure 4-45** provides a graphical representation of the segregation of workers w.r.t. the nature of work, where the proportion of main and marginal workers engaged in different occupations has been analyzed as per the data provided in the Census 2011. The proportion of workers engaged in agricultural activities in both the main and marginal category were reportedly higher than those engaged in other livelihood generating activities.



Source: Census 2011

Figure 4-45: Segregation of Working Population by Nature of Work

4.11 Project Impact Area

As per the data shared by the project proponent, the proposed pipeline route passes through Bhojakhedi, Sulyakhedi, Chhaigaon Makhan, Balkhand Sura, Chhaigaon Devi, Dodwada, Takali Mori, and Borgaon Khurd villages and the Khandwa Municipal Corporation area.

Table 4-23 : Route Specifications

S. No	Route	Village Name
1.	Proposed Pipeline Route: Near Reliance Jio BP Future Fuels in Bhojakhedi to Dharamkata Tiraha, Khandwa	Bhojakhedi, Sulyakhedi, Chhaigaon Makhan, Balkhand Sura, Chhaigaon Devi, Dodwada, Takali Mori, Khandwa Municipal Corporation area
2.	Diverted Pipeline Route: Dharamkata Tiraha, Khandwa to Naredi (HP) Petrol Pump, Khandwa	Borgaon Khurd, Khandwa Municipal Corporation area

4.11.1 Demography

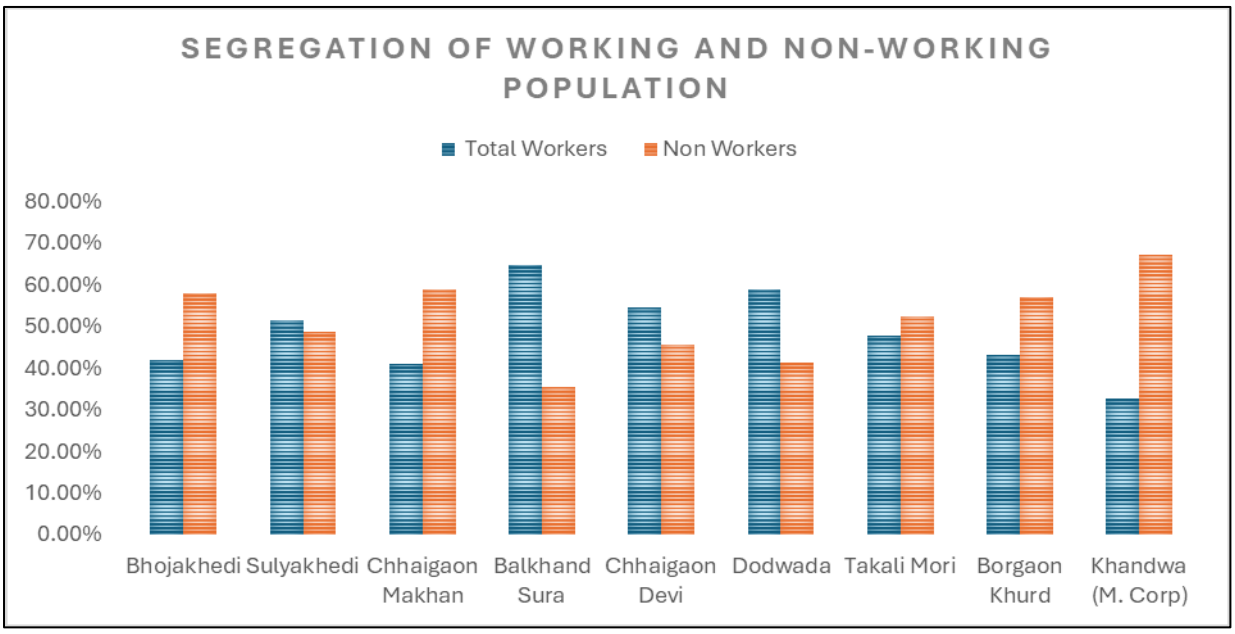
According to Census 2011 data, the demographic details of villages in the impact area highlight variations in area, population, and social composition. Chhaigaon Makhan recorded the largest geographical area amongst all villages while Khandwa town recorded the highest population and high population density. While SC and ST populations were recorded in all of the villages, Dodwada recorded highest ST population accounting for approximately 20 percent of the village's population and Borgaon Khurd higher SC population accounting for about 25 percent of its population. Literacy rates were recorded at similar levels with Balkhand Sura recording the highest literacy rates amongst all the villages at about 78 percent of population reportedly literate followed by Khandwa town recording a literacy rate of 75 percent as depicted in **Table 4-24.**

Table 4-24: Demography- Project Impact Area

Sl. No	Village/City Name	Geog Area (in Ha.)	No. of HH	Total Pop	Percent Male	Percent Female	Percent SC	Percent ST	Literacy Rate
1	Bhojakhedi	810.67	459	2236	50.98	49.02	16.10	2.10	67.80
2	Sulyakhedi	469.75	113	457	49.89	50.11	12.47	40.26	59.52
3	Chhaigaon Makhan	1138.99	1231	5741	49.59	50.41	23.17	18.92	65.48
4	Balkhand Sura	216.64	205	408	73.77	26.23	3.43	1.72	77.94
5	Chhaigaon Devi	468.99	397	1676	52.39	47.61	13.60	5.79	72.37
6	Dodwada	706.91	298	1402	53.07	46.93	21.68	20.19	63.12
7	Takali Mori	809.9	442	2129	52.75	47.25	16.06	9.44	60.73
8	Borgaon Khurd	463.52	494	2651	51.75	48.25	24.56	5.62	67.07
9	Khandwa (M. Corp)	35.77	39002	200738	51.26	48.74	13.66	4.05	75.49

4.11.2 Working Population

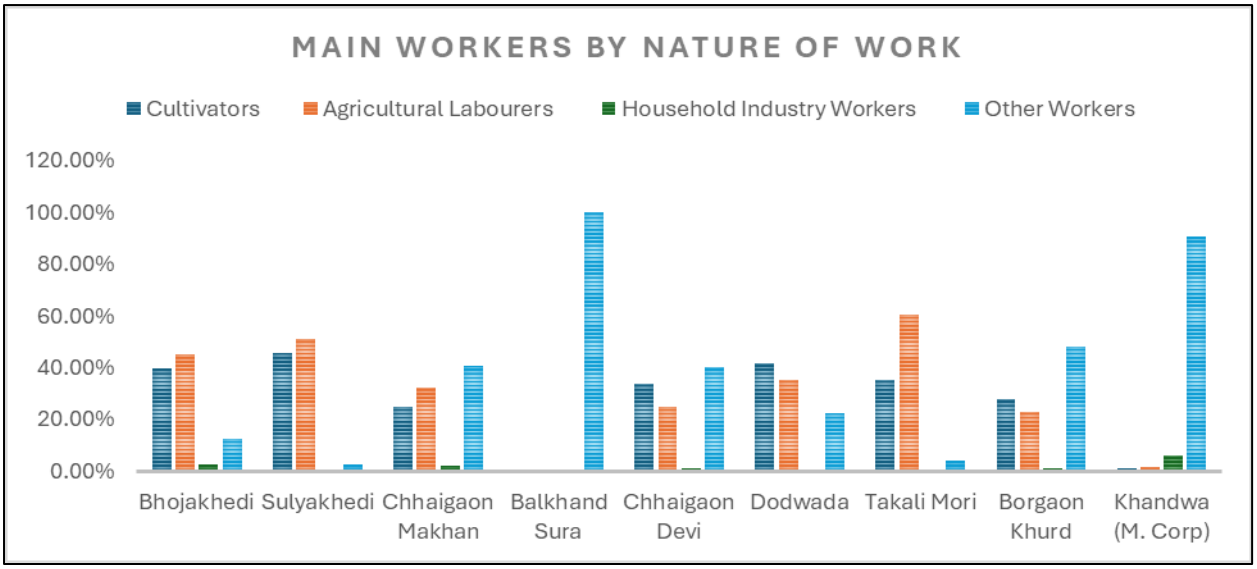
Figure 4-46 presents the distribution of working and non-working populations in villages within the project impact area, based on Census 2011. Balkhand Sura recorded the highest working population accounting for 64.71 percent of its total population, whereas Khandwa (M. Corp) recorded the lowest working population at 32.74 percent of total population.



**Source: Census,2011*

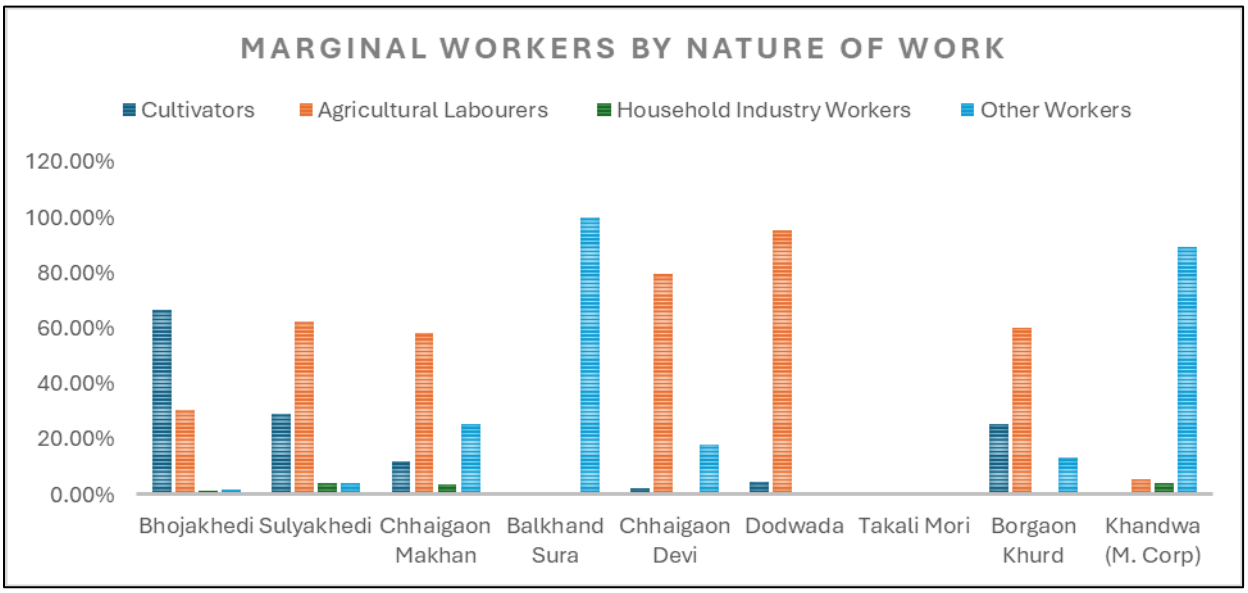
Figure 4-46: Segregation of Working and Non-working Population

Analysis of the working population in the project impact area reveals a higher proportion of main workers as compared to marginal workers. A significant portion of these workers are engaged in agriculture and cultivation. **Figure 4-47** and **Figure 4-48** provide a snapshot of the further segregation of main and marginal workers with respect to type of occupation. The data indicates a lower proportion of cultivators in the main worker category, whereas the marginal worker category has a higher proportion of workers engaged in activities other than cultivation and household worker category. Khandwa being a municipal town, reportedly has more workers engaged in occupations other than agriculture.



Source: Census, 2011

Figure 4-47: Segregation of Main Workers w.r.t type of occupational activity



Source: Census,2011

Figure 4-48: Segregation of Marginal Workers w.r.t type of occupational activity

4.11.3 Education Facilities

Table 4-25 provides details of educational facilities in villages located along the proposed pipeline route. All villages reportedly have primary schools except Balkhand Sura which did not report any kind of education facilities in the village. Secondary schools were reportedly available only in Borgaon Khurd and Chhaigaon Makhan. Senior secondary education is exclusively available in Chhaigaon Makhan.

Table 4-25: Educational Facilities-Project Impact Area

Village Name	Pre-primary	Primary	Middle	Secondary	Senior Secondary
Bhojakhedi	Available	Available	Available	Not Available	Within 5-10km
Sulyakhedi	Not Available	Available	Within 5km	Not Available	Within 5km

Village Name	Pre-primary	Primary	Middle	Secondary	Senior Secondary
Chhaigaon Makhan	Not Available	Available	Available	Available	Available
Balkhand Sura	Not Available	Not Available	Not Available	Not Available	Not Available
Chhaigaon Devi	Not Available	Available	Available	Not Available	Within 5-10km
Dodwada	Available	Available	Available	Within 5km	Within 5km
Takali Mori	Available	Available	Available	Within 5-10km	Within 5-10km
Borgaon Khurd	Available	Available	Available	Available	Within 5-10km

**Source: Census,2011*

4.11.4 Healthcare Facilities

Table 4-26 provides details on the availability of health facilities in villages. Chhaigaon Makhan village reported the presence of a primary health centre, community health centre and maternity & child welfare centre within the village, except for all the villages. Takali Mori village has reported a primary health sub centre. The villages do not have direct healthcare facilities like Community Health Centers and Maternity and Child Welfare Centers within their immediate vicinity; medical services are accessible within a reasonable distance of 5–10 kilometers from the villages.

Table 4-26: Health Infrastructure- Project Impact Area

Village Name	Community Health Centre	Primary Health Centre	Primary Health Sub Centre	Maternity and Child Welfare Centre
Bhojakhedi	Within 5-10 km	Within 5-10km	Within 5-10km	Within 5-10km
Sulyakhedi	Within 5km	Within 5km	Within 5km	Within 5km
Chhaigaon Makhan	Available	Available	Not Available	Available
Balkhand Sura	Within 5km	Within 5km	Within 5km	Within 5km
Chhaigaon Devi	Within 5-10km	Within 5-10km	Within 5-10km	Within 5-10km
Dodwada	Within 5km	Within 5km	Within 5km	Within 5km
Takali Mori	Within 5-10km	Within 5-10km	Available	Within 5-10km
Borgaon Khurd	Within 5-10km	Within 5-10km	Within 5-10km	Within 5-10km

**Source: Census,2011*

4.11.5 Drinking Water Facilities

Table 4-27 provides availability of water sources across the project impact area highlights a mix of infrastructure and natural resources. Tap water is accessible in most villages except Takali Mori. All villages in the project impact area reportedly have access to well water as source of drinking water.

Table 4-27: Drinking Water Facilities- Project Impact Area

Village Name	Tap Water	Well Water	Hand Pump	Spring	River
Bhojakhedi	Available	Available	Available	Not Available	Not Available
Sulyakhedi	Available	Available	Available	Not Available	Not Available
Chhaigaon Makhan	Available	Available	Available	Not Available	Available
Balkhand Sura	Available	Available	Available	Not Available	Available
Chhaigaon Devi	Available	Available	Available	Not Available	Available
Dodwada	Available	Available	Available	Not Available	Not Available
Takali Mori	Not Available	Available	Available	Not Available	Available
Borgaon Khurd	Available	Available	Available	Not Available	Available

Source: Census,2011

4.11.6 Communication Facilities

Table 4-28 provides details of the communication facilities available in the project impact area. Other than Suyalkhedi and Dodwada, all other villages have bus services, while none of the villages had railway stations in the village which is reportedly available within 5 to 10 kms from the village. National highway connectivity is limited, with only Bhojakhedi and Dodwada having direct access, while other villages require traveling more than 10 km. State highway access is comparatively better, with Dodwada, Chhaigaon Makhan, Chhaigaon Devi, and Takali Mori directly connected or within 10 km, whereas other villages remain more than 10 km away.

Table 4-28: Communication Facilities- Project Impact Area

Village Name	Bus Service	Railway Station	Connected to National Highway	Connected to State Highway
Bhojakhedi	Available	More than 10 km	Available	More than 10 km
Sulyakhedi	More than 10 km	More than 10 km	More than 10 km	More than 10 km
Chhaigaon Makhan	Available	More than 10 km	More than 10 km	Available
Balkhand Sura	Available	More than 10 km	More than 10 km	More than 10 km
Chhaigaon Devi	Available	Within 5km	More than 10 km	Within 5-10km
Dodwada	Available	More than 10 km	Available	Available
Takali Mori	Within 5km	More than 10 km	Within 5km	Within 5km
Borgaon Khurd	Available	Within 5-10km	More than 10 km	More than 10 km

Source: Census,2011

4.11.7 Social Sensitivity

Adani Gas Limited has been granted authorization for laying, building, operating or expanding the City Gas Distribution CGD Network in GA 11.23 i.e., Burhanpur, Khandwa, Khargone and Harda districts and the proposed CGD covers four charge areas in the state of Madhya Pradesh.

This section discusses the social sensitivities identified along the proposed route in the Burhanpur (Khandwa) District GA, where ATGL plans to install an 8-inch diameter natural gas pipeline spanning approximately 28.74 km. The route is divided into a single segment covering the Bhojakhedi Charge Area, starting near Reliance Jio BP Future Fuels along NH 347B in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. The diverted pipeline route starts from Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town, where it connects with the proposed pipeline.

Observations

The social sensitivity analysis for the natural gas pipeline project in Khandwa, Madhya Pradesh, highlights the proximity of critical community facilities to the proposed project. Observations for the proposed natural gas pipeline in Khandwa, Madhya Pradesh, along the pipeline route indicates several major crossings, including roads such as Khandwa Indore Highway (NH-347B), Khandwa Pandhana Main Road (NH-753L), Aabna river crossing, one irrigation canal, one railway track. Proximity to community facilities—including some hotels, small shops, temples, hospitals, petrol pumps, schools and one tourist attraction spot (Kishore Kumar Memorial) were also assessed during the exercise.

These primary observations during site visit are essential for risk assessment and ensuring that the necessary safety protocols and community engagement measures are implemented throughout the project lifecycle and tabulated in **Table 4-29** and **Table 4-30**.

Table 4-29: Social Sensitivities Observed at the Proposed Pipeline Route

Observation	Recommendation
Proposed Pipeline Route: Near Reliance Jio BP Future Fuels in Bhojakhedi to Dharamkata Tiraha, Khandwa	
• The proposed pipeline route runs along Khandwa GA starting at a point on NH 347B near Reliance Jio BP Future Fuels in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. • The pipeline route crosses 5 major road crossings and several village roads. • The route also crosses several seasonal streams and Aabna River at Ch: 16656.89 m. • The proposed pipeline route crosses several village roads and agricultural lands where crops like wheat, corn and toor daal was being cultivated. • The pipeline route also runs along one settled area in Dondwada village and one in Chhaegaon Devi village. • The pipeline also crosses along a township, namely Sushila Balaji Nagar in Chhaegaon Makhan, which is currently under construction located between Ch: 7362.5 m and Ch: 7608.95 m. • The pipeline route also crosses the entry gate of a university, namely C.V Raman University in Balkhand Sura at Ch: 7122.83 m. • Two to three roadside temples were spotted along the pipeline route during the site visit. One notable temple amongst them was Shri Ram Mandir in Dondwada at Ch: 10254.44 m. • Seven to eight warehousing facilities, two to three car and tile showrooms and were present along the pipeline route. A flour mill, namely Agarwal Flour mill was spotted between Ch: 13723.49 m and Ch: 13824.81 m. A wedding banquet was also spotted at Ch: 12908 m. One agro based industry, namely Nayan Agro Limited was present at Ch: 11603.61 m. Two to three hotels/resorts were	• Given the five road crossings, implementation of effective traffic diversion plans will be required to minimize disruption to residents during construction. • Usage of clear signage and direct traffic flow to alternate routes where possible. • Installation of appropriate safety barriers and signage around the road crossings and near the hospital and tourist attraction spot to protect both workers and the public. • Engagement with local communities, especially near settlements, to inform them of the construction schedule and mitigate any inconvenience caused during the project will be required. • Carrying out the pipeline laying work during inactive heavy traffic hours or at night for smoother, non-disruptive flow of traffic. • Pipeline laying work near educational institutions to be carried out after school/college hours or during vacations so that students and teachers do not get disturbed by possible noise during construction work.

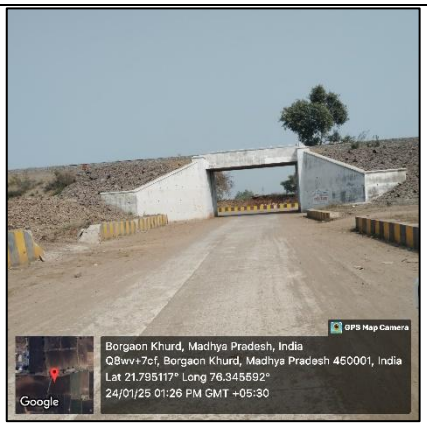
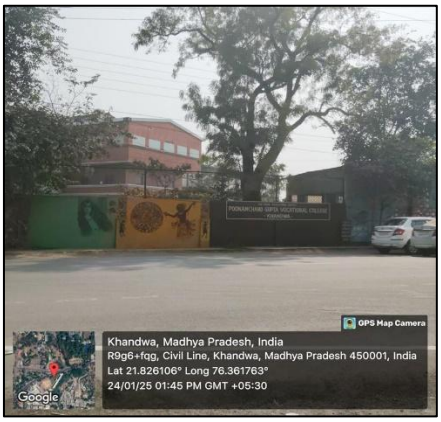
also spotted along 10 m buffer zone of the pipeline route. • A tourist attraction spot, namely, Kishore Kumar Memorial, is located along the pipeline route near Ch: 16908.64 m. • Four government schools and three private schools were present along the pipeline route in a 10m buffer zone. Principal of Saskiya Ucchatar Madhyamik Vidyalaya, Chhaegaon Devi (Government School) at Ch:12238.16 m which is located at a distance of 40 m towards LHS and Naveen Saskiya Madhyamik Vidyalaya, Sanjay Nagar, Khandwa (Government School) at Ch:18301.28 m which is located at a distance of 30 m were informed about the upcoming pipeline project in the area. • The pipeline route also crosses bridges at three locations. • One hospital, namely St. Richard Pampuri Hospital in Sanjay Nagar, Khandwa located at a distance of 20 m towards the LHS of the pipeline route. • Newly constructed bus stop at Khandwa (nearest to Ch: 18628.06) is located at a distance of 32 m which can create a heavy traffic issue during pipeline laying phase of the project. • The confirmed chainage is till 19640.2.	
Pictures	

 **Point 1: Starting Point of the Pipeline route at Bhojakhedi, Khandwa District, Madhya Pradesh**	 **Point 2: St. Richard Pampuri Hospital, Sanjay Nagar, Khandwa**
 **Photo 3: C.V Raman University, Balkhand Sura**	 **Photo 4: Saskiya Ucchatar Madhyamik Vidyalaya, Chhaegaon Devi (Government School)**
 **Photo 5: Shri Ram Mandir, Dondwada**	 **Photo 6: Kishore Kumar Memorial, Sanjay Nagar, Khandwa**

Table 4-30: Social Sensitivities Observed at the Diverted Pipeline Route

Observation	Recommendation
<u>Diverted Pipeline Route:</u> Dharamkata Tiraha, Khandwa to Naredi (HP) Petrol Pump, Khandwa	
• The diverted route starts from RHS of Dharamkata Tiraha, whose chainage is yet to be confirmed. • The diverted pipeline route starts from Dharamkata Tiraha along NH 753L and turns LHS to a village road which connects with the main pipeline route at a point near Deg English Institute in Narayan Nagar, Khandwa Town.	• Implementation of effective traffic diversion plans will be required to minimize disruption to residents during construction. • Usage of clear signage and direct traffic flow to alternate routes where possible. • Installation of appropriate safety barriers and signage around the road crossings.

• Two major road crossings can be spotted along the pipeline route. • Seven to eight small scale industries related to petroleum, car tyres, etc. have been spotted along the diverted pipeline route. Also, a mustard oil refinery is located along the pipeline route, namely M.G Oils. • The pipeline route crosses bridges at 4 locations where Aabna river flows below. • The pipeline route also crosses railway line at one location. • After joining with the proposed pipeline route at a point near Deg English Institute, the pipeline mainly crosses Khandwa town to reach to the end of the pipeline route at Naredi (HP) Petrol Pump, Khandwa. Along this route, several household settlements, hotels, restaurants, recreational parks, schools, colleges are present along 10m of buffer zone, which can cause heavy traffic issues. Notable among them is Poonamchand Gupta Vocational College, Khandwa located at 10m distance towards RHS of the pipeline route and Tagore Park located at a distance of 16 m towards LHS of the pipeline route. • The pipeline route will also cross the main road (NH 347B) to the end of the the pipeline route at Naredi (HP) Petrol Pump, Khandwa, which can cause heavy traffic issues during pipeline laying phase.	• Carrying out the pipeline laying work during inactive heavy traffic hours or at night for smoother, non-disruptive flow of traffic. • Pipeline laying work near educational institutions to be carried out after school/college hours or during vacations so that students and teachers do not get disturbed by possible noise during constructuction work.
Pictures	

 **Photo 1: M.G Oils, Borgaon Khurd**	 **Photo 2: Pipeline route running below railway crossing bridge**
 **Photo 3: Poonamchand Gupta Vocational College, Khandwa**	 **Photo 4: Pipeline End Location to Naredi (HP) Petrol Pump, Khandwa Madhya Pradesh**

5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 INTRODUCTION

The proposed project may have impact on the environment & social conditions during construction and operation phases. This chapter describes various environmental impacts identified and assessed for during construction and operation phases of the project. The identification of impacts has been done based on review of available project information, discussions with local community and representatives of project proponent and other sector-specific professionals.

During the construction phase, the impacts may be regarded as temporary or short-term, while long term impacts may be observed during the operation stage. 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 stage i.e., 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.

5.2 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

The identification of impacts has been done based on baseline environmental and social survey, review of available project information, discussions with local community and representatives of **ATGL** and other sector specific professionals. The criteria employed to appraise the proposed impacts on various social and environmental components has been presented as **Table 5-1** below.

Table 5-1: Impact Appraisal Criteria

Criteria	Sub-Classification	Defining Limit	Remarks
Spread: refers to area of direct influence from the impact of a particular project activity.	Insignificant/ Local spread	Impact is restricted within the project site.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.
	Medium Spread	Impact is spread from up to 2 km from the boundary of the project.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.
	High Spread	Impact is spread up to 2 km to 5 km from footprint boundary of the project.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.
Duration: based on duration of impact and the time taken by	Insignificant/ Short Duration	When impact is likely to be restricted for duration of less than 1 year.	The anticipated recovery of the affected environmental component within 2 years.

Criteria	Sub-Classification	Defining Limit	Remarks
an environmental component to recover back to current state	Medium Duration	When impact extends up to 3 years.	With an anticipated recovery of the affected environmental component within 6 years.
	Long Duration	When impact extends beyond 3 years.	With anticipated recovery of prevailing condition to happen within 6 years or beyond or upon completion of the project life.
Intensity: defines the magnitude of Impact	Insignificant intensity	When resulting in changes in the environmental baseline conditions is up to 10%.	However, it shall be reconsidered where the baseline values are already high.
	Low intensity	When resulting in changes in the baseline conditions up to 20%.	For ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival, or habitat change.
	Moderate intensity	When resulting in changes in the baseline conditions for up to 30%.	For ecology, it refers to changes that are expected to be recoverable.
	High intensity	When change resulting in the baseline conditions beyond 30%.	While for ecology, high intensity refers to changes that result in serious destruction to species, productivity, or their habitat.
Nature: refers to whether the effect is considered beneficial or adverse	Beneficial		Useful to Environment and Community.
	Adverse		Harmful to Environment and Community.
Likelihood: refers the possibility of a risk event occurring	Low	Will most likely not occur	Low likelihood refers that the impact will most likely not occur.
	Moderate	Possible to occur	Moderate likelihood refers that the chances of impacts are possible to occur.
	High	Likely to occur	High likelihood refers that a particular risk or impact will likely occur.

Impact identification is a continual process and completes only when the effects of the identified impact are assigned a mitigation strategy. The impacts shall be assessed based on the following criteria:

- Significance of the impact
- Duration of the impact
- Mitigation measures
- Residual impacts

5.3 ASSESSMENT OF IMPACT SIGNIFICANCE

A project specific significance assessment matrix has been developed to assess the impacts based on the appraisal criteria developed above. A reference impact significance matrix is given in **Table 5-2** below.

Table 5-2: Impact Significance Criteria

Spread	Duration	Intensity	Likelihood	Overall Significance	
				Adverse	Beneficial
Local	Short	Low	Low	Insignificant	Insignificant
Local	Short	Moderate	Moderate	Minor	Minor
Local	Medium	Low	Low	Minor	Minor
Local	Medium	Moderate	Moderate	Minor	Minor
Medium	Short	Low	Low	Minor	Minor
Local	Long	Low	Low	Minor	Minor
Local	Long	Low	Moderate	Minor	Minor
Local	Short	High	High	Moderate	Moderate
Local	Medium	High	High	Moderate	Moderate
Local	Long	Moderate	Moderate	Moderate	Moderate
Medium	Short	Moderate	Moderate	Moderate	Moderate
Medium	Medium	Low	Low	Moderate	Moderate
Medium	Medium	Moderate	Moderate	Moderate	Moderate
Medium	Long	Low	Low	Moderate	Moderate
Medium	Long	Moderate	Moderate	Moderate	Moderate
High	Short	Low	Low	Moderate	Moderate
High	Short	Moderate	Moderate	Moderate	Moderate
High	Medium	Low	Low	Moderate	Moderate
High	Medium	Moderate	Moderate	Moderate	Moderate
High	Long	Low	Low	Moderate	Moderate
Local	Long	High	High	Major	Major
Medium	Short	High	High	Major	Major
Medium	Long	High	High	Major	Major
High	Short	High	High	Major	Major
High	Medium	High	High	Major	Major
High	Long	Moderate	Moderate	Major	Major
High	Low	Low	Low	Major	Major
High	Low	High	High	Major	Major

The impacts for the proposed project have been covered under following subsections:

- Construction Phase
- Operational phase

The social impacts associated with construction and operations stages have been assessed qualitatively and, in some cases, quantitatively (subject to availability of data), using professional judgement and based on experience from similar projects.

5.4 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

The identification of impacts has been done based on baseline environmental and social survey, review of available project information, discussions with local community and representatives of **ATGL** and other sector specific professionals. 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 as depicted in **Table 5-3**:

Table 5-3: Impact Identification Matrix for NG Pipeline Route

Components	Physical				Biological		Socio-Economic		
	Ambient Air Quality	Ground/Surface Water (Qty/Quality)	Ambient Noise Quality	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	•		•						
Waste generation, handling, and disposal	•	•		•					
OPERATION PHASE									
Operation of compressors	•	•	•						
Cleaning & maintenance	•			•					

5.5 PRE-CONSTRUCTION PHASE IMPACTS

5.5.1 Impact on Land Procurement

IMPACTS

ATGL has identified the 28.74 km Natural Gas Pipeline spanning across Khandwa and nearby villages. The proposed pipeline for the CGD that run along ROW of the Khandwa GA starting near Reliance Jio BP Future Fuels in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. The diverted pipeline route starts from Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town, which connects with the main pipeline route there.

Pipeline Route: The proposed pipeline route passes through NH-347B and other district roads, hence the permission/right of way (ROW) approvals will be required from the National Highway Authority of India (NHAI). The diverted pipeline route passes through NH-753L and other district roads.

This route crosses bridges over Aabna river at one location and canals at four locations, hence permission will be required for crossing the canal, including possible diversion or construction of bridge structures for pipeline installation.

Impact significance

The significance of this impact has been evaluated to be "**Moderate"**.

Mitigation Measures

- Permission/right of way (ROW) approvals will be required from the National Highway Authority of India (NHAI), other roads, railways, forest and for canal.
- Develop and implement detailed restoration plans for land, roads, and infrastructure affected during construction to ensure full post-project restoration.
- Designing of the overpasses or other infrastructure to cross canals should be such that the effect on water flow or canal operations is minimum.

Residual Impacts

After the implementation of these mitigation measures, the residual impact significance is expected to be **"Low"**.

Table 5-4: Impact Significance on Private/Revenue Land Acquisition

Impact		Impact on land Procurement				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-Term				
Impact Extent		Regional				
Impact Scale		Low				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Land Acquisition	Without Mitigation	Local	Long-term	Moderate	Moderate	Moderate
	With Mitigation	Local	Short-term	Low	Low	Low

5.6 IMPACTS DURING CONSTRUCTION PHASE

The construction activities shall comprise of following activities that may impact the environmental and social aspects, as described in sections below:

- Site Preparation
- Labour Engagement
- Material Handling and Storage
- Construction Demobilization

5.6.1 Topography, Land use and Drainage

Impact- Context and Receptors

The surrounding area features a mix of flat terrains with gentle undulations. Land use is primarily agricultural, with some industrial and urban development. The drainage system is influenced by the Aabna River, with natural streams helping manage runoff, the proposed pipeline runs parallel to the river and does not cross it. Although, the pipeline crosses several canals in its right of way and may affect the surface drainage temporarily.

Laying of natural gas pipeline will be done within depth of 2 m in land while NG pipeline will be laid as per standard protocols and procedures. There will be limited change in topographic characteristics of project footprint area. The alteration in surface drainage pattern of the area due to construction activities will be limited to smaller areas located in project footprint. The natural flow of storm water will not be altered on contiguous larger area.

Embedded/In-Built Control

- Using trenchless construction methods like Horizontal Directional Drilling (HDD) for canal crossings, where possible, to avoid direct excavation in the canals and minimize disruption to water flow and the surrounding ecosystem.
- Implement soil erosion control measures like silt fences, sedimentation ponds, and planting grass cover in disturbed areas to minimize soil loss, especially in agricultural fields and forest areas.
- Design and layout the pipeline route to avoid impacting high-value agricultural areas as much as possible.

Impact Magnitude

There will be very limited change in the topographic character of the project footprint area. The alteration in surface drainage pattern of the area due to construction activities, if not maintained with appropriate control measures is probable. The natural flow of storm water will not be altered on contiguous larger area. Intensity of the effect can be considered as moderate, and duration of the effect would be short (during monsoon and post-monsoon season) in nature. Hence, impact magnitude is assessed to be **Moderate.** However, with controlled and managed construction work in agricultural land side may reduce the impact magnitude to **Low**.

Impact Significance

As per the impact significant assessment matrix **(Table 5-5)**, the impact has been assessed as **Moderate** considering the construction for transmission line during monsoon season along the drainage area, which can be mitigated, and magnitude of impact can be **Low** with use of mitigation measures.

Mitigation Measures

- Project shall ensure trenching along natural contours to minimize disruption to the topography especially during the pre-construction and construction phase
- Anti-buoyancy measures will be adapted during laying out of pipeline within water bodies.
- Ensure topsoil removal and its preservation during construction, so it can be returned to the disturbed area to facilitate faster vegetation regrowth.

- Use mulching and vegetative cover to stabilize disturbed soil and reduce erosion during and after construction.

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts for construction activities will be **Low**.

Table 5-5: Impact Significance for Topography and Drainage

Impact		Impact on Topography & Drainage				
Impact nature		Negative				
Impact Type		Indirect				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale		Uncontrolled construction work and waste generating from construction site may contaminate drainage of the area				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Topography and Drainage	Without Mitigation	Regional	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.2 Water Resources and Availability

Impacts- Context and Receptors

During construction phase, water will be primarily required for domestic activities by staff and to sprinkle for dust suppression. Additionally, the pipeline is crosses canals at 4 locations in its way. Freshwater will be sourced from private tankers. There will be generation of sewage by construction workers. As the pipeline crosses several canals and Aabna River, there is a possibility that deterioration of water quality during construction phase can occur due to wastewater disposal from the workers camp and sludge generated from construction sites. Inappropriate disposal of fuel & lubricants could also lead to water contamination.

Embedded/In-Built Control

NIL

Impact Magnitude

Water requirement for construction works will be temporary just during construction phase and short-lived while domestic water requirement for construction workers will be needed during the entire construction phase. The construction phase will be of duration of 6 months with peak construction period of 2 to 3 months. Hence, the magnitude of impact is assessed as **medium/ moderate.**

Impact Significance

As per the impact significant assessment matrix **(Table 5-3)**, a combination of medium-term impact duration, moderate intensity, moderate likelihood, and local level spread the impact magnitude has been assessed as **Moderate.**

MITIGATION MEASURES

- Quality of construction wastewater emanating from the construction site will 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 does not cause 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 conducted during dry seasons only.
- Construction materials to be stacked together by fencing it with brick or earth to prevent spillage into the water bodies, also these materials to be stacked away from the water bodies.
- Concrete shall be evaluated in accorder with IS: specification and shall have a minimum compressive strength to avoid pressure on water body.
- Aggregates will be clean and free from injurious amounts of salt, alkali, deleterious substances, or organic impurities as per IS 383 & evaluated as per 2386 to avoid contamination of 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 will be properly maintained or taken care off to check their entry into the water bodies like ponds, streams etc.
- Vehicle maintenance and refuelling will be confined to areas near construction camps designed to trap discarded lubricants and fuel spills from entering the water bodies.
- Drinking water supply for the workers in the construction camps to meet the Indian National Standards. 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 of daily to check the solid wastes entering the ponds, streams etc.
- Concrete will be placed within 30 minutes from the time of mixing and will be managed in such a way to prevent aggregate segregation and excessive moisture loss. Concrete container will be kept clean and free from hardened or partially hardened concrete.

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts for construction activities will be **Low.**

Table 5-6: Impact Significance on Water Resource and Quality

Impact		Impact on water resource and quality				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		local				
Impact Scale		Uncontrolled construction works and waste generating from construction site may contaminate drainage of the area.				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Impact on Water Resource	Without Mitigation	Local	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.3 Ambient Air and Noise Quality

Impacts- Context and Receptors

Air: 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. Operation of equipment and machineries for pipeline laying and civil works in pipeline ROW & other sites will generate dust that could impact the air quality. Mostly the additional automobile traffic and construction machineries involved during construction activities will generate pollutants like PM, SO_2 & NOx. Therefore, the receptor sensitivity is assessed as **"Moderate"**. However, this will not lead to any tangible effect, as the additional traffic volume related to construction activities will be low.

Noise: 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.). Operation of construction machinery may lead to rise in noise level in the range between 80-100 dB(A). The magnitude of impact from noise will depend upon types of equipment used, construction methods and on work scheduling. 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.

Embedded/In-Built Control

- Suppression of fugitive dust emissions by spraying water, wetting of the stockpile.
- Pre-identified proper locations of material stockpiles, especially sand.
- Screening or providing wind breaks for stockpiles, covering of trucks with tarpaulin sheets during transportation of material.

- Normal working hours of the contractor will be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it would be limited to activities which do not generate noise.
- Avoid unnecessary honking in traffic movement.
- Barricading of project premises to avoid dispersion of dust and noise outside the project premises.

Impact Magnitude

The major source of emissions in the construction phase is fugitive dust emissions & emissions from excavation and other construction activities. In addition, operation of DG sets will also cause gaseous emissions. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area.

The construction activities will occur for maximum 6-7 months whereas dust emitting activities such as site clearing, civil construction etc. will be of short/medium duration for 1-2 peak months. The impact magnitude has been categorized as small because the soil type is alluvial. Thus, dust emission would be restricted to construction phase only for shorter duration.

Impact Significance

As per the impact significant assessment matrix (**Table 5-3)** combination of low impact magnitude with medium receptor sensitivity results in impact significance as Moderate.

Mitigation Measures

- Proper and prior planning, appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructure supports needed for construction will be ensured to shorten the construction period vis-à-vis reduce pollution.
- Construction materials will be stored in covered godowns or enclosed spaces to prevent the windblown fugitive emissions.
- Concrete will be mixed in a mechanical mixer to ensure thorough mixing of all materials to avoid dispersion of particulate matter into the ambient air. Reinforcements will be placed around the length of pipeline. Night Caps to be provided to both ends of line pipe before starting the work.
- Stringent construction material handling / overhauling procedures shall be followed.
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads, at vulnerable areas of construction sites will be undertaken to control fugitive dust during material handling and hauling activities particularly near habitations especially in dry seasons.
- The construction material delivering vehicles will be covered to reduce spills.
- Low emission construction equipment, vehicles and generator sets to will be used.
- It will be ensured that all construction equipment and vehicles are in good working conditions, finely tuned and maintained to keep emission within the permissible limits and engines tuned off when not in use to reduce pollution.
- Vehicles and machineries will be regularly maintained so that emissions confirm to standards of Central Pollution Control Board (CPCB).
- Construction workers to be provided with appropriate PPEs during construction phase.

- 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 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.
- 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

Residual Impact Significance

The significance of residual impact will be **Low** after implementing mitigation measures.

Table 5-7: Impact Significance for Ambient Air & Noise Quality

Impact		Impact on Ambient Air & Noise Quality				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale		Impact due to construction activity and operation of construction vehicles				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Ambient Air & Noise Quality	Without Mitigation	Regional	Short	Moderate	Moderate	Moderate
	With Mitigation	Regional	Short	Low	Low	Low

5.6.4 Land and Soil Environment

Impacts- Context and Receptors

The construction activities such as earth moving may lead to reduction in vegetation 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 may 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. 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.

Embedded/In-Built Control

- Erosion and sediment control measures should be adopted including using silt fences to manage runoff, applying erosion control mats on disturbed soil, hydroseeding for vegetation restoration, and setting up sediment basins to collect runoff.
- In order to do topsoil management, the topsoil should be striped and stockpiled separately before construction, and it should be replaced after construction to restore soil fertility.
- For vegetation and habitat protection land disturbance should be minimization by keeping the construction area narrow and by the usage of controlled clearing methods for vegetation removal.
- To achieve the soil compaction prevention usage of mats or gravel paths for heavy machinery should be adopted.
- Water management and protection involves using trenchless technology for stream, canal and wetland crossings, designing proper drainage systems to prevent erosion, and managing de-watering to avoid soil erosion.
- Contaminant management includes setting up spill prevention and containment measures for fuel or oil spills and conducting soil testing to monitor contamination levels.
- Trench management focuses on stabilizing trenches during construction to prevent collapse and refilling trenches promptly to avoid long-term soil settlement.

Impact Magnitude

The overall magnitude of the land and soil impacts is expected to be moderate because the excavation of the land to lay the pipeline will disturb the soil structure and soil compaction, removal of topsoil, and trenching can alter the natural state of the soil.

Impact Significance

The significance can range from **moderate.**

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 topsoil (25cm) stripped from the area stacked separately as topsoil 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.
- 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.
- Concrete shall be tested in accorder with IS: specification and shall have a minimum compressive strength as per concrete grade design and the same will be utilized for construction purposes.
- Approved quality of cement confirming to IS code will be used only OPC 53 grades.
- Concrete coating will be reinforced by a Single layer of steel reinforcement.

Residual Impact Significance

The significance of residual impact will be **Low** after implementing mitigation measures.

Table 5-8: Impact Significance for Land and Soil Environment

Impact		Impact on Land and Soil Environment				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale		Erosion, sediment runoff, compaction, habitat loss, disruption of topsoil, Localized, with concentrated effects near water crossings, steep areas, and during trenching.				
Impact Magnitude (Without Mitigation		Medium				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Land and Soil Environment	Without Mitigation	Local	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.5 Ecology and Biodiversity

Impacts- Context and Receptors

The construction works of the NG pipeline route involves clearance of land, but it does not include uprooting of trees since most of the stretch of the pipeline route will be conducted only on the RoW of the road. Although few shrubs and herbs will be cleared. Therefore, no significant impact on the ecological environment is envisaged due to the construction activity of the proposed pipeline project.

Embedded/In-Built Control

- The clearance of shrubs and herbs should be minimal. The design should ensure that no significant disruption to larger vegetation or habitats occurs during construction.

- Design provisions should allow for buffer zones around sensitive ecological areas, further reducing potential disturbances.
- To prevent erosion during and after construction, appropriate soil erosion control measures should be in place, such as silt fences and temporary revegetation.

Impact Magnitude

The magnitude of the impact on ecology and biodiversity is expected to be **low**. Since the land clearance is minimal, restricted to shrubs and herbs, the overall disturbance to plant species and ecosystems is limited. The temporary nature of the construction activity (lasting only for the duration of the pipeline installation) ensures that any impacts will be short-term and reversible.

Impact Significance

Given the minimal scope of vegetation clearance and the lack of uprooting of trees, the significance of ecological and biodiversity impacts is considered negligible to **low**.

Mitigation Measures

- No vegetation clearance will be undertaken in the pipeline route. Only few shrubs and herbs located within ROW of pipeline will be cleared.
- 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.

Residual Impact Significance

The significance of residual impact will be **insignificant** after implementing mitigation measures.

Table 5-9: Impact Significance for Ecology and Biodiversity

Impact		Impact on Ecology and Biodiversity				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale						
Impact Magnitude (Without Mitigation)		Medium				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Ecology and Biodiversity	Without Mitigation	Local	Short	Low	Low	Low
	With Mitigation	Local	Short	Insignificant	Low	Insignificant

5.6.6 Socio-economic Environment

Impacts- Context and Receptors

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 labour force from outside the project area during construction phase, which may put some pressure on the local settlements and resources. Local skilled employees will be preferred.

There will be a temporary rise in traffic on nearby roads during the construction phase, both inside and outside the project site, because the pipeline route crosses several major roadways. The transportation of building equipment and raw materials will be the primary cause of this rise. Due to the project's size and nature, there can be inconveniences for the public as well as possible safety hazards. Residents may be at risk for health and safety issues since the pipeline route travels through villages with dense human settlements along the right of way (ROW). This will have minimal affect considering the size and nature of the project.

Impact Significance

The significance of this impact is evaluated to **low**, which can be translated to positive beneficial impacts of the area.

Mitigation Measures

- Implement a traffic management plan to regulate the movement of vehicles and machinery.
- Schedule transportation of raw materials and heavy equipment during off-peak hours to minimize traffic congestion.
- Designate specific routes for construction vehicles to reduce disturbances in residential and high-traffic areas.
- Install appropriate road signage, speed limits, and warning signals to alert commuters and pedestrians.
- Deploy trained personnel for traffic control at critical junctions to ensure smooth vehicle movement and public safety.
- Conduct awareness programs for nearby residents on safety precautions related to pipeline construction.
- Implement strict safety protocols, including barricading construction areas and placing warning signs along the Right of Way (ROW).
- Establish emergency response plans and provide first aid facilities at construction sites.
- Regular monitoring of air and noise pollution levels in residential areas near the construction zone.
- Ensure compliance with occupational health and safety standards to protect both workers and the public.
- Adopt strict measures to prevent spills or leakages of hazardous substances into rivers and water bodies.
- Install silt traps and sedimentation barriers near river crossings to control soil erosion and prevent contamination.
- Conduct water quality monitoring before, during, and after construction to ensure no significant impact on aquatic life.
- Avoid construction activities near riverbanks during peak fishing seasons to minimize disruptions.
- Implement eco-friendly construction techniques to reduce the risk of river pollution and maintain biodiversity.
- Compensate affected individuals for any temporary disruptions to their livelihood due to construction activities.

- Promote local employment opportunities by prioritizing the hiring of skilled and unskilled workers from nearby villages.

Residual Impact Significance

After the implementation of these mitigation measures, the residual impact significance is expected to be **Positive low to moderately beneficial.**

Table 5-10: Impact Significance for Ecology and Biodiversity

Impact		Impact on Socio-economic condition of the study area				
Impact nature		Negative (with mitigation impact would be positive and beneficial)				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Local				
Impact Scale		Construction activity may impact on public health in close proximity of the project foot-print area. However, construction work may create jobs for local population/PAFs, which may convert the impact to beneficial.				
Impact Magnitude (Without Mitigation)		Negative-Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Socio-economic Impacts	Without Mitigation	Local	Short	Moderate	Moderate	Low
	With Mitigation	Local	Short	High	High	Moderate-beneficial

5.7 IMPACT DURING OPERATION STAGE

The impact during the operation phase will be continuous in nature. For a gas-based pipeline, the potential 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.

5.7.1 Air Environment

The pipeline will be 1.2-1.5 m below the ground and would be monitored via SCADA System. Some vehicular emissions during maintenance that will be short-term and temporary in nature. Therefore, there will be no impact on air environment due to operation of NG pipeline.

5.7.2 Noise Environment

The NG pipeline being underground in nature will not lead to noise pollution during its operation. However, noise could be generated during maintenance and repair works that will be temporary in nature.

5.7.3 Water Environment

IMPACTS

There will be no consumption of water during operation phase of the NG Pipeline. However, there are chances of water contamination due to unprecedented leakage of pipeline within the water bodies located in ROW of the pipeline.

Embedded/In-Built Controls

Nil

Impact Magnitude

The **magnitude** of potential impacts is also expected to be **low** during the operational phase. The pipeline's construction did not disturb any major water bodies.

Impact Significance

During the operation phase of the natural gas pipeline project, the impact on the water environment is expected to be minimal.

MITIGATION MEASURES

- Leak Detection and Control System shall be in place.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.
- Edges of the spilled area will be undercut so as to provide a key lock for the repair material. A stiff mixture of cement, water and aggregate will be throttled into & through the reinforcement and built-up until the surface is level with coating around the repair. The pipe will then be carefully laid with the repaired area at the top and will be moist cured for twenty-four (24) hours before further handling.

Table 5-11: Impact Significance for Water Environment

Impact		Impact for Water Environment				
Impact nature		Operation of the pipeline involves minimal disturbance to water bodies.				
Impact Type		Temporary impacts, such as minor risks of water contamination due to accidental leakage or malfunction.				
Impact Duration		Long-term operational phase with minimal ongoing impact.				
Impact Extent		Local				
Impact Scale		Localized to the pipeline's specific route				
Impact Magnitude (Without Mitigation)		Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Water Environment	Without Mitigation	Local	Long	Low	Moderate	Low
	With Mitigation	Local	Long	Low	Low	Insignificant

5.7.4 Environment, Health, and Safety

There could be impacts on environment, health, and safety due to leakage from pipelines from likely external physical forces (Floods & Cyclones). Natural Gas being inflammable in nature could lead to fire hazards. Since the pipeline route passes through the several areas with the heavy settlements, canals,

drains, railway crossing and heavy traffic areas. Ensuring the safety of workers during the construction phase, especially in highways and high-traffic areas along the pipeline route, requires the implementation of strict safety protocols and a comprehensive monitoring system. These precautions are essential to minimize risks related to natural gas leakage and to protect both workers and the surrounding community from potential hazards and accidents.

Embedded/In-Built Controls

- Project specific Health and Safety Management Plan will be put in place.
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, earmuffs, face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks.
- Use of permit to work system
- Cranes and other lifting equipment are operated by trained and authorised persons.
- An up to date first aid box should be provided at all construction sites and a trained person should be appointed to manage it.

Impact Magnitude

As mentioned above, the O&M activities will be carried out by qualified team. With above embedded controls, the magnitude of impacts will be **Low**.

Impact Significance

As per the impact significant assessment matrix (**Table 5-2**) a combination of small impactmagnitude with medium receptor sensitivity results in impact significance as **Low**

MITIGATION MEASURES

- Leak Detection and Control System shall be in place.
- SCADA monitoring shall be carried out.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.
- Continuous metering will be done to provide a comparison between input and output for leak detection.
- Periodic audits of pipeline and its control measures will be conducted regularly.
- Demarcation of Hazard Zones and pipeline chainage will be done.

Residual Impact Significance

Residual significance of impacts during operation phase will be **Low to Insignificant.**

Table 5-12: Impact Significance for Environment, Health, and Safety

Impact	Impact for Environmental Health and Safety
Impact nature	Negative

Impact Type		Direct				
Impact Duration		Long-term				
Impact Extent		Local				
Impact Scale		Operational activity may impact occasionally on health & Safety of operational work force				
Impact Magnitude (Without Mitigation)		Negative-Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Environmental Health and Safety	Without Mitigation	Local	Long	Low	Moderate	Low
	With Mitigation	Local	Long	Low	Low	Insignificant

5.8 SUMMARY OF PRE AND POST MITIGATION IMPACT SIGNIFICANCE

Table 5-13 below presents the summary outcome of the comprehensive assessment of identified impacts pre and post mitigation during various phases of the project. During impact assessment study, significant impacts have been considered, and mitigation plans have been developed in accordance to mitigate the impacts.

Table 5-13: Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to Land Procurement	Moderate	Low
Construction Phase		
Topography and Drainage	Moderate	Low
Water resources and availability	Moderate	Low
Ambient air and noise quality	Moderate	Low
Ecology	Low	Insignificant
Socio-economic Impacts	Low	Moderate-beneficial
Occupational Health and Safety	Moderate	Low
Operational Phase		
Water Environment	Low	Insignificant
Environment Health & Safety	Low	Insignificant

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:

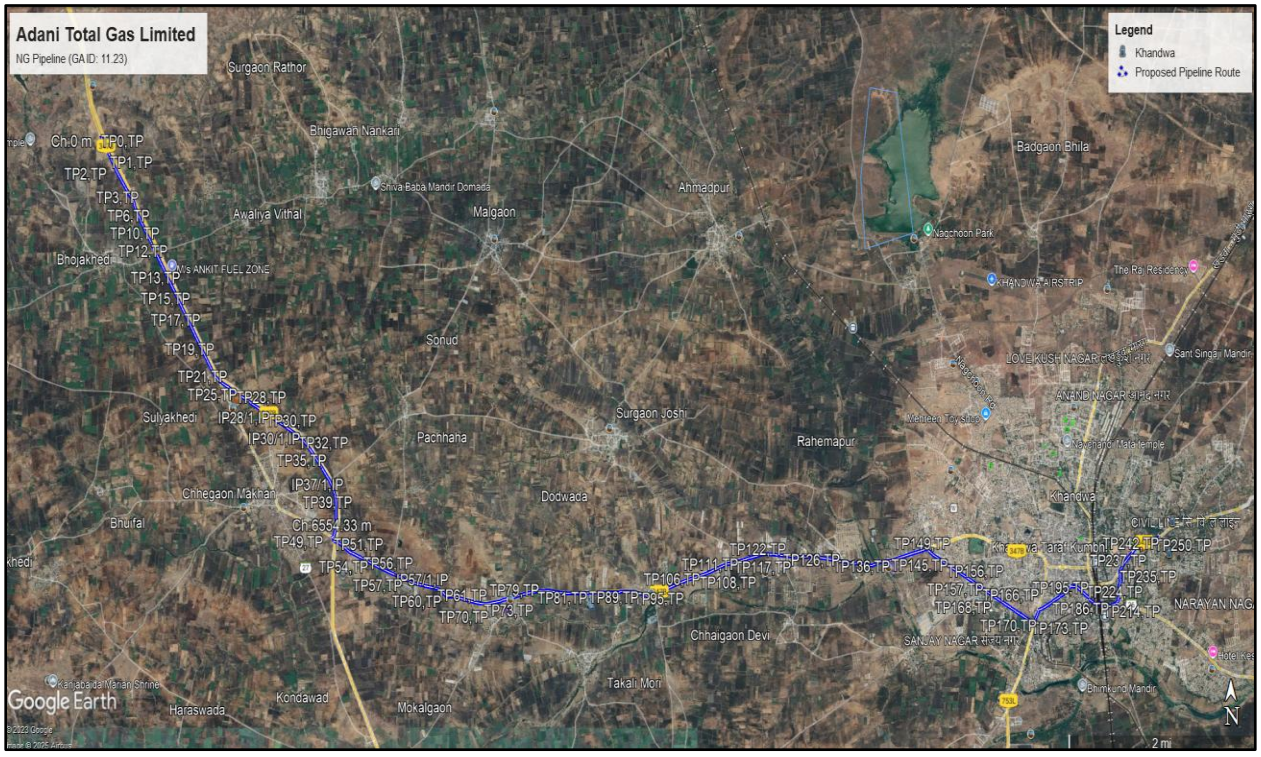
- Safety of public lives and property and safety of the pipeline from engineering and other considerations.
- Shortest pipeline length.
- Easy and favorable terrain condition free of large water bodies, low lying marshy lands, obstacles like ravines, depressions and unstable grounds, meandering rivers, 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.

a) 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.

b) 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 so as to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country. Hence the project was

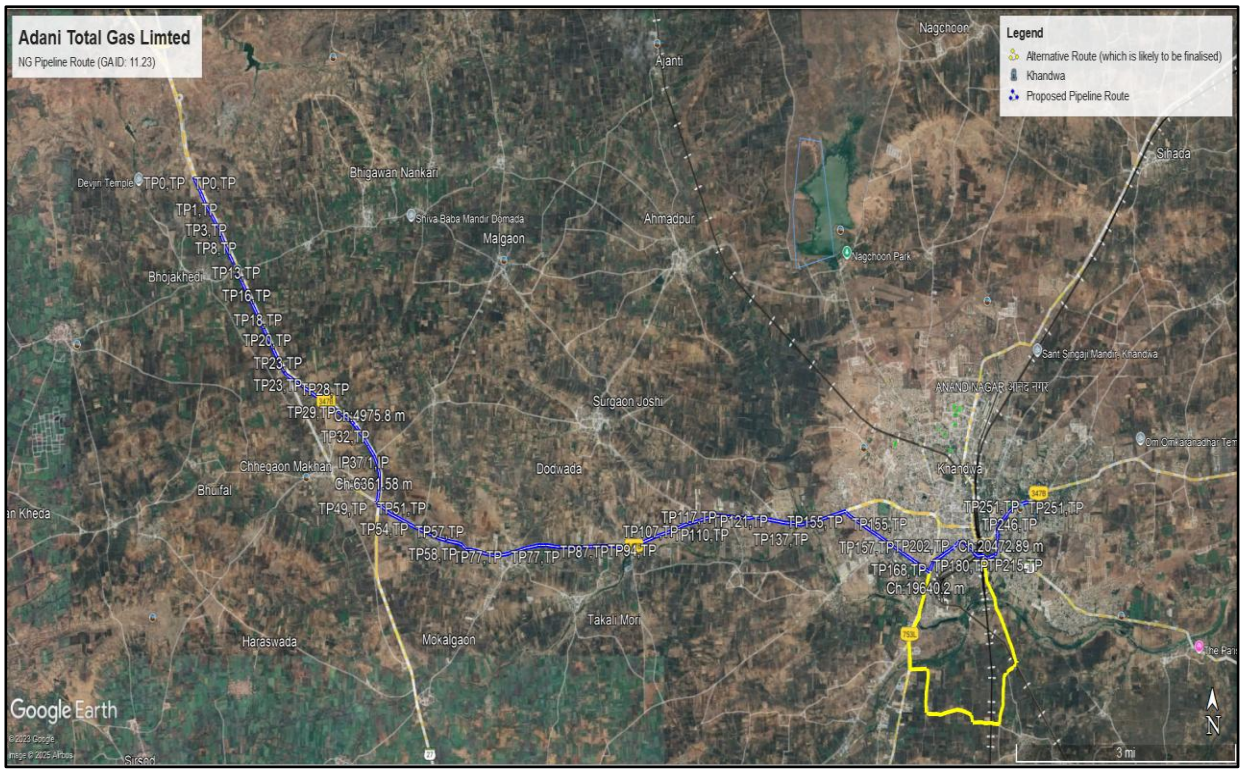
acquired through the bidding process and the area, number of customers, total CNG stations were already mentioned in it. So, the route selection was done within the allotted area.

ATGL has initially proposed a route for the Natural Gas Pipeline Route passing along the Khandwa District starting near Reliance Jio BP Future Fuels in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. However, that route was not finalised since the pipeline route would pass across the railyard near Khandwa Railway Junction because of which Railway Department did not give their clearance for the route. Therefore, the pipeline follows it general path till a point named "Dharamkata Tiraha" (Ch: 19640.2) and turns towards Khandwa-Pandhana Main Road and follows that route to join the main pipeline route at a point near Deg English Institute, Khandwa Town. Both pipeline route are shown in **Figure 6-1** and **Figure 6-2** respectively.



**Source: KML received from ATGL*

Figure 6-1: Proposed Natural Gas Pipeline Route



Source: KML received from ATGL

Figure 6-2: Diverted Natural Gas Pipeline Route which will be considered as the Final Pipeline Route (*Yellow marked line demarcating the Diverted Line*)

7 ADDITIONAL STUDIES

7.1 QUANTITATIVE RISK ASSESSMENT

Quantitative Risk Assessment (QRA) study should be undertaken for the proposed 8" diameter underground pipeline for the transfer of 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. This 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.

7.2 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 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: PP 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.

8 PROJECT BENEFITS

8.1 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 tons of oil equivalent by 2047 out of which natural gas will contribute 173 million tons of oil equivalent 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. 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 on the energy sector to self-reliance for energy resources, particularly oil and gas by encouraging of exploration and extraction operations and reduce dependence on overseas.

8.2 REDUCED RISKS AND 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 help in reducing the travel cost in comparison to other resources and they are 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.

8.3 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. Natural gas pipelines provide a reliable mode for transportation, reducing dependence on less stable energy supplies. Access to natural gas will decrease heating and electricity costs for residents and businesses. Usage of gas in domestic households and other commercial activities will reduce consumption of fossil fuels that would be lead reduction in pollution.

9 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

9.1 INTRODUCTION

The Environmental Social and Biodiversity Management Plan (ESBMP) provides an essential link between predicted impacts and mitigation measures during implementation and operational activities. ESBMP 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 ESBMP 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 ESBMP 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.

9.2 ENVIRONMENT, HEALTH & SAFETY POLICY

ATGL believes that Environment, Health, Safety and Quality (EHS&Q) is integral part of their business. By embracing the best principles EHS&Q, the company sincerely attempts to have all overall positive impact on the environment and communities where they operate. **ATGL** is committed to continually improve their EHS&Q performance by including the points below: The EHS&Q Policy of **ATGL** emphasizes on the following objectives:

- Implement highest standards of Environment, Health, Safety & Quality in planning, construction, operations, and maintenance of projects throughout their lifecycle to provide a safe and conducive working environment to its employees.
- Identify, eliminate, or mitigate potential EHS&Q risks associated with our business by implementing a robust due diligence and monitoring mechanism.
- Evaluate and comply with applicable regulations related to EHS&Q.
- Provide adequate training & resources to its employees to achieve its EHS&Q targets.
- Voluntarily adopt to an integrated Management Systems, compliant with international standards ISO 14001, ISO 45001, and ISO 9001 for EHS&Q respectively.

This EHS&Q policy is applicable for **ATGL**'s all business and project related activities and its subsidiaries. All employees and contractors of **ATGL** are required to adhere with this policy.

The HSE policy further ensures adherence of health and safety norms by hired contractor. The specific provisions to be followed includes the following:

- The contractor shall in its performance of the contract and carrying out of the work to ascertain and comply with all the relevant statutory laws and directives act as applicable.
- The contractor shall provide detail of EPF, ESIC, Labour License, medical fitness of workmen, valid photo id of workmen, undertaking letter mentioning workmen criminal record and other documents as applicable.
- All required safety item shall be supplied by contractor and any accident occurs during the contract period shall be to the contractor's account and **ATGL** will not be responsible for the minor/major accident/incident legally or financially.
- Workmen compensation policy must be obtained and kept in force.
- If contractor assigning the whole or partial work to third party should be intimated to **ATGL** in written with all required documents.
- Daily manpower and man-hour shall be reported by contractor.
- The contractor shall provide Attendance Register, Wages Register, EPF Remittance Challans, ESIC remittance challans every month or as on when required. This is also required for release of payment.

- The contractor shall make provisions for potable and domestic water for manpower, proper sanitary requirements with sufficient toilets and wastewater management for workmen which will be deployed for all ongoing work.
- Dedicated safety supervisor/officer should be available at site all the time during work execution.
- Mandatory PPE. (All PPE's Should be of IS standards)
    - ✓ Safety Helmet / Hard Hat.
    - ✓ Safety Shoes.
    - ✓ Safety Goggle.
    - ✓ Safety Jacket.
    - ✓ Safety Hand gloves.
- Job Specific PPE's

a. Welding Work (Basic)

✓ Safety Goggle / Welding Shield.

✓ Leather Hand Gloves.

✓ Leather apron.

✓ Full sleeves shirt

✓ Pant that covers the top of shoe.

b. Drilling Work (basic)

✓ Safety Goggle

✓ Nose mask.

✓ Hand Gloves.

✓ Ear Plug (as per requirement)

c. Electrical

✓ Insulating (rubber) gloves.

✓ Insulated tools.

✓ All electrical extension boards should have industrial plug to wherever required.

✓ All electrical extension boards should have 30mA ELCB MCB.

d. Civil Work

✓ Gum Boot with steel toe.

✓ Rubber Gloves.

- ✓ Nose mask.
- ✓ Safety Goggles.
- ✓ Ear plug if working in high noise area.

- Any other specific PPE required that will be intimated time to time.
- All required safety training will be provided by **ATGL** time to time.

Contractor should adhere all the **ATGL** & end customer safety norm. Failing to adhere may result in suspension of work or penalty will be applicable.

9.3 ORGANIZATION STRUCTURE

The overall management and coordination of the project will be managed through Chief Executive Officer (**ATGL**) who will be supported by the Plant Manager and Head (EHS&S). The Head- EHS&S /ESG will overview, monitor and control the activities of Site Manger and Safety officer. The contractors will be controlled by the site manager during construction phase. The construction contractor shall have a Health, Safety and Environment supervisor in their team who shall work in coordination with the EHS officer.

The primary responsibility of management of EHS&S functions within **ATGL** lies with the head quality control and EHS&S Officer. For management of land related issues, the responsibility rests directly with the land procurement personnel and HR related issues is managed by dedicated HR team. CSR is managed by a separate team and is responsible for overlooking all assets operated by **ATGL.**

9.3.1 ROLES AND RESPONSIBILITIES

Head EHS

The Head EHS should be the designated EHS&S head at **ATGL**. The key Roles and Responsibilities are as follows:

- The overall responsibility for implementation and communication of the EHS&S and associated policies and meeting ESMS performance objectives for the organization with respect to project.
- Ensuring adherence of EHS&S Policy and procedures and Safety compliance by Contractors.
- Ensuring compliance of existing and future operations with respect to the applicable national laws, rules and regulations, permits pertaining to Environmental, Safety, Health and Social as well as international best practices including reference frameworks such as IFC Performance Standards.
- Communication of EHS&S related issues and concerns with the CEOs office and project heads as well as guiding them on Go and No-Go decisions for projects with serious EHS&S risks and issues.
- Decision on internal risk categorization and rating lies with the ESHS head.
- Approvals for commissioning of ESIA studies, Resettlement Action Plans etc.
- Responsible for recommendation and appointment of EHS&S personals.

- Responsible for taking up monitoring reports and audit reports with the CEO's office.
- Changes in this ESMS manual must be sanctioned by the EHS&S head and formalized by the ESMS head.
- Responsible for decisions on higher level EHS&S non-compliance by external stakeholders such as contractors and vendors with respect to fines and associated penalties.

Corporate EHS&S Officer

EHS&S Manager at the corporate level will be responsible for the following:

- Overseeing successful EHS&S screening, audit and impact assessment of assets either internally or through external agencies as the case maybe.
- Overseeing the implementation of the systems, protocols and checklists of the ESMS at the corporate level and where necessary, transferring information and expertise at the site level.
- Interaction with other teams such as project team, land, procurement, HR etc. for handling and resolution of EHS&S issues and risks.
- Ensuring implementation of training and capacity building exercises at the corporate levels and project levels.
- Documentation and control of ESMS related documents.
- Development of processes with respect to EHS&S. Also includes internal updates of existing systems pertaining to EHS&S wherever feasibly and technically possible.

Functions of HR Department

The HR department is responsible only for the management of HR relations for internal employees within **ATGL**. Some of the primary roles and responsibilities undertaken by HR department are as follows:

- Responsible for implementation of the corporate HR Policy, manual and practices.
- Planning and recruitment of new employees as aligned with the business plan.
- Management of performance appraisal & review process.
- Implementation of desired employee engagement programs & practices.
- Management of any internal Human Resources Information System.
- Assessing and evaluation of competencies of existing employees.
- Carrying out of training programs and orientation of new employees.
- Liaise with law enforcement agencies whenever necessary.
- Manage harmonious industrial relations.
- Handling and management of employee grievances.

CSR Team

The CSR department established at the corporate level primarily has the following roles and responsibilities:

- Conducting need-based assessment studies (internal or external) for project relevant CSR programs and activities.
- Undertaking stakeholder identification, profiling, analysis, and influence impact matrix.
- Defining and developing strategies which underpin the company's CSR objectives in the aspects defined under the central CSR policy.
- Developing site specific CSR engagement plan.
- Liaison and maintaining good rapport with government, educational institutions & community-based organization & engaging them for CSR activities.
- Developing evaluation and monitoring indicators for implementation across locations & conducting review meetings at regular intervals.
- Establishing effective ways of measuring and articulating **ATGL** impact in social development through the various CSR programs.
- Disclosure of the impacts and other aspects of the project including emergency response plan for the community.
- Ensuring sharing of project benefits to the local community.
- Visit project sites on a regular basis, monitor program progress and resolve implementation obstacles to ensure the programs are being implemented in accordance with plans and agreements.

Legal Team

Broadly key functions of legal team at Corporate Office of **ATGL** are as follows:

- Managing compliance and statutory requirements and records applicable to **ATGL** businesses including necessary licenses and permits.
- Providing legal support to land, asset, and contractual transactions.
- Ensuring legal compliance of contractors and vendors to established terms and conditions.
- Government sanction/approvals.
- Checking, proofing and validation of legal documentations.
- Addressing legal disputes and litigation.
- Maintenance of legal records.

- Review contractor/ supply chain engagement with compliance of all legal requirement related to EHS&S and HR provisions.

SITE LEVEL

Site Manager/ EHS&S Officer

The Project Manager/ EHS&S Officer are responsible for overall management of the project and ESMP implementation. The following tasks will fall within his/her responsibilities:

- Monitor site activities on a daily basis for compliance.
- Conduct internal audits of the construction site against the ESMP.
- Confine the construction site to the demarcated area.
- Reporting EHS&S related issues & incidents in respective area to Head-Solar Vertical.

Project Manager

- Responsible for the overall implementation of the EHS&S plan.
- Shall establish EHS&S organization for the effective implementation of this plan.
- Shall provide all resources to effectively implement the EHS&S plan.
- Shall initiate disciplinary actions for any violations of the EHS&S plan.
- Shall ensure project EHS&S plan is integrated with customer requirements and ensure its compliance.
- Communicate all kinds of events to customer and regulatory agencies as appropriate.
- Shall act as the highest authority in taking any decisions related to EHS&S violations.

EHS&S Officer

The EHS&S Officer will have the following responsibilities:

- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP.
- Role may be combined with Project Security Manager's role.
- Ensuring this plan requirement are communicated to all sub-contractors and their contractors, employees, customers and visitors.
- Sub-Contractor shall take conduct periodic inspections to ensure compliance with the requirements of this plan.
- Provide support to implement the procedures of this plan for the respective project site.
- Ensuring that Identification Badges and Helmet Badges is not issued to his Employees, Visitors, Sub-Contractors and their contractors without undergoing the orientation training.

- Ensuring compliance with legislative, IFC's and other lender's requirements.
- Carrying out audits, and inspection of all the project activities at regular intervals and rectify non-compliances if any.
- Preparation of necessary documents and record keeping system.
- Reviewing and updating of ESMP for its effective implementation.
- Acting as a point of contact for residents and community members.
- The contractor should develop a code of conduct to guide the employees on how to behave with the community to avoid conflicts.
- Develop a Grievance Redressal Mechanism in lines with informing the local community about the Grievance Redressal Mechanism and ensuring effective implementation; and
- Conducting periodic meetings with local community for understanding their grievances and outcomes of the CSR activities; and
- Address training needs of contractors and other employees for social and community issues.

Sub-Contractors/ Labour Contractors

- The sub-contractor's / labour contractors working for **ATGL** is hereby responsible to comply with the guidelines of this plan.
- Sub-Contractor shall provide all resources to implement the requirements of this plan in their respective work area.
- Sub-Contractor is responsible to communicate the requirements of the plan to all their sub-contractors and their contractors, their employees and visitors.
- Sub-Contractor shall take disciplinary actions for any violations of this plan as required.
- Sub-Contractor shall not issue Identification Badges and Helmet Badges to his employees, his Sub-Contractors and their contractors without undergoing the orientation training on the plan.
- Sub-contractor shall ensure commitment and compliance for no child/forced labour involvement in the project.

Training and capacity building

Training is one common method of supplying individuals with additional skills and knowledge. In order to be successful in EHS&S management, training programs need to be thought out carefully and systematically. A robust social and environmental, health and safety training plan is important for effective implementation of ESMS.

The Corporate EHS&S head at **ATGL** along with recommendations from EHS&S officers will ensure that the job specific training and EHS&S induction training needs are identified based on the specific requirements of the ESMS and existing capacity of site and project personnel (including the Contractors

and Sub-contractors) to undertake the required actions and monitoring activities. Some of the specific trainings that will be carried out on routine basis are as follows:

- ESMS Checklists and procedural guidance
- Occupational Health & Safety
- Fire Safety and Prevention
- Emergency Response Preparedness
- Operational Training
- HR Induction Training
- PPE Training
- Driver Safety
- Implementation of Environmental and Social Management/Action plans

The above listed trainings are the preliminary trainings which will be undertaken at the inception stage once the employee/worker joins the company and/or Project. Post that, monthly refresher trainings will be undertaken, especially for the workers. Other training will be identified and implemented during the project lifecycle as per the need assessment, as part of mitigation measure and also capacity building of the staffs.

An environmental and social management training program will be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training program will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities.
- Requirements of the specific Action Plans.
- Understanding of the sensitive environmental and social features within and surrounding the project areas.
- Aware of the potential risks from the project activities.

In case of contractors or turnkey contractors having sufficiently well-developed standards on EHS&S management, the training can be sub-let to the same for their respective employees and **ATGL** will monitor the completion and sufficiency status of these programs. In case of subcontractors, the training and capacity building will be done by the site level EHS&S's officers along with the contractor's EHS&S manager to ensure such trainings of the contracted staffs either directly or through trainers of **ATGL**. Subsequently the responsibility can be passed on to the sub-contractors for all future training programs.

It is further advised that **ATGL** shall consider engaging a third party EHS&S audit to monitor and evaluate the EHS compliance during the construction phase. The EHS&S officer shall be responsible for checking compliance of the contractor(s) with the requirements of this ESMP and any other relevant environmental

legislation for all activities associated with the contract. The general duties of the EHS&S officer will be as follows:

- Third Party EHS&S Officer will be responsible for conducting of an EHS&S audit during the construction phase of the project according to the provisions of the Environmental Management Plan.
- Conduct independent environmental audits.
- Submit audit reports to the EHS&S Specialist/ Head EHS&S and if required, relevant authority.

9.4 CONTRACTORS MANAGEMENT PLAN

The overall responsibility of the project will be of **ATGL**. It shall thus ensure that the ESMP is implemented by its contracts through contractual arrangements. **ATGL** has developed a Vendor's Code of Conduct which requires that all service providers and their directors, employees, agents, suppliers, and subcontractors (collectively Service Providers' representatives) always conduct themselves with integrity and in full compliance with this Code of Conduct and applicable laws, rules and regulations that govern their business activities. All **ATGL** service providers will be required to educate and, when appropriate, train their representatives to ensure they understand and comply with this Code of Conduct. The code of conduct principles of **ATGL** are as follows:

- Corruption & Prohibited Business Practices
- Health and Safety
- Environment
- Labor Standards
- Acting in Concert
- Mirroring of Contractual Requirements towards sub-suppliers
- Human Rights

The EHS norms in the code of conduct covers the following elements:

- The service provider shall secure that its workers are provided with a healthy and safe working environment in accordance with recognized standards. The Service Provider shall do its utmost to control hazards and take necessary precautionary measures against accidents and occupational diseases. The Service Provider shall ensure compliance with the provisions of Building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1976. Whenever necessary the workers are to be provided with, and instructed to use, appropriate personal protective equipment, and are adequately & regularly trained to ensure that they are adequately educated on health and safety issues.
- Compliance with labour laws and legislations i.e. the Contract Labour (Regulation and Abolition) Act, 1970, Employees State Insurance Company Act, 1948, Employees' Provident Funds and (Misc. Provisions) Act 1952, Payment of Bonus Act 1965, Payment of Gratuity Act, 1972, Equal

Remuneration Act, 1976, Maternity Benefit Act, 1961, Labour Welfare Fund Laws, Minimum Wages Act, 1948, Payment of Wages Act, 1936, Shops and Establishment Act and Inter-State migrant workmen (Regulation of Employment) and (Conditions of service) Act, 1979.

- Non-engagement of child labour and bonded labour.
- Non-discrimination based on caste, creed, religion, or sex.
- Ensuring that women employees of Service Provider are given full protection from sexual harassment as per guidelines laid down by the Supreme Court of India.
- Ensuring adherence of EHS policies and procedures by Contract Agreement in order to secure that its own suppliers', sub-supplier's, business partners and other third parties directly or indirectly used by the Service Provider in the provisioning of services to accept and adhere to the EHS requirements.

General environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project through an EHS Management Plan prepared for Project and Contractors engaged for the project. It shall ensure compliance with meeting **ATGL**'s Environmental Performance Guidelines for New Projects and Developments, minimizing the safety hazards through good engineering design through the implementation of the Group Integrity Management Standard, and achieving a record of 'zero' Lost Workday Case (LWDC) injuries and incidents on the Project. Itcomprises of the following aspects:

- Project Management Plan Deliverables Register
- Project Contractor Requirements
- Project Risk Management Plan
- Project Training Matrices
- Project Reward & Recognition Program
- Project Safe Work Practices
- Project Document Management Procedure
- Project Records Management Procedure
- Project Communications Table
- Project Audit Program
- Project Emergency Response Plan

ATGL shall ensure that the job specific training and EHS Induction Training needs are identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the

Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Special emphasis will be placed on traffic management and operation of Cranes.

An environmental and social management training program will be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training program will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities.
- Requirements of the specific action plans.
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities.

A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Workers with rescue and first-aid duties shall receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.

Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

9.5 COMMUNITY/ STAKEHOLDERS ENGAGEMENT PLAN (SEP)

ATGL shall adhere to Stakeholder Engagement Plan (SEP) for engagement with community, government bodies during the lifecycle of the project and to assess the efficiency of the communication process in meeting the objectives of the SEP and ensuring the projects' 'social license to operate'.

Table 9-1: Stakeholder Group Categorization

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	Sub-contractors, local labours	Local community, agricultural labour, vulnerable communities
Institutional Stakeholders	Gram Panchayat, Project Investors	Village Institutions, (schools, health centers etc.)
Government Bodies	Regulatory Authorities, District Administrations	-
Other Groups	-	Media, other industries, projects

9.5.1 AIMS AND OBJECTIVES OF SEP

The engagement plan is to guide all the stakeholders' engagement during construction phase and operations phase. The objectives of the SEP are:

- Enable management to develop effective stakeholder management strategies for various projects in order to build long term relationship so as to ensure smooth functioning of the projects.

- To define and standardize the process that the project will use to communicate with respective stakeholders.
- To ensure regular and timely sharing of information with project team to spruce up their understanding and skills of engaging with the stakeholders.
- Ensuring coordination in approach and message to be shared with the community regarding the company and the projects.
- To assess the efficiency of the communication process in meeting the objectives of the SEP and ensuring the projects' 'social license to operate.'

The community engagement process is informally managed by the QHSE Head and is limited to liaison with local authorities and the panchayat. To ensure the implementation of the ESMP and engage all the stakeholders identified, this process will need to be formalized through the social officer defined as above.

The two important elements of community engagement will be disclosure and consultation. This implies that as a first step, the findings of the ESIA, especially the ESMP will have to be disclosed to the community. The ESMP should be finalized through consultation with the community and an action plan shall be developed. Further, the community should be regularly updated about the implementation of the ESMP and all other relevant information pertaining to the construction phase, activities, health, and safety risks etc. The community shall also be made aware of the available job opportunities from time to time.

The project will engage with the affected people to understand the stakeholders on the common property resources (roads, grazing areas etc.) which would be impacted. It shall work closely with the Panchayat and local administration to identify and develop alternate areas for common resources (fodder,) if required.

To understand community expectations and manage any local concerns, **ATGL** will constitute a Grievance Redressal Mechanism to be managed by the Social Officer. This grievance mechanism will respond to the concerns and grievances of local communities, NGOs, Panchayats and any other aggrieved party or stakeholder. The project will share information about these mechanisms to the stakeholders through locally appropriate communication tools.

The Grievance Redressal Procedure will also outline the process and steps to be taken and the time limit within which the issue would need to be resolved to the satisfaction of the complainant. The project will endeavor to get all complaints recorded and addressed in a uniform and consistent manner. For disputes that cannot be internally resolved, the project will set up an independent mechanism with representation from community, Panchayats, and locally respected citizens of the area to sort these conflicts. If it has a legal implication the district administration will be approached.

9.6 ESMP REVIEW & AMENDMENT

ESMP is a social and environment management tool which shall be reviewed periodically (at least once in 2 years or earlier) to address changes in the project design, life cycle processes and activities, organization, and regulatory requirements.

9.6.1 INSPECTION, MONITORING & AUDIT

To implement the ESMP, the on-site team will develop a time-bound and action- oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP will have to be monitored on a regular basis, quarterly or half-yearly, and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process will cover all stakeholders including contractors, labourers, suppliers, and the local community impacted by the project activities and associated facilities. Inspection and monitoring of the environmental and social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring, the company will ensure that all the contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by **ATGL**'s trained team and external agencies/experts. The entire process of inspections and audits will be documented. The inspection and audit findings will be implemented by the contractors in their respective areas.

9.6.2 REPORTING AND REVIEW

ATGL will develop and implement a program of reporting through all stages of the project viz., construction and commissioning, operation, and decommissioning. Contractors will be required to fully comply with the reporting requirements in terms of timely report submission with acceptable level of details. Reporting will be done in form of environmental, health, safety and social check list, incident record register, environmental, health, safety, and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.).

9.6.3 EXTERNAL REPORTING AND COMMUNICATION

All complaints and enquiries are to be appropriately dealt with, and records be maintained in a Complaint/Enquiry Register by QHSE Head or other delegated staff.

9.6.4 INTERNAL REPORTING AND COMMUNICATION

Inspection and audit observations along with their improvement program are to be regularly reported to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain open communication between the staff and management on EHS&S issues the following shall be used:

- Team Briefings,
- On-site work group meetings.
- Key Incidents/accidents and lessons learnt.

- Work Specific Instructions; and
- Meeting with stakeholders.

9.7 DOCUMENT & RECORD KEEPING

Documentation and record keeping system must be established to ensure updating and recording of requirements specified in ESMP. Responsibilities must be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured through access by and distribution to identified personnel in form of the following:

- Documented Environment management system.
- Legal Register.
- Operation control procedures.
- Work instructions.
- Incident reports.
- Emergency preparedness and response procedures.
- Training records.
- Monitoring reports.
- Auditing reports; and
- Complaints register and issues attended/closed.

The following table provides a sample summary of engagements which are required in a typical project lifecycle. It indicates the methodology on how these stakeholder consultations are accomplished.

Table 9-2: Methods of Consultations and Engagement

Stakeholder	Stakeholder Category	Objective of Engagement	Stakeholder Influence	Methods of Consultation and Engagement	Frequency of Consultations and Engagement
Sub- contractors/ Labours/Employees	Primary Stakeholder	To appraise about labour working condition and EHS compliance	Medium	Periodic Meetings (for the purpose of information dissemination, including information regarding labour laws, safety measures and discussions of grievances) as per the working duration, Information dissemination regarding welfare provisions for Labourers Information dissemination regarding welfare provisions for Labourers, employment opportunities, grievances, EHS and CSR activities though notice board and display of key messages on billboard.	Meetings and periodic reporting in the operation phase
Gram Panchayats And Village institutions	Primary Stakeholder	For necessary information disclosure of SEP. As Part of GRM Ensured involvement in CSR activities and local procurement if required	High	Consultations, meetings (FGD and individual interview) and Discussions; Sharing of documents, if required, as part of the disclosure mechanism; Meetings as a part of the Grievance Redressal mechanism, if required; Attendance at Panchayat meetings and participation in CSR activities and agreements with communities documented in minutes of meetings	• As and when required; and • As per the regulatory requirements
Regulatory Authorities	Primary Stakeholder		High	Meetings and Discussions	• As per the regulatory requirements • As and when required
District Administration (Tehsildar, SDO, Patwari)	Primary Stakeholder	Regular engagement Participation in CSR Activities	High	Regular meetings and participation in CSR events	• Regular Meetings; or • Monthly or as & when required
Landowner	Primary Stakeholder	Discussion on land purchase modalities.	Very Low	Discussion during various festivals and other relevant occasions.	• As and when required.

Stakeholder	Stakeholder Category	Objective of Engagement	Stakeholder Influence	Methods of Consultation and Engagement	Frequency of Consultations and Engagement
Community	Primary Stakeholder	Managing and ensuring participation in CSR activities. As part of GRM.	Low	• Open Meetings, • Interactions with community at Gram Panchayat, • Discussion on CSR programs	• As and when required

9.8 GRIVANCE REDRESSAL MECHANISM (GRM)

ATGL has a well-defined Grievance Redressal Mechanism (GRM) procedure. This GRM serves as one of the components of **ATGL**'s Environmental and Social Management for managing overall performance of its projects as well as providing more accountability to its stakeholders. The GRM, which caters to both internal and external grievances is based on four (4) guiding principles of the company which include:

- Transparency
- Fairness
- Respect
- Accountability

9.8.1 INTERNAL GRIEVANCES

Employee Grievance: These include the employees hired specifically for the site.

9.8.2 EXTERNAL GRIEVANCES

Contractor and labour related grievances (directly /indirectly controlled by **ATGL**). Community grievances including those on land and resettlement issues, project activities, CSR intervention, employee/worker-community conflicts, and other project related issues (Directly/Indirectly controlled by **ATGL**).

This grievance mechanism shall respond to the concerns and grievances of local communities, NGOs, Panchayats and any other aggrieved party or stakeholder. The project shall share information about these mechanisms to the stakeholders through locally appropriate communication tools.

In case the contractors have their own GRM, **ATGL** should ensure that it is functioning effectively and even review the grievance records. However, if the contractors lack GRM in the first place, **ATGL** should ensure that the workers are linked to their GRM process.

The project shall endeavor to get all complaints recorded and addressed in a uniform and consistent manner. For disputes that cannot be internally resolved, the project shall set up an independent mechanism with representation from community, panchayats, and locally respected citizens of the area to sort these conflicts. If it has a legal implication the district administration shall be approached.

ATGL has developed procedures for handling grievances, reviewing, and investigating grievances, grievance closure, monitoring, and review procedures.

A grievance body, leaded by designated Grievance officer is proposed for effective implementation of GRM and coordinating day to day functions. The grievance body would be reporting back to the appropriate authority including functional areas such as HR, Project, O&M, BD/Land, CSR, EHS etc. as per requirement. The mandate of this cell would be managed as part of the ESG forum. **ATGL** should ensure appropriate budget allocation in coordination with **ATGL** to deal with grievance tracking and handling with consent of appropriate authority. Awareness shall be provided in the company's policy and practices for both employee and appropriate stakeholder grievance mechanisms, relevant to their exposure and responsibilities

9.9 CORPORATE SOCIAL RESPONSIBILITY (CSR) POLICY

ATGL will focus on the following areas for CSR projects from amongst the activities specified under Schedule VII of the Companies Act, 2013 and the Rules made thereunder including but not limited to Education, Empowerment, Environment and Health:

- Promoting gender equality & empowering women
- Employment enhancing vocational skills and livelihood enhancement programs
- Rural Infrastructure Development Projects

CSR committee may recommend to the Board of Directors additional CSR initiatives, based on specific merit, provided that these projects fall under the scope of schedule VII of the Companies Act, 2013, as may be amended from time to time.

As part of its devising and planning for CSR activities and programs, prior to the commencement of projects, **ATGL** carry out impact assessment studies or need based assessment studies within the proposed project footprint area in order to understand the basic needs, problems and requirements where interventions/intervention activities can be implemented in.

The study encompasses various parameters such as-health indicators, access to infrastructure, vulnerability, literacy levels, workforce participation, employment opportunities, sustainable livelihood options, and demographic profile including population data –below the poverty line and above the poverty line, state of infrastructure. From the data generated, project specific CSR plans are developed for implementation. CSR programs and activities can also be reactive in nature where the need and requirement for the same may arise even outside the purview of the impact assessment or the need-based assessment or may be entirely disassociated from any project implementation. Proper budgeting and scheduling are carried out for the programs.

ATGL will seek to identify suitable projects/programs for implementation in line with the CSR policy of the Company.

By and large, it may be endeavored to execute most of the CSR programs/ activities forming part of defined scope in and around the areas adjoining projects.

The medium of implementation of CSR programs would be directly by the CSR department or company's own foundation or collaboration/ tie-ups with Trust/ Society/ Section 8 Company/ NGOs as per the decision taken by the CSR committee.

Monitoring And Reporting

The CSR department will be responsible for regular monitoring & reporting of the CSR programs and provide regular progress report to the CSR Committee of the Board. This report would indicate:

- Achievement of the year-to-date in terms of coverage compared to the target, reason for variance, plans to overcome shortfalls if any and support required from the CSR Committee/Board to overcome the shortfalls.
- Actual year-to-date spends compared to the budget and reasons for variance.
- In respect of activities undertaken through outside Trust/Society/NGO's/Government recognized funds, etc. there will be mechanism of reporting of progress on each such activities and the amount incurred thereon at the subsequent CSR Committee Meeting.
- The Board shall seek a progress report from the CSR Committee at least twice in a year.

9.10 LABOUR MANAGEMENT PLAN

The construction of the project has not yet started, and locals have been proposed to be hired for the project during construction phase. However, in case of hiring migrant labour, **ATGL** needs to adhere to implementation of *Labour Camp Management Plan Guidelines* as provided under "*Worker's Accommodation Processes and Standards: A Guidance Note by IFC and EBRD*[7]" and ensure that the worker's accommodation should be at clean, safe place and, at the minimum, should meet the basic requirements of workers. In particular, the provision of accommodation should meet national legislations and international good practices in relation, but not restricted, to the following:

- Practice for charging for accommodation.
- Provision of minimum amounts of space for each worker.
- Provision of sanitary, laundry and cooking facilities and potable water.
- Location of accommodation in relation to the workplace.
- Any health, fire safety or other hazards or disturbances and local facilities.
- Provision of first aid and medical facilities; and heating and ventilation.
- Workers' freedom of movement to and from the employer-provided accommodation should not be unduly restricted.

9.10.1 DRINKING WATER RESOURCES AND MONITORING WATER QUALITY

- Access to adequate & convenient supply of free potable water should be always available to workers.
- Depending on climate, weather conditions and accommodation standards, 80 to 180 liters per person per day are available.
- Drinking water should meet national/local or WHO drinking water standards.
- All tanks used for the storage of drinking water should be constructed and covered as to prevent water stored therein from becoming polluted or contaminated.
- Drinking water quality should be regularly monitored.

[7] https://www.ifc.org/wps/wcm/connect/60593977-91c6-4140-84d3-737d0e203475/workers_accomodation.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-60593977-91c6-4140-84d3-737d0e203475-jqetNIh

9.10.2 WASTEWATER AND SOLID WASTE

- Arrangements for discharge of wastewater, sewage, and disposal of food, kitchen waste and any other waste materials should be made without causing any impact on biophysical environment or surrounding communities.
- Specific containers for rubbish collection should be provided and emptied on a regular basis.
- Adequate number of rubbish containers to providing leak proof, non-absorbent, rust and corrosion-resistant containers protected from insects and rodents needs to be provided.
- The garbage/rubbish containers should be 30 meters from each shelter on a wooden, metal, or concrete stand. Such containers must be emptied at regular intervals (to be determined based on temperatures and volumes generated) to avoid unpleasant odors associated with decaying organic materials.
- Pest extermination, vector control and disinfection should be carried out throughout the living facilities in compliance with local requirements and/or good practice. Where warranted, pest and vector monitoring should be performed on a regular basis.

9.10.3 LABOUR CAMP ROOM/ DORMITORY FACILITIES

- Rooms/dormitories should be kept in good condition.
- Rooms/dormitories should be aired and cleaned at regular intervals.
- Rooms/dormitories are built with easily cleanable flooring material.
- Sanitary facilities should be located within the same buildings and provided separately for men and women. Usual standards range from 10 to 12.5 cubic meters (volume) or 4 to 5.5 square meters (surface).
- A minimum ceiling height of 2.10 meters is provided.
- In collective rooms, which are minimized, in order to provide workers with some privacy, only a reasonable number of workers are allowed to share the same room. Standards range from 2 to 8 workers.
- All doors and windows should be locked and provided with mosquito screens where conditions warrant.
- There should be mobile partitions or curtains to ensure privacy.
- Every resident should be provided with adequate furniture such as a table, a chair, a mirror, and a bedside light.
- Separate sleeping areas should be provided for men and women, except in family accommodation.

9.10.4 BED ARRANGEMENTS AND STORAGE FACILITIES

- A separate bed for each worker should be provided. The practice of “hot bedding” should be avoided.
- There should be a minimum space between beds of 1 meter.
- Double deck bunks are not advisable for fire safety and hygiene reasons, and their use is minimized. Where they are used, there must be enough clear space between the lower and upper bunk of the bed. Standards range from to 0.7 to 1.10 meters.
- Each worker should be provided with a comfortable mattress, pillow, cover, and clean bedding.
- Bed linen should be washed frequently and applied with repellents and disinfectantswhere conditions warrant (malaria).
- Facilities for the storage of personal belongings for workers should be provided.
- Separate storage for work boots and other personal protection equipment needs to be provided.

9.10.5 SANITARY AND TOILET FACILITIES

- Sanitary and toilet facilities should be constructed of materials that are easily cleanable.
- Sanitary and toilet facilities should be cleaned frequently and kept in working condition.
- Sanitary and toilet facilities should be designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
- Sanitary and toilet facilities should not be shared between men and women, except in family accommodation.
- An adequate number of toilets should be provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.
- Toilet facilities should be conveniently located and easily accessible. Standards range from 30 to 60 meters from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins, and be conveniently located.

9.10.6 SHOWERS/BATHROOMS AND OTHER SANITARY FACILITIES

- Shower/bathroom flooring should be made of anti-slip hard washable materials.
- An adequate number of handwash facilities should be provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash facilities should consist of a tap and a basin, soap, and hygienic means of drying hands.
- An adequate number of shower/bathroom facilities need to be provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.

- Showers/bathrooms should be conveniently located.
- Shower/bathroom facilities should be provided with an adequate supply of cold and hot running water.

9.10.7 COOKING FACILITIES

- Places for food preparation should permit good food hygiene practices, including protection against contamination between and during food preparation.
- Kitchens should be provided with facilities to maintain adequate personal hygiene including sufficient washbasins designated for cleaning hands with clean, running water and materials for hygienic drying.
- Wall surfaces adjacent to cooking areas should be made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Further, to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.
- All kitchen floors, ceiling and wall surfaces adjacent to, or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials.
- Wall surfaces adjacent to cooking areas should be made of fire-resistant materials. Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials. Further, to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures have a smooth, durable, and washable surface.
- Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment should be provided.
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation.

9.10.8 MEDICAL FACILITIES

- A number of first aid kits adequate to the number of residents should be available.
- First aid kits should be adequately stocked.
- An adequate number of staff/workers (1 first aider for every 50 persons) should be trained to provide first aid.
- Where possible and depending on the medical infrastructures existing in the community, other medical facilities should be provided (nurse rooms, dental care, minor surgery).

9.10.9 LEISURE, AND SOCIAL FACILITIES

- Basic collective social/rest spaces should be provided to workers. Standards range from providing workers multipurpose halls to providing designated areas for radio, TV, cinema.
- Recreational facilities should be provided for the workers.

9.10.10 SECURITY OF WORKERS' ACCOMMODATION

- A security plan including clear measures to protect workers against theft and attack should be implemented.
- Security staff should be checked to ensure that they have not been implicated in any previous crimes or abuses. Where appropriate, security staff from both genders should be recruited.
- Security staff should have a clear mandate and have received clear instruction abouttheir duties and responsibilities, in particular their duties not to harass, intimidate, discipline, or discriminate against workers.
- Security staff should have received adequate training in dealing with domestic violence and the use of force.
- Security staff should have a good understanding about the importance of respecting workers' rights and the rights of the communities.
- Workers and the locals residing in nearby areas in villages should have specific means to raise concerns about security arrangement and staff.
- **ATGL** should also adhere to Standard Operating Procedure for Work Resumption after Lockdown prepared by **ATGL** and ensure compliance with respect to following measures:
- Maintaining Social Distancing in Labour Accommodation (2 meter)
- Soap solutions / hand sanitizers to be placed in all quarters / washroom's places wherever required and replenished periodically.
- Ensuring that all doors / windows/fittings are sanitized frequently.
- Special attention to be given for the washrooms / toilets by periodical cleaning, Swabbing, disinfecting, and maintaining dry.
- Emergency Facilities to be available for 24 X 7 and displayed emergency key contacts.
- Soap solutions / hand sanitizers to be placed in all quarters / washroom's places wherever required and replenished periodically.
- To ensure that all the workers who are coming for work are healthy and not having any symptoms of COVID-19 (Fever, Dry cough, breathing problem).
- Arrangements to be made to supply all essential items like rice, wheat, groceries, water, etc. to colony itself so as to restrict movements of Labourers.

- Appropriate masks to be distributed to all Labourers.
- All labour engaged at site shall be advised to wear mask always while at colony, movement outside and during duty timings.
- Ensuring availability of the following at all times

    1. Sanitizer
    2. Face mask
    3. Hand gloves
    4. Hand Wash
    5. Dettol
    6. Soap
    7. Thermometer
    8. BP checking machine
    9. First Aid Box

- Tie up with nearest Hospital/COVID-19 Rescue Team shall be made for getting medical examination of all people for any Covid-19 symptoms.
- Quarantine hall or room shall be established in labour colony for the said purpose.
- Contractor shall display precautions measures - dos and don'ts at colony premises in all languages spoken by the workers.
- Vehicle shall be kept ready or tip up for vehicle shall be made for emergencypurpose.
- Minimum social distancing shall be ensured in keeping occupants in a single room.
- Disinfecting spray done at all the areas of colony after workers are left for work daily.
- A team comprising **ATGL** Admin, **ATGL** HSE and Contractor site in charge shall visit labour colony daily to ensure availability of essential things and regarding no off occupants, cleanliness, sanitization status, etc. and submit a report to Construction Manager and Project Manager.
- Feedback in written form or through personal interaction regarding labour colony requirements shall be obtained from contract labours on weekly basis.

9.11 WASTE MANAGEMENT PLAN

The proposed project should handle all incoming waste materials, all waste generated on site and both the disposal, and potential recycling of such materials. The exact quantities need to be detailed once agreed packaging and quantities of incoming material is identified. The project waste is primarily related to civil works, and packaging of incoming materials. The following principles are put in place to reduce the amount of waste generated:

- Packaging will be optimized to reduce non-recyclable content.
- Orders of cables and other consumables will be kept to a minimum.

- The amount of earth works is kept to a minimum, including optimized road works to reduce required import of material to site.

Registered vendors are appointed by **ATGL** for collection of waste generated from their natural gas pipeline projects.

9.12 DISASTER MANAGEMENT PLAN

The district of Khandwa is prone to natural and man-made disasters. The study area falls in Zone III: Moderate Damage Risk Zone (MSK VII) in accordance with the Earthquake Hazard map of India, Vulnerability Atlas of, 3rd edition, 2019 prepared by BMTPC. Khandwa has no recorded history of flooding, and the entire district falls within a low-damage risk zone. However, since the pipeline route crosses Aabna river at four locations, special care needs to be taken during period construction work.

During the construction of the site the site will at times consist of loose and/or un-compacted soil and removed or destroyed vegetative cover. During this phase temporary drainage system will have to be installed. This will consist of landforms, both trenches, and deep pits to collect and dissipate water. The temporary drainage will either be converted into permanent drainage with masonry (where co-located) or closed off after completion of the planned system.

9.13 TRAFFIC MANAGEMENT PLAN

9.13.1 Introduction

The Traffic Management Plan (TMP) is designed to ensure the safe and efficient movement of vehicle and pedestrian traffic through and around construction zones. It also aims to safeguard workers and minimize disruptions to the public. This plan outlines the procedures, safety measures, and control devices to be implemented during road construction activities.

This TMP has been developed based on the preliminary site survey conducted during the Environmental and Social Impact Assessment (ESIA) phase. As such, it reflects the anticipated traffic conditions and construction impacts identified at that stage. However, recognizing that actual site conditions may vary during implementation, the TMP will be reviewed and updated by the contractor during the construction phase to ensure it remains responsive to real-time requirements and evolving site-specific challenges.

9.13.2 Objectives

The primary objectives of the TMP are:

- To ensure the safety of road users and construction workers.
- To maintain efficient traffic flow during construction.
- To provide clear and timely information to road users.
- To minimize environmental and social impacts due to traffic disruptions.

9.13.3 Key Principles

- **Warning Sign**: Inform road users well in advance of any changes or hazards.

- **Safe Guidance**: Provide clearly marked and safe lanes for traffic.
- **Work Zone Protection**: Establish buffer zones and barriers to protect workers.
- **Driver Behavior Control**: Use signage and devices to influence safe driving behavior.

9.13.4 Planning Considerations

Traffic control plans will be tailored to specific site conditions, considering:

- **Traffic Volume**: Peak and non-peak hour densities.
- **Lane Requirements**: Width and number of lanes needed for construction.
- **Junction Complexity**: Number and type of intersections.
- **Pedestrian Infrastructure**: Availability and condition of footpaths.
- **Speed Limits**: Regulatory and advisory limits in the area.
- **Lane Geometry**: Changes in lane width or alignment.

9.13.5 Construction Zone Layout

Construction Zone is an integral part of any road construction system. The safety practices in construction will, therefore, be oriented towards reducing conditions, which lead to such hazards and consequent stress whereby the risk of accident increases.

Safety measures will be aimed at avoiding hazardous conditions, especially in work sub-zones where major construction activities are going on.

The construction zone is divided into four sub-zones:

i. **Advance Warning Sub-zone**

- **Purpose:** Alert drivers to upcoming construction. The warning system should educate the driver well in advance by providing information regarding distance, extent and type of hazard ahead so that he can gradually reduce the speed of his vehicle.
- **Features:** Warning signs placed ~60m before the work zone.
- **Devices:** Retro-reflective signage, flashing beacons.

ii. **Transition Sub-zone**

- **Purpose**: Guide traffic into the diversion path. This is the most crucial sub-zone from safety point of view since most of the movements are turning movements.
- **Features:** Begins ~30m before the work zone.
- **Devices:** Barricades, channelizers, directional signs.

iii. **Work Sub-zone**

- **Purpose:** Area of active construction, and therefore the safety of the Project workers / pedestrians / members of the road are the major concern at site from the plying traffic.

- **Features:** The path of the traffic must be clearly delineated to prevent vehicle intrusion.
- **Devices:** Cones, barriers, safety signage, flagmen.

iv. Terminal Sub-zone

- **Purpose:** Indicate the end of the construction zone.
- **Features:** "End of Work Zone" signage.
- **Devices:** Informational signs, speed normalization signs.

Other Aspects: Following sections are from guidelines for Safety Construction, Indian Road Congress, IRC: SP: 55: 2001.

The pictorial representation of the sub-zones is depicted in **Figure 9-1** and the recommended length of traffic control zones are shown in the **Table 9-3**.

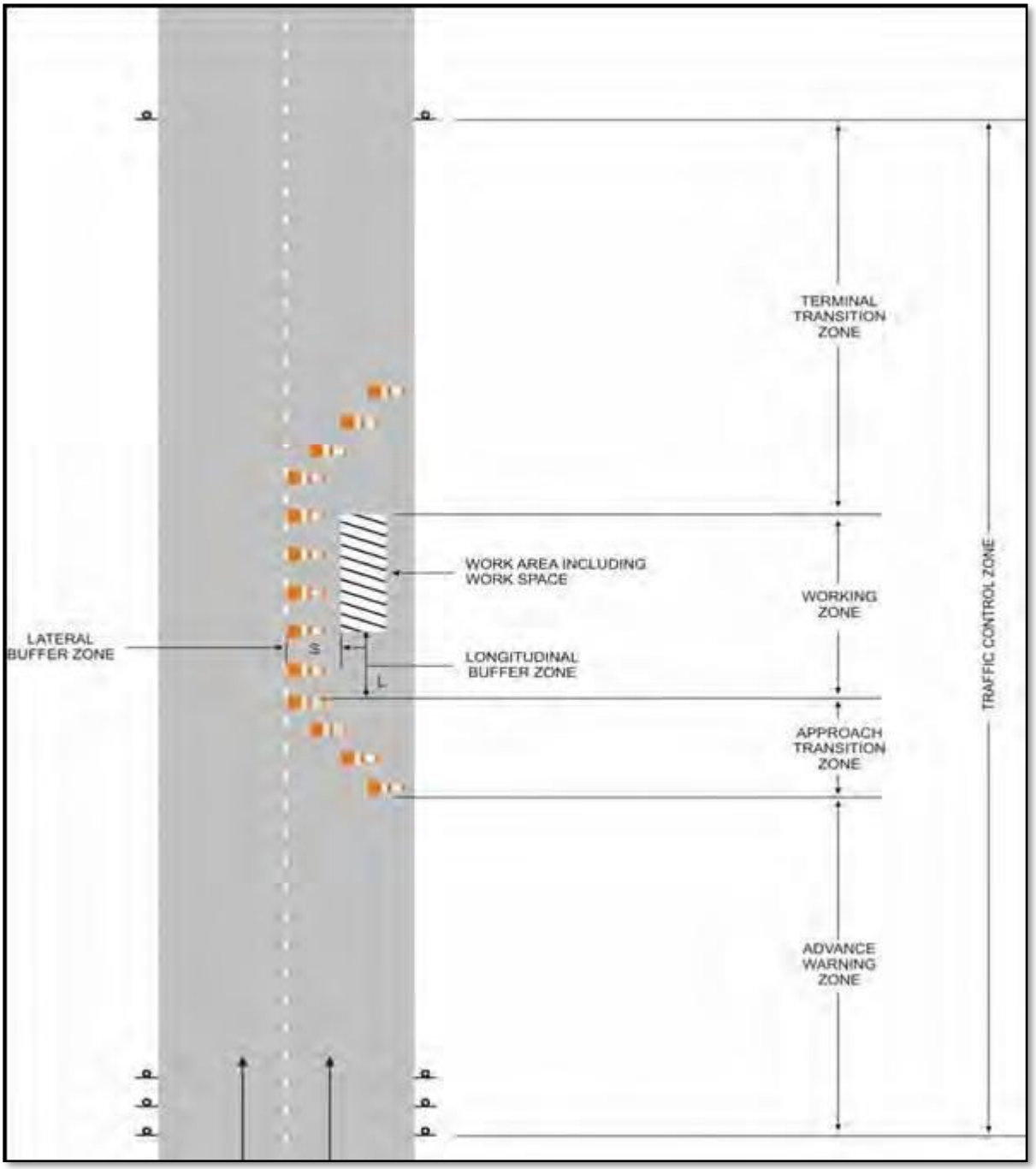


Figure 9-1: Recommended length for Construction Zones as per IRC: SP:55-2001

Table 9-3: Recommended Lengths of Traffic Control Zones

Average Approach Speed (Km/h)	Length of advance warning Zone (M)	Length Approach Transition Zone(M)	Length of working Zone(M)
50 or less	100	50	Varies
51-80	100-300	50-100	
81-100	300-500	100-200	
Over 100	1000	200-300	

9.13.6 Traffic Control Devices

Traffic control devices are essential components of a safe and effective traffic management system within construction zones. These devices serve the critical functions of warning, informing, guiding, and protecting both road users and construction personnel. Their proper deployment ensures smooth vehicular movement, minimizes confusion, and significantly reduces the risk of accidents.

This section is prepared in accordance with the Indian Roads Congress (IRC) Guidelines for Safety in Construction Zones (IRC: SP: 55-2001) and other relevant standards.

9.13.6.1 Purpose and Function

Traffic control devices are strategically installed across all sub-zones of the construction area to:

- Alert drivers to upcoming changes in road conditions.
- Provide clear guidance on lane usage and diversions.
- Protect workers and pedestrians from vehicular intrusion.
- Ensure safe passage for vehicles through or around the work zone.

These devices must be:

- Easily understandable and unambiguous.
- Clearly visible during both day and night.
- Stable under adverse weather conditions.
- Easy to install, maintain, and remove.

As per Specification 112.4, the use of barricades, signs, markings, flags, lights, and flagmen is mandatory for the safety and information of traffic approaching or passing through construction or maintenance zones.

9.13.6.2 Types of Traffic Control Devices

1. Regulatory Signs

These signs impose legal restrictions and must be installed in consultation with local traffic authorities. Common regulatory signs used in construction zones include:

- Do Not Enter

- Road Closed
- Give Way to Pedestrians
- Speed Limit

2. Warning Signs

Warning signs alert drivers to potential hazards ahead. Typical examples include:

- Lane Closed
- Diversion to Other Carriageway
- Divided Carriageway Starts/Ends
- Two-Way Traffic

These signs may be supplemented with rectangular definition plates placed 0.15 m below the warning triangle for added clarity.

3. Directional (Guide) Signs

Guide signs provide navigational information and differ in appearance from standard informatory signs. As per IRC: 67-1977, construction zone guide signs should have: Black text and arrows on a Traffic Yellow (IS: 5-1978) background.

Common examples include:

- Diversion
- Road Ahead Closed
- Sharp Deviation of Route

4. Delineators and Channelizing Devices

Delineators help guide traffic safely through the construction zone. As per IRC: 79-1981, these include:

Traffic Cones: Typically, 0.5–0.75 m high and 0.3–0.4 m in diameter, made of plastic or rubber with red and white retro-reflective bands. Cones should be anchored securely and spaced 3–9 m apart, depending on speed and visibility requirements.

Traffic Cylinders and Tapes: Used for lane separation and guidance.

Drums: Metal or plastic drums (0.8–1 m high, 0.3 m diameter) painted with alternating black and white circumferential stripes. Metal drums offer high visibility and psychological deterrence, while plastic drums are lightweight and easier to handle.

5. Barricades

In urban construction zones, barricades are used to restrict unauthorized access and protect traffic from hazards such as excavated areas. These are typically constructed using MS frames and reinforced with horizontal bamboo or wooden posts to maintain continuity. Openings are provided only at designated access points such as shop entrances or residential driveways.

6. Flagmen

Flagmen play a vital role in ensuring on-site safety. Their responsibilities include:

- Controlling vehicle speed and movement near active work areas.
- Providing visual signals to drivers.
- Assisting in the safe movement of construction equipment such as cranes and excavators.

Flagmen must be properly trained, clearly visible to drivers, and equipped with appropriate signalling tools.

7. Vehicle Parking

A designated parking area will be developed to accommodate all work-related vehicles. This area will be:

- Firm and leveled to prevent vehicle instability.
- Free from obstructions to allow safe maneuvering.
- Clearly marked and labeled for easy identification.
- Located away from pedestrian pathways to avoid conflicts.
- Equipped with safety protocols requiring all raised parts of equipment (e.g., booms, backhoe buckets) to be fully lowered to the ground when parked.

Safe Parking Protocols

To ensure safety during vehicle parking, the following measures will be strictly enforced:

- The vehicle engine must be turned off.
- Keys must be removed from the ignition.
- Hand brakes must be applied.
- Wheel chocks must be used when parking on slopes.

8. Material Transportation

All construction materials will be transported to the site using suitable trucks or other appropriate vehicles. The following precautions will be taken:

- Materials will be securely fastened to prevent shifting or falling during transit.
- Wooden blocks or padding will be used between the load and vehicle body to ensure stability and minimize damage.
- Unloading and storage of materials will be done in a manner that does not obstruct traffic or cause congestion.

9. Speed Control

To maintain safety within the construction site:

- The maximum vehicle speed limit will be restricted to 20 km/h, except for emergency vehicles during critical situations.
- Speed limit signs will be prominently displayed at strategic locations across the site.
- In areas with high pedestrian activity, reduced speed limits will be enforced and clearly indicated.

Speed Limit Violations

Violations of the prescribed speed limits will be treated with strict disciplinary action, including:

- Temporary suspension of the vehicle operator.
- Permanent removal from the site in cases of repeated or severe violations.

10. Personnel Safety

To ensure the safety of all personnel working near or on the roadway:

- All workers will always wear high-visibility reflective jackets.
- Additional personal protective equipment (PPE) such as helmets, safety shoes, and protective goggles will be mandatory based on the nature of the task.
- Site engineers and supervisors will be responsible for monitoring compliance and enforcing the use of PPE.

11. Signage and Visual Aids

The following standard traffic signs will be used throughout the construction site to guide and inform both workers and road users:

- Regulatory Signs: Stop, Entry Prohibited, Parking Prohibited, Speed Limit, Heavy Vehicle Prohibition.
- Warning Signs: Go Slow, Men at Work, Pedestrian Prohibited.
- Informational Signs: Parking Area, Pedestrian Only, Diversion.

All signs will be:

- Retro-reflective for night visibility.
- Mounted at appropriate heights and locations.
- Maintained regularly to ensure legibility and effectiveness.

For Sensitive Receptors no honking board should be provided with the minimal construction activity during the day time.

		
Stop Sign	Entry Prohibited	Parking Prohibited
		
Pedestrian Prohibited	Speed Limit	Heavy Vehicle Prohibition
		
Go Slow	Parking Area	Pedestrian Only
		
Diversion	Diversion	Men at Work

Figure 9-2: Traffic Regulatory Signs

9.13.7 Traffic Diversion Planning

During the construction phase, traffic diversions will be implemented based on actual site conditions to ensure minimal disruption and maximum safety for road users and workers. The diversion routes will be designed in accordance with the Indian Roads Congress (IRC) guidelines and will be finalized in coordination with local traffic authorities.

A detailed Traffic Diversion Plan will be prepared for each affected road segment, considering factors such as pipe diameter, road width, junction complexity, and availability of alternative routes. The plan will be updated dynamically as construction progresses as depicted in the **Table 9-4.**

In addition, visual diagrams (the

Figure 9-3, Figure 9-4 and **Figure 9-5)** will be provided to illustrate :

- Traffic management during survey activities.
- Traffic control during active work zone operations.
- Diversion plans during full or partial road closures.

Table 9-4: Proposed Details of Traffic Diversion Plan

S. No.	Road/Location	Dia of Pipe	Chainage	Total Length	Road Blockage	Alternative Route	Available Road Width	Type of Road
1.								
2.								
3.								
4.								
5.								
6.								

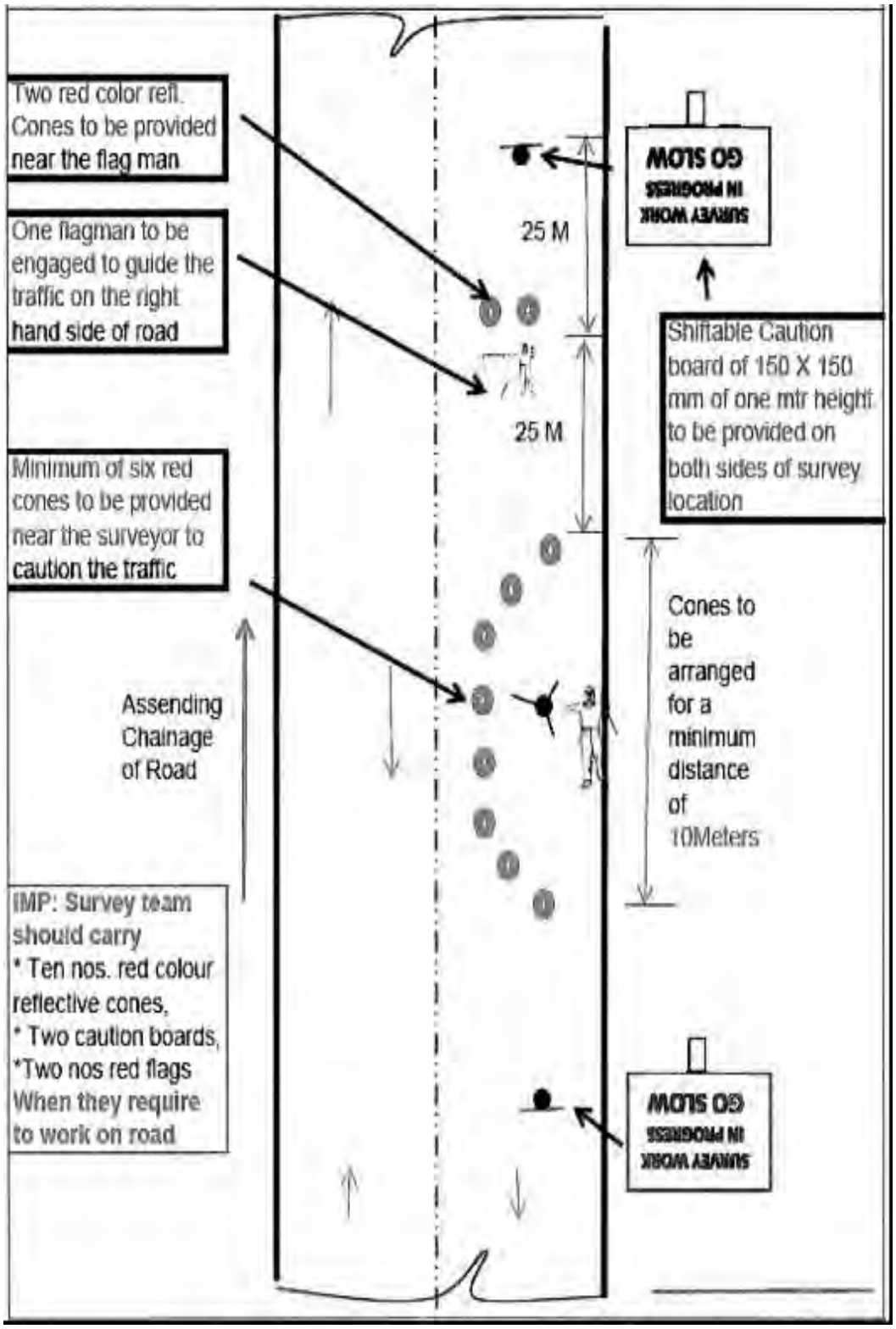


Figure 9-3: Traffic Management Plan for doing Survey

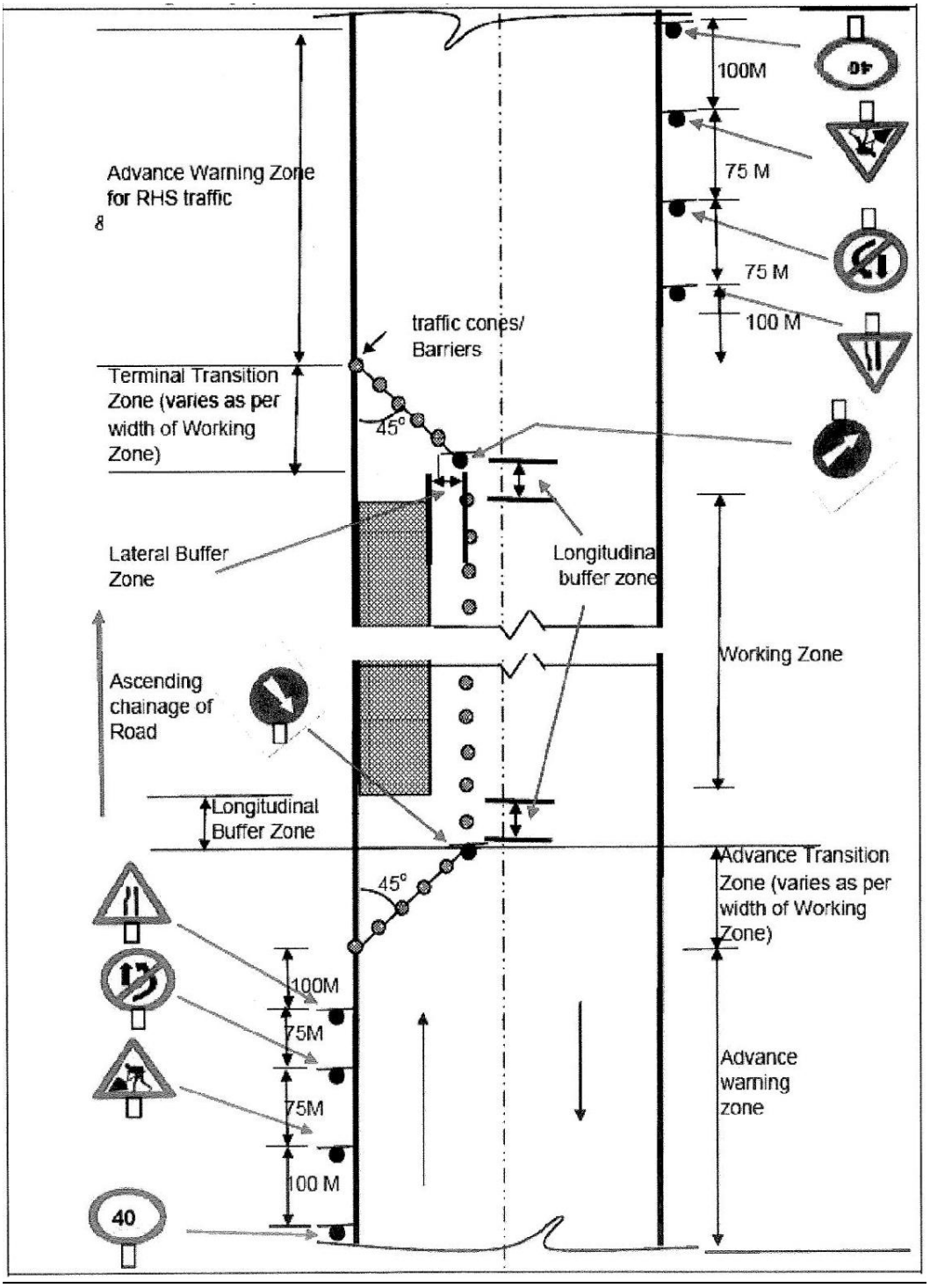


Figure 9-4: Traffic Management Plan for Working Zone

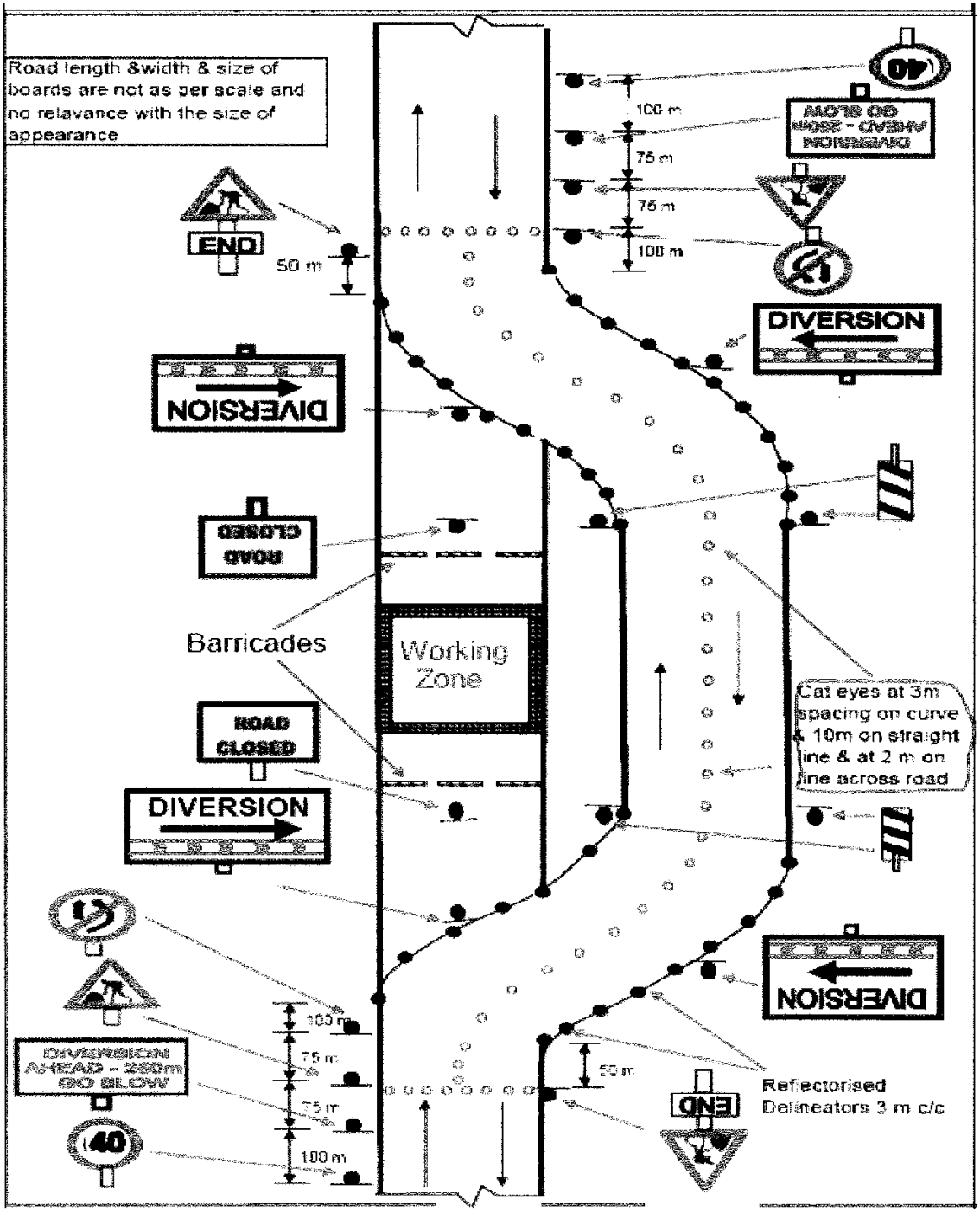


Figure 9-5: Traffic Management Plan for Diverting the Traffic

9.13.8 Traffic Management Practices

The implementation of traffic management during construction will be guided by the following operational principles:

- **Optimal Use of Existing Lanes**: Existing carriageways will be utilized to the maximum extent possible to minimize the need for diversions.
- **Intersection Management**: At major intersections, turning movements will be maintained wherever feasible to reduce congestion.
- **Lane Bifurcation**: In constrained areas, two-way traffic may be temporarily accommodated on a single carriageway with appropriate signage and barriers.
- **Speed Control**: Vehicle speeds through construction zones will be reduced using speed breakers, warning signs, and visual cues.
- **Standardized Signage**: All advance warning and information signs will comply with IRC standards for visibility, placement, and content.
- **Equipment Placement**: Construction materials, machinery, and equipment will be stored away from berms and pedestrian paths, within the available road land.
- **Safe Machinery Parking**: All parked machinery will be clearly marked with red flags and red lights. Only the minimum quantity of material required for immediate operations will be stored at the work site.
- **Wildlife Safety**: In areas with dense vegetation, precautions will be taken to prevent snake encounters. This includes clearing bushes, applying carbolic acid, and mandating the use of gumboots.
- **Heat Stress Prevention**: During summer months, workers will be provided with adequate rest intervals to prevent heat-related illnesses such as sunstroke.

9.14 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures will be adopted by the project proponent and imposed as conditions of contract of the sub-contractor employed for respective phases of the power project. The mitigation measures suggested during operation will be made part of the regular maintenance and monitoring schedule.

The ESMP includes the following:

- Investigations suggested for adverse environmental and social impacts and associated risks.
- Institutional arrangement - management tools and techniques for the implementation of environmental impacts and risk mitigations.
- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations.

- Monitoring arrangements for effective implementation of suggested mitigations for the proposed project; and
- Reporting requirement to the regulatory agencies and funding institutes.

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- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations.
- Monitoring arrangements for effective implementation of suggested mitigations for the proposed project; and
- Reporting requirement to the regulatory agencies and funding institutes.

Table 9-5: Environment and Social Management Plan

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
Planning Phase				
• Land Acquisition	• Land procured for the project is prominently in RoW of government land. Permission must be obtained from the respective government or private authorities wherever the pipeline route crosses their jurisdiction.	• As per land acquisition policy	• **ATGL**	• Pre-Construction
Construction Phase				
Soil Characteristics				
• Erosion and compaction	• Loose soil to be protected from wind and runoff by covering / watering / other means of covering. • Existing roads to be used for transport of material to extent possible. • All construction materials should be kept within the project footprint area. • Re-fueling of machinery at site should be undertaken over paved surface. • In case of any accidental spill, soil should be cut and stored securely for disposal with waste.	• Project representative to make observations on storage and handling of construction material. • Drivers should be instructed about use of dedicated tracks within the site workers to be trained on handling and storage of waste by contractor. • Workers handling activity to be briefed about the need to prevent contamination. • Inspection/Monitoring to conduct construction activities within the site boundary only. • Soil monitoring for physical properties to be at least once during construction phase.	• EPC contractor/Site supervisor/ Project Director to make observations and convey it to the contractors. • EHS Personnel/ Project Director should monitor implementation of ESMP.	Throughout project cycle
Waste Disposal				
• Accumulation of construction waste	• Construction debris should be utilised for levelling of land and unused debris shall be disposed-off to C&D Disposal Site.	• **ATGL** representative should brief specific needs as per country's requirement for further execution, as and when required.	• Contractors will be abided with Hazardous Waste (Management, Handling and Transboundary	• Should be incorporated as part of project budget, no additional cost is envisaged.

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Unhygienic conditions for labours. • Hazardous waste from machinery, generators etc. • Soil and land contamination due to accidental leakage. • Run off into rainwater channels.	• Proper sanitation and sewage facility in terms of septic tank with soak pit should be provided. • Nearby municipality should also be contacted for regular disposal of the labour camp waste. • Other wastes like packaging material, metal, jute, etc. to be sold to scrap dealers/ buyers. • Random stocking of raw material, storage of debris, piling of loose soil etc. should be strictly controlled. • Portable toilets/ suitable arrangements with septic tank-soak pit arrangement should be provided for workers.	• Workers should be instructed to maintain neat, clean & hygiene at facilities. • Contractors should be briefed about need for proper storage and disposal of construction waste.	Movement) Rules, 2023. • Site Engineer to make observations and convey it to the contractors. • Monthly report of EHS Officer to include the compliance and observations if any.	• During Construction Phase
Water Resource and Quality				
• Run off into rainwater channels and drains passing through the site and ultimately into nearby surface water body. • Wastage of water and sewage discharge from labour camp	• Water for construction and consumption to be arranged by suitable local contractors through authorized tanker water suppliers. • Arrangement for storm water management in construction area should be made to avoid sediment run off. • Storm water flow during monsoon should be directed to existing drains. • Natural flow and topography of the drains flowing inside the project boundary should be maintained. • Septic tank with soak pits should be provided at site to facilitate the sewage generated from labour area.	• Daily consumption of water should be recorded. • Storm water arrangements should be monitored. • Performance parameters are EC, TSS, TDS, Oil & Grease, Total Coliforms, BOD, etc. • Workers should be instructed about optimal use of water	• Conditions should be the part of contract with the EPC contractor. • Project Director or EHS personnel should make observations and convey it to the contractors. Report of Project Director/ Site EHS Officer should be sent to EHS head.	Construction Phase
Ecology				

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Clearance of vegetation	• Tree cutting or shrub clearance should be limited to those patches directly affecting solar panel exposure. • Workforce should be instructed to avoid any other activity likely to affect the local flora & fauna. • Movement of construction & transport vehicles should follow dedicated paths to avoid any injury/mortality to the wildlife.	• Visual damage loss inspection should be undertaken by Site Engineer • Construction contractor should instruct and inform workers to refrain from activities that may adversely affect the ecology in near vicinity of the project.	Project Director/EPC Contractor	Construction Phase
Traffic and Transport				
• Break-down and Improper halt of vehicles. • Discomfort due to air and noise pollution due to raw materials transportation. • Damage to road and related structure from heavy vehicles.	• Vehicle movement and parking within the project premises should be managed properly to avoid accidents. • Routes for use by construction traffic should be planned to minimize impact on adjoining activities. • Dedicated path within the site for exclusive entry and exit of construction vehicles should be provided. • Only PUC certified vehicle should be deployed. • Construction material should be transported in covered trucks. • Transportation should be undertaken along pre-identified paths only. • High noise generating activities should be restricted to daytime with proper mitigation measures.	• Necessary training to the driver of construction vehicles for speed restrictions. • Drivers should be assessed for their knowledge on traffic rules before engagement. • During the construction phase, number of vehicles as well as any incidents and accidents need to be reported, and their outcomes should be monitored.	• Project Director/ site EHS person should provide the training. • Should be mentioned in the contract with the construction contractor.	• Regular maintenance of vehicle and upkeep of roads should be included in O&M budget. • For all construction related activities during construction and operation phases.
Air Quality				
• Fugitive dust	• Regular water sprinkling while undertaking dust generation activities.	• Awareness should be developed among the site workers for fugitive dust management.	• Project Director should regularly coordinate and supervise work.	Water sprinkling will be done throughout construction phase.

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Emissions from diesel engines/ vehicles	• Construction activities should be avoided during high wind speed time. • Construction material should be covered to prevent any fugitive dust from these areas. • Regular maintenance of construction machineries. • Deployment of only PUC certified vehicles. • Flyable Construction material should be transported in covered trucks only. • Vehicle speed should be restricted to 30km/hour at site to minimize potential for dust emission in the surroundings.	• Air Quality monitoring specifically for particulate matter in nearby settlement areas once during construction for compliance to NAAQ Standards.	• Monitoring agency should take out the monitoring work. • Should be incorporated in the contract with contractor	
Noise and Vibration				
• Disturbance to habitations • Occupational Hazard	• Only well-maintained equipment should be operated on site. • DG sets should only be used for emergency power/ backup. • Scheduling of the construction activities should be done. • Loud, sudden noise emissions to be avoided wherever possible.	• Arrangements/facilities for noise reduction should be monitored as and when required. • Personal protective devices for site workers working near high noise equipment. • Schedule of activities should be discussed and finalized between site manager and the contractor. • Noise monitoring in nearby settlement areas once during construction period to ensure compliance with Noise Rules	• Project Director should take care of the compliance of ESMP. • External training on use of PPE should be the responsibility of EPC Contractor	Throughout construction phase
Cultural				
Cultural differences amongst workers	To the extent possible sourcing of construction labour should be done from local region by contractor for unskilled activities.	Workers should be briefed about need for cooperation and harmony with the community.	EPC Contractor	Normal Practice
Health and Safety				

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Operation of heavy machinery • Accidents leading to injuries fatalities. • Occupational health hazards	• Operation of loading–unloading equipment should be undertaken under the guidance / supervision of trained professional. • Sufficiently competent person should be engaged in driving or operating construction machineries. • Should ensure personal protective equipment for all personnel present at site are made available during Construction period. • Arrangement for fire control measures • Display of Emergency phone numbers at site.	• Proper training of the workers regarding health and safety procedures. • Workers should be trained through sub-contractors regarding use of Personal protection equipment and its importance. • Operation of Cranes shall normally be limited for transmission line as per requirement. Crane (If required) should be operated as per contractor's Crane Safety Plan only.	• Project Director should ensure compliance of safety guidelines. • Safety Officer of contractor should be responsible for implementation of safety guidelines. • To form part of the contractor's contract	Training of workers shall mostly be given by internal resources during Construction phase
Social				
Expectations for infrastructure development benefits	• Project officials should communicate and discuss with the community in a transparent manner on a regular basis and demonstrate their concerns. • Consultation with women 's groups should also be held during construction and operation phases to listen to their issues and concerns regarding labour, health, and safety etc. as well as to solicit their ideas on various community initiatives.	• Project officials should hold regular consultations with appropriate stakeholders. • All concerns must be addressed through systematic process.	Project Director	Normal Practice
Local Employment	• Assess the exact number of workers should be required at each stage through contractor/ own resource in the construction period. • Should ensure priority is given to local people for short term/long term employment opportunities, based on required skill and education level.	• Explore possibilities of training and capacity building to enable the community to be able to secure the available jobs and contracts, as per the applicability and requirement of the business.	EPC contractor in discussion with project director should assess potential for engagement of local community and for women.	Normal Practice

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
Demands for materials	Should ensure local contracting and vendor opportunities aligned with the scope and demand as far as possible.	-	Project proponent/Contractor	Normal Practice
Livelihood of roadside vendor might be impacted during to construction period at daytime.	• Construction time should be selected in such a manner that minimum livelihood loss occurs due to construction and other project related activities. • Compensation paid to roadside vendor if inconvenience caused due to construction of pipeline project.	Fair Compensation Policy	Land Team	Normal Practice
• Excess load on existing resources	• Local labour should be preferred for unskilled work. • Awareness camp for communicable disease understanding. • Medical camp as part of CSR activities	Awareness training for applicable regulatory regulations.	Project Director through EPC Contractor	During Construction Phase
Operation Phase				
Waste Generation				
Construction waste	• Should earmark designated areas for storage of waste separately. • Waste should be given to approved recyclers.	Training and briefing of the staff involved in waste management.	Project Director	Normal Process
Ecological Impact				
Impacts on existing flora and fauna	• A monitoring of bird and bat species within the project study area should be undertaken that may help understand the presence of threatened species inside the project area and their movement. This will further help in assessing the site-specific impacts and updating the mitigation measures.	Training and briefing of the staff involved for record keeping for any electrocution or carcass incident.	Plant EHS or Safety Officer	On regular basis

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
	• Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors. • General awareness regarding wildlife shall be enhanced through trainings, posters, etc. among the staff and labourers.			
Water Resources				
Surface water body located across pipeline route.	• Natural slope of the site shall be maintained laying of pipeline structures require very less topographical correction. • Used oil and Waste should be stored in separate designated areas to avoid any contamination due to run-off. • Avoidance of water wastage to the maximum extent • Proper storm water facility	• Regular check on water use quantity • Awareness campaign for effective use of water	Plant EHS or Safety Officer	-
Soil Quality Degradation				
Soil quality might be impacted due to construction work	• Topsoil Preservation: Strip and store topsoil separately before excavation to facilitate land restoration after construction. • Soil Stabilization: Use geotextiles, mulch, or temporary vegetation cover to prevent soil erosion. • Controlled Excavation: Minimize the area of disturbance by restricting excavation to designated work zones.	Regular record management of waste materials.	Plant EHS or Safety Officer	-
Health and Safety				

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Accidents leading to Injury / fatality. • Fire Risk	• Schedule high-risk work (such as excavation and pipe laying) during non-peak traffic hours to minimize risks. • install warning signs, barricades, and reflective cones well in advance of the worksite. • Fire extinguisher in accident prone areas. • High-visibility safety jackets, hard hats, safety boots, gloves, Protective Eye Wear.	• Health and safety awareness training on regular interval • Safety incidents should be recorded and monitored with an aim that numbers are never significant and gradually reduce.	Plant EHS or Safety Officer	-
Social Aspects				
• Local Economy • Upgradation of infrastructure	• Should boost the local economy though local contracting to the extent possible. • Infrastructure upgradation as part of CSR	-	CSR Team	Continuous improvement
Decommissioning Phase				
• Impacts due to disposal of material after construction work, • Contamination of soil	• Segregate waste into recyclable (metal scraps, plastic, wood) and non-recyclable (hazardous, non-biodegradable) materials. • Reuse excavated soil for backfilling and land restoration. • Recycle metal pipes, concrete debris, and plastic materials wherever possible.	-	Plant EHS or Safety Officer	-

9.15.1 ON-SITE EMERGENCY MANAGEMENT PLAN

The probability of inevitable residual risk arising out of operations, capable of causing emergencies cannot be ruled out no matter how well a process is being controlled or safeguarded by instruments and process safety procedures. Such emergencies could be the result of malfunction, ignorance, non-observance of operating instructions or be the consequence of acts outside the control of people.

Hence the needs to prepare an **ON-SITE EMERGENCY PLAN (OSEP)** for dealing with accidents and natural calamities which may still occur and are likely to affect health, safety, life, property, and environment both at site and in the immediate neighborhood. An OSEP mitigates the effects of a major accident/emergency when these effects are contained within the boundary of the site.

This plan is guideline for employees, workers, contractors, sub-contractors, visitors etc., informing about prompt rescue operations, medical treatment, coordination, and communication among various internal & external members. The plan should be pro-active to avoid any confusion/panic and should direct to handle the emergency with clear instructions.

Purpose

ATGL has prepared an Emergency Management Plan for implementation at the project site in the event of an emergency so that the loss of life and damage to the properties and natural resources are minimized.

Objective

The overall objective of a good emergency preparedness plan is for what to do and what not during an emergency. The following aspects shall be included in emergency preparedness plan: -

- To assess what dangers could arise to people on and offsite as a result of these foreseeable emergencies and what the effects it could pose on the environment.
- To contain and control incidents.
- To assess the risk involved, and to mitigate the same by pre-planned remedial and rescue measures using, when necessary, the combined resources of the organization concerned and the public emergency services.
- To safeguard residents, employees and any one nearby who might be affected and to minimize the damage to property or the environment.
- The training of the individual personnel with duties under the plans will be familiarizing on site personnel with their roles, their equipment, and the details of the plans.
- The onsite emergency plan should be based on the specific needs of each particular site for dealing with those emergencies which it is for seen may arise.
- For an emergency plan to be successful, it should be tested, when first devised and thereafter to be rehearsed at suitable intervals.

9.15.2 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring is an effective tool in making necessary recommendations and adopt suitable control strategies so that menace of rising environmental pollution could be minimized, and a relief be extended to the people including labours in case of any damage caused under occupational health hazards. The monitoring is necessary for the following reasons:

- To verify the results of the impact assessment study.
- To assess what impacts have occurred.
- To evaluate the performance of mitigation measures proposed in the ESMP.
- To ensure that the conditions of necessary consent and approvals are adhered.
- To suggest improvements in management plan, if required.
- To ensure that any additional parameters, other than those identified in the impact, do not become critical after the commissioning of proposed project.
- Considering the short duration of construction phase (around 3-5 months), environmental monitoring can be considered on yearly basis during operation phase only. However, other mitigation measures suggested for construction phase shall be maintained for env. protection.

The proposed environmental monitoring program during both construction and operation phases of the project are given in Error! Reference source not found. below:

Table 9-6: Environment Monitoring Program- Construction & Operation Phase

Sl. No.	Component	Location	Parameters	Frequency
Construction Phase				
1	Stack emission characteristics	Stacks attached to emission sources (e.g. DG set)	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 (Leq Day & Leq Night)	Once in a month
Operation Phase				
8	Greenbelt development	Along the ROW of pipeline	Plant density, health, growth, and survival rate	Once in 6 months

Sl. No.	Component	Location	Parameters	Frequency
9	Waste (including hazardous)	Along the ROW of pipeline	Quantity/ volume generated and disposed of.	Once in a month
10	Effluent quality	Along the ROW of pipeline	According to general discharge standards	Once in 6 months

10 SUMMARY AND CONCLUSION

10.1 SUMMARY OF IMPACTS

Among the pipeline lifecycle stages of construction and operation, 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.

10.2 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.
- Easy access to the route during construction, operation, and maintenance of the pipeline.

10.3 IMPACTS DUE TO CONSTRUCTION OF PIPELINE

- The land identified for the proposed pipeline project is of 28.74 km Natural Gas Pipeline Infrastructure that is located within Khandwa district. The proposed pipeline for the CGD runs along ROW of the Khandwa GA starting near Reliance Jio BP Future Fuels along NH 347B in Bhojakhedi to Naredi (HP) Petrol Pump in Khandwa Town. The diverted pipeline route starts from Dharamkata Tiraha to a point near Deg English Institute in Narayan Nagar, Khandwa Town, where it connects with the proposed pipeline route. Permission will be required for NH from the NHAI, for SH and ODR from the relevant state department for the pipeline route. Therefore, in terms of land procurement there will be no major impact that is observed due to proposed pipeline project except for the permissions.
- Earth work excavation, 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 could lead to PM and other air emissions. However, the impact shall be short-term & temporary in nature.
- There will be no abstraction of ground water from project as freshwater for domestic purposes will be supplied by SEZ department/private tankers. Domestic sewage will be disposed of to septic tanks with soak pits.
- 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 buried all along its length hence impact on land use pattern will be marginal and reversible. Appropriate reinforcements will be done to avoid contamination.
- 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 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 daytime 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 minimized.

10.4 IMPACTS DURING OPERATION OF PIPELINE

- No impact on any ecological sensitive area is envisaged during operation.
- No air emissions will be generated during the operation phase except during maintenance that could be temporary in nature.
- 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 at major crossings.

10.5 MITIGATION AND ENVIRONMENTAL MANAGEMENT PLAN

10.5.1 General

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

- Project decisions taken by ATGL 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.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.

10.5.2 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, considering 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

10.6 CONCLUSION

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 employment opportunities 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 **ATGL** will have negligible impact on environment and will improve economy of the state and the nation.

ANNEXURE A: LABORATORY REPORTS

Annexure I: Laboratory Reports for Ambient Air Quality Analysis

SHRI OM TESTING & RESEARCH LABORATORY

Plot No. 296, 1st FNG Road, Sector-121, Ghari Chaukhandi, Noida - 201301
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GSTIN : 09ADHFS2444J1ZS

N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 45001 Certified Laboratory.

TEST REPORT

Report No: STRLA- 3103202504-07 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

RESULTS
(Ambient Air Quality Analysis)

SAMPLING DETAILS			
Sampling Protocol	STRL/LAB/AIR/STP/01	Sampling Duration	24 Hours
Flow Rate of Air	1.0 M³/Min	Flow Rate of Gas	1.0 LPM
Sample Packing	Plastic Bottle / Zip Polybag	Analysis Duration	10.03.2025 to 30.03.2025

S. No.	Parameters	Unit	AAQ1 HP Petrol Pump-Shree Balaji Travels (Between Ch: 3666.57 m and Ch: 3732.93 m) 21°50'45.75"N, 76°12'26.42"E	AAQ2 Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m) 21°49'32.16"N, 76°13'46.61"E	AAQ3 New Bus Station, Khandwa (Near Ch: 18628.06 m) 21°49'14.74"N, 76°20'6.36"E	AAQ4 Beside Railyard, Khandwa Station 21°49'4.70"N, 76°21'19.24"E	NAAQ Standards
1.	Particulate Matter-10 (PM-10)	µg/m³	58.6	61.3	58.3	59.2	100
2.	Particulate Matter-2.5 (PM-2.5)	µg/m³	36.7	38.5	42.5	40.8	60
3.	Sulphur Dioxide (SO_2)	µg/m³	7.27	7.39	7.40	7.81	80
4.	Nitrogen Dioxide (NO_2)	µg/m³	8.29	7.01	7.23	8.88	80
5.	Ozone (O_3) -8Hr.	µg/m³	12.1	11.8	13.7	12.9	100
6.	Lead (Pb)	µg/m³	<1.0	<1.0	<1.0	<1.0	1.0
7.	Carbon Mono Oxide (CO)-1.0 Hr.	mg/m³	0.20	0.21	0.36	0.37	4.0
8.	Ammonia (NH_3)	µg/m³	< 10	< 10	< 10	< 10	400
9.	Arsenic (As)	ng/m³	<1.0	<1.0	<1.0	<1.0	6
10.	Nickel (Ni)	ng/m³	0.15	0.18	0.20	0.25	20

End of Report (Page No 01 of 01)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
31/3/25
Technical Manager
Authorised Signatory
(Name, Designation & Signature with Seal)

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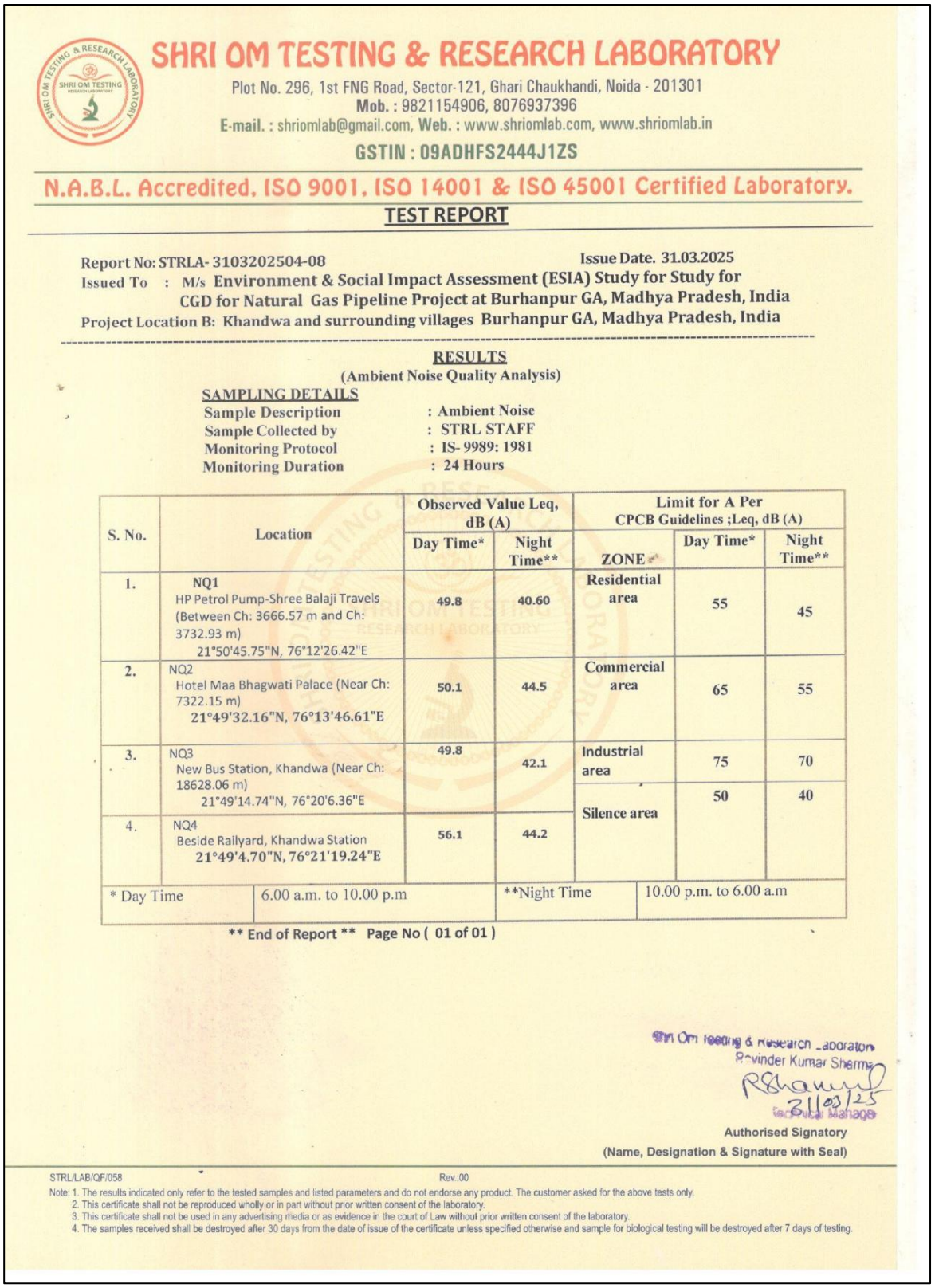
4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for biological testing will be destroyed after 7 days of testing.

Annexure II: Laboratory Reports for Ambient Noise Quality Analysis



SHRI OM TESTING & RESEARCH LABORATORY

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TEST REPORT

Report No: STRLA- 3103202504-08 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

RESULTS

(Ambient Noise Quality Analysis)

SAMPLING DETAILS

Sample Description : Ambient Noise
Sample Collected by : STRL STAFF
Monitoring Protocol : IS- 9989: 1981
Monitoring Duration : 24 Hours

S. No.	Location	Observed Value Leq, dB (A)		Limit for A Per CPCB Guidelines ;Leq, dB (A)		
		Day Time*	Night Time**	ZONE	Day Time*	Night Time**
1.	NQ1 HP Petrol Pump-Shree Balaji Travels (Between Ch: 3666.57 m and Ch: 3732.93 m) 21°50'45.75"N, 76°12'26.42"E	49.8	40.60	Residential area	55	45
2.	NQ2 Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m) 21°49'32.16"N, 76°13'46.61"E	50.1	44.5	Commercial area	65	55
3.	NQ3 New Bus Station, Khandwa (Near Ch: 18628.06 m) 21°49'14.74"N, 76°20'6.36"E	49.8	42.1	Industrial area	75	70
				Silence area	50	40
4.	NQ4 Beside Railyard, Khandwa Station 21°49'4.70"N, 76°21'19.24"E	56.1	44.2			

* Day Time	6.00 a.m. to 10.00 p.m	**Night Time	10.00 p.m. to 6.00 a.m

** End of Report ** Page No (01 of 01)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
31/03/25
Technical Manager
Authorised Signatory
(Name, Designation & Signature with Seal)

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Annexure III: Laboratory Reports for Ground Water Quality Analysis (GWQ1-GWQ2)

SHRI OM TESTING & RESEARCH LABORATORY

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TEST REPORT

Report No: STRLA- 3103202504-09 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

Sample Description: Ground Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS

Sample Collected by	: STRL STAFF
Sampling Protocol	: IS-3025(P-1)1987
Weather Condition	: Clear Sky
Sampling Quantity	: 5L+500ml
Sample Packing	: Plastic/Glass Bottle

S. No.	Parameters	Limits (as per IS:10500-2012)		Results GWQ1 Near Ch: 920.86 m 21°52'4.05"N, 76°11'40.36"E	Results GWQ2 Hotel Maa Bhagwati Palace (Near Ch: 7322.15 m) 21°49'32.04"N, 76°13'47.37"E	Test Methods
		Desirable Limit	Permissible Limit			
1	Color	--	--	0.1	0.1	IS : 3025(Pt-4) 1983, Reaff. 2017
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-5) 1983, Reaff. 2017
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-8)-1984, Reaff. 2017
4	Temperature	-	-	20.5	20.3	IS: 3025(Pt-9)1984 Reaff 2002
5	pH	6.5-8.5	No Relaxation	7.40	7.34	IS : 3025(Pt-11)1983, Reaff. 2017
6	Electric Conductivity	-	-	810	965	IS : 3025 (Pt-14)-2013
7	Total Hardness (as $CaCO_3$)	200	600	232	310.1	IS : 3025(Pt-21)1983, Reaff. 2014
8	Iron (as Fe)	0.3	No Relaxation	0.12	0.12	APHA 22nd Ed., 3120B (3111B (AAS),
9	Chlorides (as Cl)	250	1000	136.6	149.6	IS : 3025(Pt-32)1988, Reaff. 2014
10	Fluoride (as F)	1	1.5	< 0.5	< 0.5	APHA 22nd Ed., 4500F(D)
11	TDS	500	2000	489	548.3	IS: 3025(Pt-16)1984, Reaff. 2017
12	Calcium (as Ca^{2+})	75	200	46.1	50.9	IS :3025(Pt-40)1991, Reaff. 2014
13	Magnesium (as Mg^{2+})	30	100	28.2	42.0	APHA 22nd Ed., 3500-Mg (B)
14	Sulphate (as SO_4)	200	400	30.4	32.1	IS : 3025(Pt-24)1986, Reaff. 2014
15	Nitrate(as NO_3)	45	No Relaxation	24.3	25.7	IS : 3025(Pt-34)1988, Reaff. 2014
16	Alkalinity (as $CaCO_3$	200	600	310	319.9	IS: 3025(Pt-23)1986, Reaff. 2014
	Bacteriological Parameters					
1	Total Coli form	MPN/100ml	Shall Not Be Detectable	Not Detected (<2)	Not Detected (<2)	IS : 1622-1981 (Reaff.2003)
2	E.coli	E.coli/100ml	Shall Not Be Detectable	Absent	Absent	IS : 1622-1981 (Reaff-2003)

*END OF REPORT * Page (01 of 01)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
31/3/25
Authorised Signatory
(Name, Designation & Signature with Seal)

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Annexure IV: Laboratory Reports for Ground Water Quality Analysis (GWQ3)

SHRI OM TESTING & RESEARCH LABORATORY

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TEST REPORT

Report No: STRLA- 3103202504-10 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

Sample Description: Ground Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS

Sample Collected by : STRL STAFF
Sampling Protocol : IS-3025(P-1)1987
Weather Condition : Clear Sky
Sampling Quantity : 5L+500ml
Sample Packing : Plastic/Glass Bottle

S. No.	Parameters	Limits (as per IS:10500-2012)		Results GWQ3 M G Oils 21°47'44.40"N, 76°20'37.10"E	Results GWQ4 Tagore Park 21°49'32.29"N, 76°21'37.67"E	Test Methods
		Desirable Limit	Permissible Limit			
1	Color	--	--	0.1	0.1	IS : 3025(Pt-4) 1983, Reaff. 2017
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-5) 1983, Reaff. 2017
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-8)-1984, Reaff. 2017
4	Temperature	-	-	18.8	20.3	IS: 3025(Pt-9)1984 Reaff 2002
5	pH	6.5-8.5	No Relaxation	7.46	7.29	IS : 3025(Pt-11)1983, Reaff. 2017
6	Electric Conductivity	-	-	812	924	IS : 3025 (Pt-14)-2013
7	Total Hardness (as $CaCO_3$)	200	600	238.0	306.1	IS : 3025(Pt-21)1983, Reaff. 2014
8	Iron (as Fe)	0.3	No Relaxation	0.13	0.13	APHA 22nd Ed., 3120B (3111B (AAS),
9	Chlorides (as Cl)	250	1000	134.4	145.7	IS : 3025(Pt-32)1988, Reaff. 2014
10	Fluoride (as F)	1	1.5	< 0.5	< 0.5	APHA 22nd Ed., 4500F(D)
11	TDS	500	2000	486.1	556.6	IS: 3025(Pt-16)1984, Reaff. 2017
12	Calcium (as Ca^{2+})	75	200	46.8	52.8	IS :3025(Pt-40)1991, Reaff. 2014
13	Magnesium (as Mg^{2+})	30	100	29.5	42.4	APHA 22nd Ed., 3500-Mg (B)
14	Sulphate (as SO_4)	200	400	32.1	32.1	IS : 3025(Pt-24)1986, Reaff. 2014
15	Nitrate(as NO_3)	45	No Relaxation	24.3	26.1	IS : 3025(Pt-34)1988, Reaff. 2014
16	Alkalinity (as $CaCO_3$	200	600	299.2	320.2	IS: 3025(Pt-23)1986, Reaff. 2014
	Bacteriological Parameters					
1	Total Coli form	MPN/100ml	Shall Not Be Detectable	Not Detected (<2)	Not Detected (<2)	IS : 1622-1981 (Reaff.2003)
2	E.coli	E.coli/100ml	Shall Not Be Detectable	Absent	Absent	IS : 1622-1981 (Reaff-2003)

*END OF REPORT *** Page (01 of 01)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
31/3/25
Technical Manager
Authorised Signatory
(Name, Designation & Signature with Seal)

STRL/LAB/QF/058 Rev.:00

Note: 1. The results indicated only refer to the tested samples and listed parameters and do not endorse any product. The customer asked for the above tests only.
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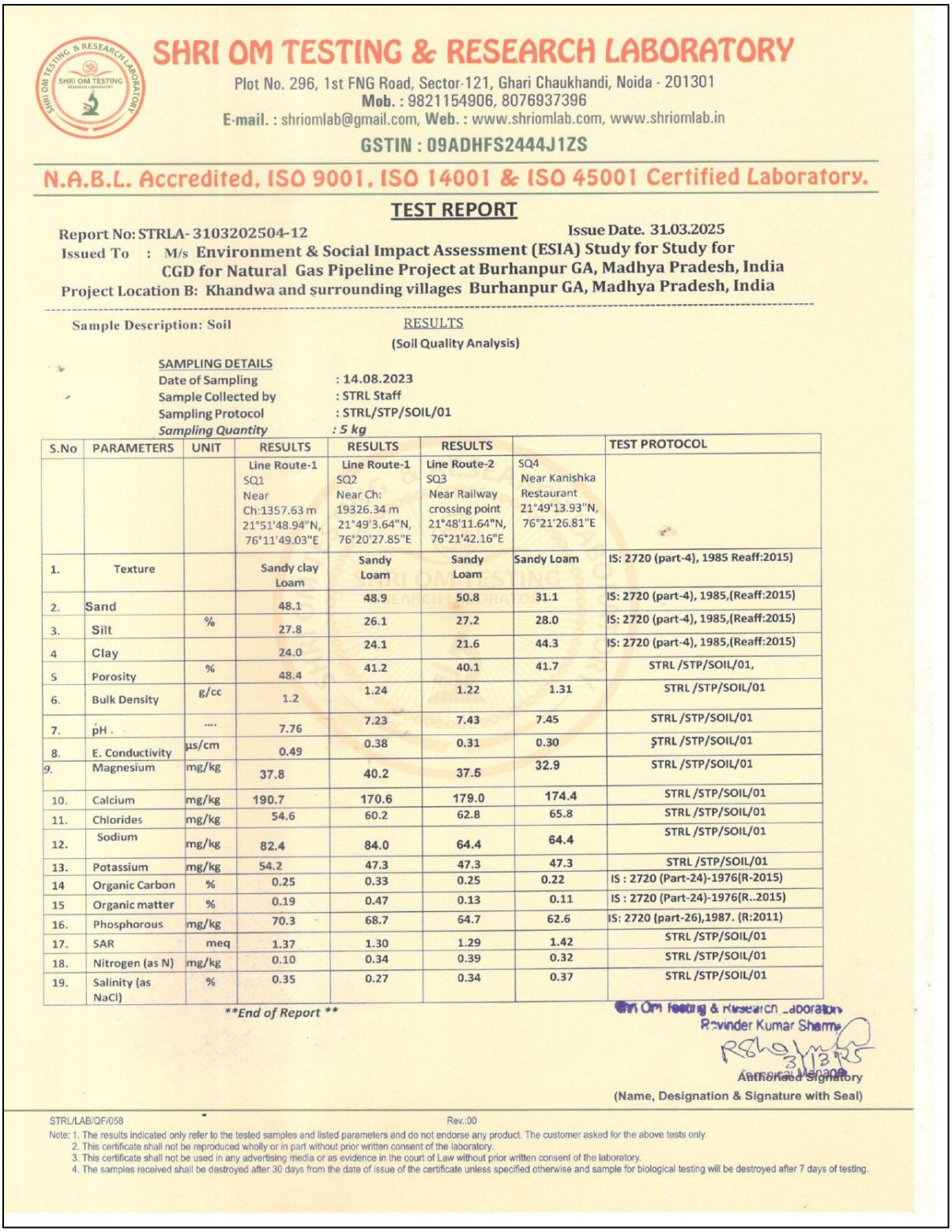
3. This certificate shall not be used in any advertising media or as evidence in the court of Law without prior written consent of the laboratory.
4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for biological testing will be destroyed after 7 days of testing.

Annexure V: Laboratory Reports for Soil Quality Analysis



SHRI OM TESTING & RESEARCH LABORATORY

Plot No. 296, 1st FNG Road, Sector-121, Ghari Chaukhandi, Noida - 201301
Mob. : 9821154906, 8076937396
E-mail. : shriomlab@gmail.com, Web. : www.shriomlab.com, www.shriomlab.in
GSTIN : 09ADHFS2444J1ZS

N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 45001 Certified Laboratory.

TEST REPORT

Report No: STRLA- 3103202504-12 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

Sample Description: Soil

RESULTS

(Soil Quality Analysis)

SAMPLING DETAILS

Date of Sampling : 14.08.2023
Sample Collected by : STRL Staff
Sampling Protocol : STRL/STP/SOIL/01
Sampling Quantity : *5 kg*

S.No	PARAMETERS	UNIT	RESULTS	RESULTS	RESULTS		TEST PROTOCOL
			Line Route-1 SQ1 Near Ch:1357.63 m 21°51'48.94"N, 76°11'49.03"E	Line Route-1 SQ2 Near Ch: 19326.34 m 21°49'3.64"N, 76°20'27.85"E	Line Route-2 SQ3 Near Railway crossing point 21°48'11.64"N, 76°21'42.16"E	SQ4 Near Kanishka Restaurant 21°49'13.93"N, 76°21'26.81"E	
1.	Texture		Sandy clay Loam	Sandy Loam	Sandy Loam	Sandy Loam	IS: 2720 (part-4), 1985 Reaff:2015)
2.	Sand	%	48.1	48.9	50.8	31.1	IS: 2720 (part-4), 1985,(Reaff:2015)
3.	Silt	%	27.8	26.1	27.2	28.0	IS: 2720 (part-4), 1985,(Reaff:2015)
4	Clay	%	24.0	24.1	21.6	44.3	IS: 2720 (part-4), 1985,(Reaff:2015)
5	Porosity	g/cc	48.4	41.2	40.1	41.7	STRL /STP/SOIL/01,
6.	Bulk Density	....	1.2	1.24	1.22	1.31	STRL /STP/SOIL/01
7.	pH .	µs/cm	7.76	7.23	7.43	7.45	STRL /STP/SOIL/01
8.	E. Conductivity	mg/kg	0.49	0.38	0.31	0.30	STRL /STP/SOIL/01
9.	Magnesium	mg/kg	37.8	40.2	37.5	32.9	STRL /STP/SOIL/01
10.	Calcium	mg/kg	190.7	170.6	179.0	174.4	STRL /STP/SOIL/01
11.	Chlorides	mg/kg	54.6	60.2	62.8	65.8	STRL /STP/SOIL/01
12.	Sodium	mg/kg	82.4	84.0	64.4	64.4	STRL /STP/SOIL/01
13.	Potassium	mg/kg	54.2	47.3	47.3	47.3	STRL /STP/SOIL/01
14	Organic Carbon	%	0.25	0.33	0.25	0.22	IS : 2720 (Part-24)-1976(R-2015)
15	Organic matter	%	0.19	0.47	0.13	0.11	IS : 2720 (Part-24)-1976(R..2015)
16.	Phosphorous	mg/kg	70.3	68.7	64.7	62.6	IS: 2720 (part-26),1987. (R:2011)
17.	SAR	meq	1.37	1.30	1.29	1.42	STRL /STP/SOIL/01
18.	Nitrogen (as N)	mg/kg	0.10	0.34	0.39	0.32	STRL /STP/SOIL/01
19.	Salinity (as NaCl)	%	0.35	0.27	0.34	0.37	STRL /STP/SOIL/01

**End of Report **

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
General Manager
Authorised Signatory
(Name, Designation & Signature with Seal)

STRL/LAB/QF/058 Rev.:00

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Annexure VI: Laboratory Reports for Surface Water Quality Analysis

SHRI OM TESTING & RESEARCH LABORATORY

Plot No. 296, 1st FNG Road, Sector-121, Ghari Chaukhandi, Noida - 201301
Mob. : 9821154906, 8076937396
E-mail. : shriomlab@gmail.com, **Web.** : www.shriomlab.com, www.shriomlab.in
GSTIN : 09ADHFS2444J1ZS

N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 45001 Certified Laboratory.

TEST REPORT

Report No: STRLA- 3103202504-11 Issue Date. 31.03.2025

Issued To : M/s Environment & Social Impact Assessment (ESIA) Study for Study for CGD for Natural Gas Pipeline Project at Burhanpur GA, Madhya Pradesh, India

Project Location B: Khandwa and surrounding villages Burhanpur GA, Madhya Pradesh, India

Sample Description: Surface Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS

Date of Sampling : 14.08.2023
Sample Collected by : STRL Staff
Sampling Protocol : IS-3025(P-1)1987
Sampling Quantity : 5L+500ml

S.NO	Parameter	Unit	Result Line Route 2 SWQ1 Near Ch: 16656.89 m 21°49'24.64"N, 76°19'0.36"E	Result SWQ2 Stream (upstream) 21°48'40.57"N, 76°21'38.43"E	Result SWQ3 Stream (downstream) 21°48'40.87"N, 76°21'23.00"E
1	Turbidity	NTU	3.42	2.94	3.0
2	pH (at 25°C)	-	7.48	7.56	7.32
3	EC	µS/cm	886	907	851
4	Total Dissolve Solids	mg/l	376	410	320.1
5	Total Hardness as CaCO3	mg/l	217	243	218.7
6	Calcium as Ca	mg/l	44.7	38.3	39.2
7	Magnesium as Mg	mg/l	23.9	35.7	29.3
8	Sodium as Na	mg/l	78	80.1	87
9	Potassium as K	mg/l	48	62.1	50
10	Chloride as Cl	mg/l	166.4	190.3	140.1
11	Sulphate as SO4	mg/l	75.0	77.1	68.8
12	Nitrate as NO3	mg/l	36.7	36.2	30.2
13	Total Alkalinity as CaCO3	mg/l	199.8	258.8	198.5
14	Fluoride	mg/l	0.12	0.11	0.13

Page (01 of 02)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
31/3/25
Technical Manager

Authorised Signatory
(Name, Designation & Signature with Seal)

STRL/LAB/QF/058 Rev.:00

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ANNEXURE B: Permission & NOC's

Annexure I: Permission from Municipal Corporation, Khandwa

कार्यालय नगर पालिक निगम,खण्डवा

कमांक– जलकार्य उद्यान/2024/ 424 खण्डवा, दिनांक 04/10/2024

प्रति,

वरिष्ठ प्रबंधक,
अडानी टोटल गैस लिमिटेड,
शांती ग्राम एस.जी. हाईवे अहमदाबाद

विषय – 8 इंच डाया गैस पाईप लाईन डालने हेतु रोड कटिंग की राशि का भुगतान करने बाबत।

संदर्भ – आपका 003 पत्र दिनांक 13/06/2024.

––00––

उपरोक्त विषयान्तर्गत सूचित किया जाता है कि शहर के 05 स्थानो (किशोर कुमार समाधि के पास, कृषि उपज मंण्डी संजय नगर वार्ड रहवासी एरिया में 06 स्थानों पर, मॉ.तुलजा भवानी माता मंदिर के पास एवं घासपुरा रोड) पर 8 इंच डाया गैस पाईप लाईन डाली जाना है। प्राक्कलन अनुसार निगम स्वामित्व सडक की क्षतिपूर्ति की राशि रूपये– 2,16,125/– (रूपये– दो लाख सोलह हजार एक. सौ पच्चीस मात्र) निगम कोष में (नगद , चेक या डी.डी.) आयुक्त नगर पालिक निगम खण्डवा के नाम से होगा तथा धरोहर राशि – 2,50,000/– की एफ.डी.आर. आयुक्त नगर पालिक निगम खण्डवा के नाम से जमा करे। ताकि अनुमति जारी की जा सके।

कार्यपालन यंत्री,
नगर पालिक निगम खण्डवा

आयुक्त नगर पालिक निगम, खण्डवा

SBI – पटेल चेम्बर

खाता नम्बर 53045866871

I.F.C. कोड – SBIN0030102

SBIN 0030102

MUNICIPAL CORPORATION, KHANDWA
GSTIN : 23AAALM0528K1Z9

4/10/24

प्र. लेखापाल
नगर पालिक निगम
खण्डवा

Annexure II: Collector Permission for River-Nala

:: न्यायालय कलेक्टर, जिला–खण्डवा ::

आदेश

राजस्व प्रकरण कमांक 64 बी-121/2024–25
ग्राम– खण्डवा, तहसील खण्डवा

आवेदक/ आवेदक/प्रोजेक्ट मेनेजर अडानी टोटल गैस लिमिटेड, अमरावती, हाल कैम्प–खण्डवा द्वारा आवेदन प्रस्तुत कर 8′ डाया स्टील पाईपलाईन गैस डिस्ट्रीब्यूशन लाईन प्रस्तावित स्थल से नरेडी गोयल एच.पी. सी.एल. पम्प खण्डवा तक लाईन डालने हेतु बीच में पडने वालें विभिन्न नदी, नाला, रोड किनारे से पाईपलाईन पार करने हेतु ,उक्त गैस पाईपलाईन ग्राम भोजाखेडी, सुल्याखेडी, छैगांवमाखन, दोंदवाडा, छेगांव देवी, एडीशनल आर.ओ. कार्या. खण्डवा, सं. किशोर कुमार स्मारक खण्डवा, संजय नगर खण्डवा, पदमनगर खण्डवा, धासपुरा खण्डवा, संतथामस स्कूल खण्डवा से होकर नरेडी गोयल पेट्रोल पम्प खण्डवा तक उक्त ग्रामों से होकर स्टील गैस पाईपलाईन गुजरेगी , जिसमें निजी एवं शासकीय भूमि का उपयोग किया जायेगा। आवेदक/प्रोजेक्ट मेनेजर अडानी टोटल गैस लिमिटेड, अमरावती, हाल कैम्प–खण्डवा द्वारा स्टील गैस पाईपलाईन उक्त स्थानों से बिछाये जाने अनुमति चाही है।

2– तहसीलदार, खण्डवा व्दारा की गई जांच के आधार पर अनु–विभागीय अधिकारी, खण्डवा ने प्रोजेक्ट मेनेजर अडानी टोटल गैस लिमिटेड, अमरावती, हाल कैम्प–खण्डवा द्वारा को 8′ डाया स्टील पाईपलाईन गैस डिस्ट्रीब्यूशन लाईन प्रस्तावित स्थल से नरेडी गोयल एच.पी. सी.एल. पम्प खण्डवा तक लाईन डालने हेतु बीच में पडने वालें विभिन्न नदी, नाला, रोड किनारे से पाईपलाईन पार करने हेतु ,उक्त गैस पाईपलाईन ग्राम भोजाखेडी, सुल्याखेडी, छैगांवमाखन, दोंदवाडा, छेगांव देवी, एडीशनल आर.ओ. कार्या. खण्डवा,. सं.किशोर कुमार स्मारक खण्डवा, संजय नगर खण्डवा, पदमनगर खण्डवा, धासपुरा खण्डवा, संतथामस स्कूल खण्डवा से होकर नरेडी गोयल पेट्रोल पम्प खण्डवा तक उक्त ग्रामों से होकर भूमिगत स्टील गैस पाईपलाईन बिछाने नगरपालिका निगम खण्डवा के अनापत्ति पत्र कमांक 735/2024, दिनांक 31.12.2024, कार्यपालन यंत्री लोक निर्माण विभाग खण्डवा के अनापत्ति पत्र कं. 4029/2024, लोक निर्माण विभाग राष्ट्रीय राजमार्ग संभाग इंदौर के पत्र कमांक 3163/तक.रा.रा./2024 दिनांक 04.12.2024 तथा ग्राम पंचायत दोंदवाडा द्वारा अपने क्षेत्र से भूमिगत पाईपलाईन बिछाने/गुजरने की अनुमति/अनापत्ति प्रदान की गई है। उक्त विभागीय अनापत्ति के अधार पर आवेदक/संस्था को भूमिगत स्टील गैस पाईपलाईन बिछाने की की अनुमति दिए जाने की अनुशंसा की है।

3– अतः तहसीलदार, खण्डवा व्दारा की गई जांच एवं अनु–विभागीय अधिकारी, खण्डवा के अभिमत को दृष्टिगत रखते हुए प्रोजेक्ट मेनेजर अडानी टोटल गैस लिमिटेड, अमरावती, हाल कैम्प–खण्डवा द्वारा को 8′ डाया स्टील पाईपलाईन गैस डिस्ट्रीब्यूशन लाईन प्रस्तावित स्थल से नरेडी गोयल एच.पी. सी.एल. पम्प खण्डवा तक लाईन डालने हेतु बीच में पडने वालें विभिन्न नदी, नाला, रोड किनारे से पाईपलाईन पार करने हेतु ,उक्त गैस पाईपलाईन ग्राम भोजाखेडी, सुल्याखेडी, छैगांवमाखन, दोंदवाडा, छेगांव देवी, एडीशनल आर.ओ. कार्या. खण्डवा, सं.किशोर कुमार स्मारक खण्डवा, संजय नगर खण्डवा, पदमनगर खण्डवा, धासपुरा खण्डवा, संतथामस स्कूल खण्डवा से होकर नरेडी गोयल पेट्रोल पम्प खण्डवा तक उक्त ग्रामों से होकर भूमिगत स्टील गैस पाईपलाईन बिछाने नगरपालिका निगम खण्डवा के अनापत्ति पत्र कमांक 735/2024, दिनांक 31.12.2024, कार्यपालन यंत्री लोक निर्माण विभाग खण्डवा के अनापत्ति पत्र कं. 4029/2024, लोक निर्माण विभाग राष्ट्रीय राजमार्ग संभाग इंदौर के पत्र कमांक 3163/तक.रा.रा./2024 दिनांक 04.12.2024 तथा ग्राम पंचायत दोंदवाडा द्वारा अपने क्षेत्र से भूमिगत पाईपलाईन बिछाने/गुजरने की अनुमति/अनापत्ति के अधार पर भूमिगत स्टील गैस पाईप लाईन बिछाने की अनुमति म.प्र. भूमिगत पाईप लाईन, केबल एवं डक्ट (भूमि के उपयोक्ता के अधिकारों का अर्जन) अधिनियम, 2012 के प्रावधानों के तहत निम्नलिखित शर्तो के अधीन प्रदान की जाती हैः–

1– नियमानुसार शासकीय परिसंपत्तियों को भूमिगत पाईप लाईन कार्य से क्षतिग्रस्त होने पर उसका मूल्यांकन उपरांत मुआवजा राशि शासकीय खाते में जमा कराना होगा।

2– भूमिगत पाईप लाईन बिछाने के पश्चात उक्त भूमि पर भवन या किसी संरचना का निर्माण, तालाब, कुआं, जलाशय या बांध का निर्माण, उत्खनन आदि नहीं किया जावेगा।

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3– प्रश्नाधीन शासकीय भूमि पर निर्मित वृक्षों को हटाने के पूर्व उसका वनमण्डलाधिकारी, सामान्य वनमण्डल खण्डवा से मूल्यांकन करवाकर लकडी की नीलामी राजस्व एवं वन अमले के माध्यम से करवाकर नीलामी से प्राप्त राशि शासकीय खजाने में जमा कराना होगी।

5– शासकीय भूमि पर गैस परिवहन के लिये भूमिगत पाईप लाईन बिछाने हेतु भविष्य में यदि देय प्रतिकर की राशि का निर्धारण किया जाना आवश्यक होता है तो नियमानुसार उक्त राशि शासकीय खजाने में जमा करना होगी।

6– भूमिगत पाईप लाईन बिछाने के उपरांत भूमि को पूर्ववत स्थिति में समतल की जाना आवश्यक होगा एवं उक्त आवेदित भूमि शासन की रहेगी।

7– शासन व सक्षम अधिकारी व्दारा समय समय पर जारी निर्देशों का पालन करना संबंधित विभाग के लिए बंधनकारी होगा।

4– उपरोक्त शर्तो का पालन करना आवश्यक होगा। किसी भी शर्तो का उल्लंघन किये जाने की स्थिति में दी गई अनुमति बिना पूर्व सूचना के निरस्त की जावेगी।

(ऋषव गुप्ता)
कलेक्टर,
जिला खण्डवा

पृ0कमांक/ 2356 /वाचक कले0/2025 खण्डवा, दिनांक 06/02/2025.

प्रतिलिपिः–

1– सचिव, मध्य प्रदेश शासन, राजस्व विभाग, मंत्रालय, वल्लभ भवन, भोपाल।
2– आयुक्त, इन्दौर सम्भाग, इन्दौर।
की ओर सूचनार्थ प्रेषित।
3– वन मण्डलाधिकारी, सामान्य वन मण्डल, खण्डवा
4– अनुविभागीय अधिकारी (राजस्व) खण्डवा
5– तहसीलदार, खण्डवा/छैगांवमाखन
6– प्रोजेक्ट मेनेजर अडानी टोटल गैस लिमिटेड, अमरावती, हाल कैम्प–खण्डवा
की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित।

कलेक्टर,
जिला–खण्डवा.

न्यायालय कलेक्टर जिला खण्डवा

Annexure III: Demand Letter from NH Division

कार्यालय कार्यपालन यंत्री
लोक निर्माण विभाग राष्ट्रीय राजमार्ग संभाग इन्दौर

Telephone : 0731-4900367, Email-eepwdnhdivisionindore@gmail.com

क्र.1825/तक./रा.रा./2024 इन्दौर, दिनांक 15/07/24

प्रति,

सीनियर मैनेजर,
अडानी टोटल गैस लिमिटेड,
खण्डवा प्रोजेक्ट्स

विषय :— **Khandwa connectivity (Proposed LNG location to Naredi Goyal HPCL Pump) : Request for granting permission for laying 8" dia steel pipeline to set up a Gas Distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa - Pipeline laying along & across to National Highway - 347B along the pipeline route in Khandwa District** की अनुमति के संबंध में।

संदर्भ :—1. आपका पत्र कं. **ATGL/Khandwa GA/NH-347B/Per/2024/001** दिनांक 14.06.2024.
2. इस कार्यालय का पत्र कं. 1612/ई.ई./पी.डब्ल्यू.डी./रा0रा0/तक./2024 इन्दौर दिनांक 27.06.2024.

उपरोक्त विषयान्तर्गत लेख हैं कि आपके संदर्भित पत्र कं. ATGL/Khandwa GA/NH-347B/Per/2024/001 दिनांक 14.06.2024 द्वारा Khandwa connectivity (Proposed LNG location to Naredi Goyal IIPCL Pump) : Request for granting permission for laying 8" dia steel pipeline to set up a Gas Distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa - Pipeline laying along & across to National Highway - 347B along the pipeline route in Khandwa District की अनुमति हेतु लेख किया गया हैं। इस कार्यालय के संदर्भित पत्र कं. 1612/ई.ई./पी.डब्ल्यू.डी./रा0रा0/तक./2024 इन्दौर दिनांक 27.06.2024 द्वारा अनुविभागीय अधिकारी लो.नि.वि.रा.रा. उपसंभाग कन्नौद को उक्त स्थल का निरीक्षण कर कैल्यूलेशन शीट इस कार्यालय में प्रस्तुत करने हेतु लेख किया गया था। अनुविभागीय अधिकारी लो.नि.वि.रा.रा. उपसंभाग कन्नौद द्वारा MoRTH के सर्कुलर दिनांक 24.04.2023 के अनुसार लाईसेंस फीस राशि रू. 9,83,739/— एवं बैंक ग्यारंटी राशि रू. 14,39,900/— का कैल्यूलेशन शीट तैयार कर इस कार्यालय में प्रस्तुत की गई हैं।

उक्त प्रकरण की अनुमति हेतु अनुविभागीय अधिकारी लो.नि.वि.रा.रा. उपसंभाग कन्नौद द्वारा MoRTH के सर्कुलर दिनांक 24.04.2023 के अनुसार लाईसेंस फीस भारत कोष में राशि रू. 9,83,739/— एवं बैंक ग्यारंटी राशि रू. 14,39,900/— कार्यपालन यंत्री, लो.नि.वि रा.रा. संभाग इन्दौर के नाम से बैंक ग्यारंटी तैयार कर इस कार्यालय में शीघ्र प्रस्तुत करें ताकि अनुमति की अग्रिम कार्यवाही की जा सके।

संलग्न :— उपरोक्तानुसार।

कार्यपालन यंत्री
लो.नि.वि रा.रा. संभाग इन्दौर
इन्दौर, दिनांक .....

पू. क्र. ...../तक./रा.रा./2024

प्रतिलिपि :—

1. मुख्य अभियंता, लो.नि.वि. रा.रा. परिक्षेत्र निर्माण भवन भोपाल की ओर सूचनार्थ प्रेषित।
2. अनुविभागीय अधिकारी लो.नि.वि.रा.रा. उपसंभाग खरगोन की ओर सूचनार्थ प्रेषित।

कार्यपालन यंत्री
लो.नि.वि रा.रा. संभाग इन्दौर

D:\pwd\PWD\D\NH INDORE\LETTER'S 2\LETTERS FOLDERS\2024-25\07 # JULY_2024 (Hindi).docx

LICENSE FEE / BG CALCULATION SHEET FOR LAYING ATGL'S 8" DIA NATURAL GAS PIPELINE ALONG & ACROSS NH - 347B

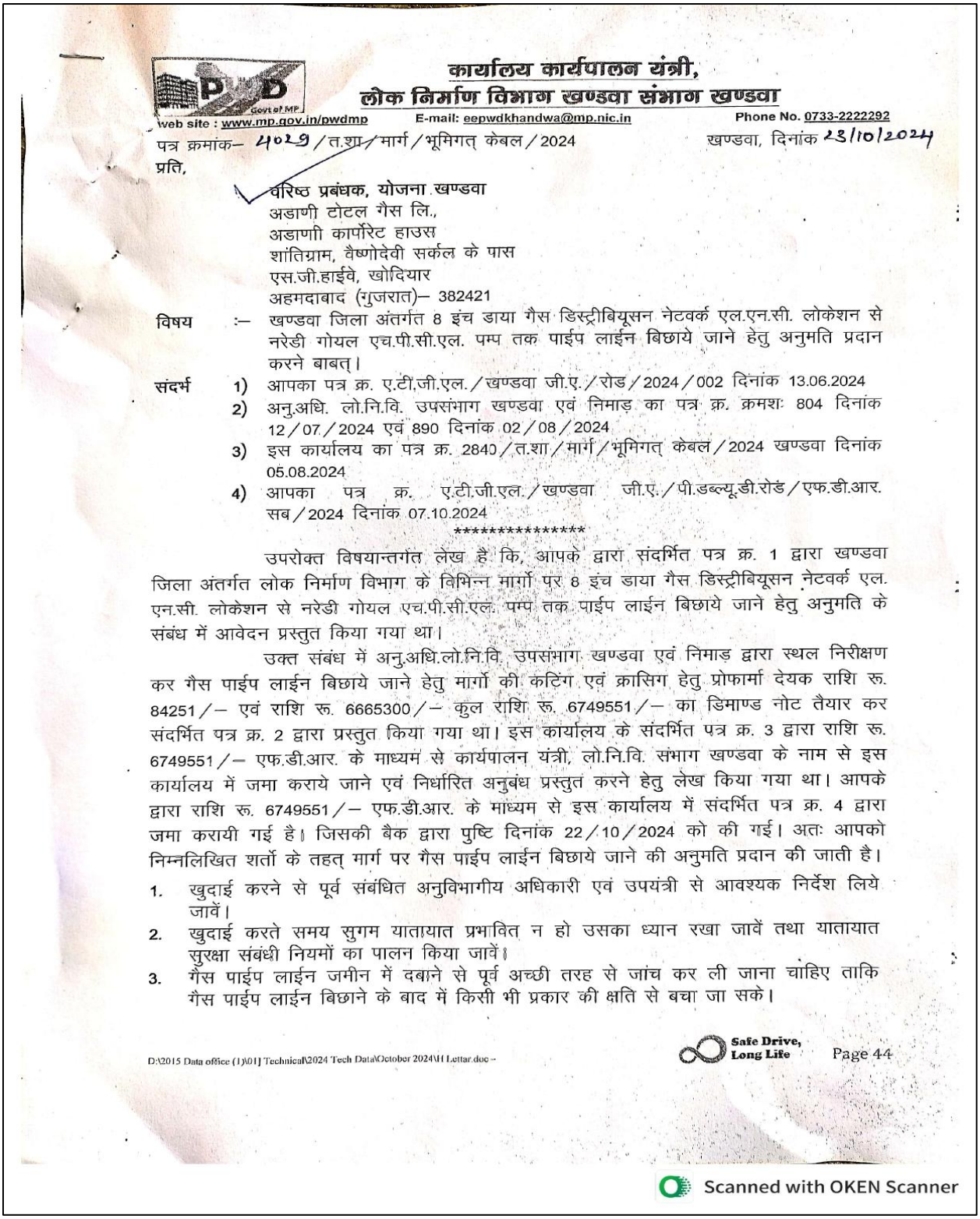
Statement Showing Rent & Deposite for laying Natural Gas Pipeline along & across to National Highway (As per MORTH Letter No.RW/NH-33044/29/2015-S&R ® (Pt) Dated. 22 nd November,2016 & amendments by letter No. NH-36094/01/2022-S&R (P&B), (E-208825) Dated. 24.04.2023 (RAJA SANSI CONNECTIVITY)

Sl. No.	Name of Road & Type of laying of Pipeline (Along/Crossing)	NH Chainage in Km	ATGL P/L Chainage in Km.	Village Name	Area Circle Rate per Sq. Meter (2024-25)	Length in (Mtr.)	Width (Mtr.)	Utilised N.H. Land Area in Sq. Mtr.	Fee/Year = (Area X Rate X 0.015)	Subject to Minimum amount taken @ 10,000/- in Rs.	2nd Year	3rd Year	4th Year	5th Year	Fees for Five Years (Col. 11/12+13+ 14+15+16)	For Deposit for BG Rs. 100/- per mtr OR Rs.200000/- per crossing
1	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Across to NH-347B (Khandwa - Chhegaon Makhan Road)	17.402	3/830.29	Sulyakhedi	900	30	0.3	9	121.50	10000.00	10600.00	11236.00	11910.16	12624.77	56370.93	200000.00
2	Across to NH-347B (Khandwa - Chhegaon Makhan Road)	14.305	7/115.50	Balkhand Sura	3727	30	0.3	9	503.15	10000.00	10600.00	11236.00	11910.16	12624.77	56370.93	200000.00
3	Along the NH-347B (Khandwa - Chhegaon Makhan Road) in RHS	From Ch. 3/906 to 14/305 Km.	From Ch. 7/133 to 17/532 Km.	Balkhand Sura	3727	1420	0.3	426	23815.53	-	25244.46	26759.13	28364.68	30066.56	110434.83	142000.00
				Dondwada	2795	2810	0.3	843	35342.78	-	37463.34	39711.14	42093.81	44619.44	163887.73	281000.00
				Takali Mori	2420	345	0.3	104	3757.05	10000.00	10600.00	11236.00	11910.16	12624.77	56370.93	34500.00
				Chhaigaon Devi	4928	1980	0.3	594	43908.48	-	46542.99	49335.57	52295.70	55433.44	203607.70	198000.00
				Rahemapura	6160	1725	0.3	518	47817.00	-	50686.02	53727.18	56950.81	60367.86	221731.87	172500.00
				Khandwa	2600	2119	0.3	636	24792.30	-	26279.84	27856.63	29528.03	31299.71	114964.20	211900.00
Total in Rs.															983739.13	1439900.00

Sub Divisional Officer, P.W.D.(N.H.) Sub-Division, Kanwad

Executive Engineer PWD (NH) Division Indore

Annexure IV: EE PWD Khandwa Permission



कार्यालय कार्यपालन यंत्री,
लोक निर्माण विभाग खण्डवा संभाग खण्डवा

web site : www.mp.gov.in/pwdmp E-mail: eepwdkhandwa@mp.nic.in Phone No. 0733-2222292

पत्र क्रमांक– 4029 /त.शा./मार्ग/भूमिगत् केबल/2024 खण्डवा, दिनांक 23/10/2024

प्रति,

वरिष्ठ प्रबंधक, योजना खण्डवा
अडाणी टोटल गैस लि.,
अडाणी कार्पोरेट हाउस
शांतिग्राम, वैष्णोदेवी सर्कल के पास
एस.जी.हाईवे, खोदियार
अहमदाबाद (गुजरात)– 382421

विषय :– खण्डवा जिला अंतर्गत 8 इंच डाया गैस डिस्ट्रीबियूसन नेटवर्क एल.एन.सी. लोकेशन से नरेडी गोयल एच.पी.सी.एल. पम्प तक पाईप लाईन बिछाये जाने हेतु अनुमति प्रदान करने बाबत्।

संदर्भ 1) आपका पत्र क्र. ए.टी.जी.एल./खण्डवा जी.ए./रोड/2024/002 दिनांक 13.06.2024
2) अनु.अधि. लो.नि.वि. उपसंभाग खण्डवा एवं निमाड़ का पत्र क्र. क्रमशः 804 दिनांक 12/07/2024 एवं 890 दिनांक 02/08/2024
3) इस कार्यालय का पत्र क्र. 2840/त.शा./मार्ग/भूमिगत् केबल/2024 खण्डवा दिनांक 05.08.2024
4) आपका पत्र क्र. ए.टी.जी.एल./खण्डवा जी.ए./पी.डब्ल्यू.डी.रोड/एफ.डी.आर. सब/2024 दिनांक 07.10.2024

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उपरोक्त विषयान्तर्गत लेख है कि, आपके द्वारा संदर्भित पत्र क्र. 1 द्वारा खण्डवा जिला अंतर्गत लोक निर्माण विभाग के विभिन्न मार्गो पर 8 इंच डाया गैस डिस्ट्रीबियूसन नेटवर्क एल. एन.सी. लोकेशन से नरेडी गोयल एच.पी.सी.एल. पम्प तक पाईप लाईन बिछाये जाने हेतु अनुमति के संबंध में आवेदन प्रस्तुत किया गया था।

उक्त संबंध में अनु.अधि.लो.नि.वि. उपसंभाग खण्डवा एवं निमाड़ द्वारा स्थल निरीक्षण कर गैस पाईप लाईन बिछाये जाने हेतु मार्गो की कटिंग एवं क्रासिंग हेतु प्रोफार्मा देयक राशि रू. 84251/– एवं राशि रू. 6665300/– कुल राशि रू. 6749551/– का डिमाण्ड नोट तैयार कर संदर्भित पत्र क्र. 2 द्वारा प्रस्तुत किया गया था। इस कार्यालय के संदर्भित पत्र क्र. 3 द्वारा राशि रू. 6749551/– एफ.डी.आर. के माध्यम से कार्यपालन यंत्री, लो.नि.वि. संभाग खण्डवा के नाम से इस कार्यालय में जमा कराये जाने एवं निर्धारित अनुबंध प्रस्तुत करने हेतु लेख किया गया था। आपके द्वारा राशि रू. 6749551/– एफ.डी.आर. के माध्यम से इस कार्यालय में संदर्भित पत्र क्र. 4 द्वारा जमा करायी गई है। जिसकी बैक द्वारा पुष्टि दिनांक 22/10/2024 को की गई। अतः आपको निम्नलिखित शर्तो के तहत् मार्ग पर गैस पाईप लाईन बिछाये जाने की अनुमति प्रदान की जाती है।

1. खुदाई करने से पूर्व संबंधित अनुविभागीय अधिकारी एवं उपयंत्री से आवश्यक निर्देश लिये जावें।
2. खुदाई करते समय सुगम यातायात प्रभावित न हो उसका ध्यान रखा जावें तथा यातायात सुरक्षा संबंधी नियमों का पालन किया जावें।
3. गैस पाईप लाईन जमीन में दबाने से पूर्व अच्छी तरह से जांच कर ली जाना चाहिए ताकि गैस पाईप लाईन बिछाने के बाद में किसी भी प्रकार की क्षति से बचा जा सके।

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Safe Drive, Long Life Page 44

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4. खुदाई कार्य कम से कम तीन फीट गहराई में होकर उसकी चौड़ाई 2 फीट से अधिक नहीं होना चाहिए।
5. गैस पाईप लाईन दबाने के बाद भराव कार्य मापदण्डानुसार सतह से ऊंचा नहीं होना चाहिए।
6. मार्ग का रख–रखाव, निर्माण तथा परिवर्तन एवं परिवर्धन के समय गैस पाईप लाईन हटाने का उत्तरदायित्व आवेदक का स्वंय का होगा।
7. गैस पाईप लाईन के टूट फूट की मरम्मत आदि आवेदक द्वारा स्वंय की जावेगी।
8. यदि आपके द्वारा दिए गये निर्देशो का पालन नहीं किया जाता है तो, यह अनुमति स्वतः ही निरस्त मानी जावेगी। उक्त अनुमति बिना आवेदक को सूचना के विभाग द्वारा निरस्त की जा सकती है।
9. खुदाई कार्य हेतु प्रस्तुत अनुबंध की शर्तो का पूर्ण रूप से पालन किया जावें।
10. खुदाई कार्य हेतु प्रस्तुत ले–आउट प्लान अनुसार एवं दी गई अनुमति वाले मार्ग एवं हिस्से में ही खुदाई कार्य किया जावें॥
11. मार्ग को यथास्थिति लोक निर्माण विभाग के मापदण्डानुसार किया जाना अनिवार्य है तथा मार्ग क्षतिग्रस्त होने की स्थिति में आपकी जमा राशि से आपके हर्जे खर्चे पर उक्त कार्य करा लिया जावेगा। जिसकी जवाबदारी आपकी होगी ।
12. यदि लोक निर्माण विभाग द्वारा मार्गो का उन्नयन/चौडीकरण कार्य किया जाता है तो आपके द्वारा डाली गई गैस पाईप लाईन को आपको स्वंय के व्यय पर हटाया जाना होगा एवं उन्नयन/चौडीकरण कार्य में गैस पाईप लाईन के टूट–फूट की जवाबदारी इस विभाग की नही होगी।
13. यदि गैस पाईप लाईन डालते समय आपके द्वारा स्थान परिवर्तित किया जाता है तो यह अनुमति स्वतः ही निरस्त मानी जावेगी। किसी भी स्थिति में मार्ग के सामांतर डामर एवं सी.सी. हिस्से को खोदकर पाईप लाईन न डाली जाये।
14. लोक निर्माण विभाग उपसंभाग निमाड़ अंतर्गत यह अनुमति भैरव मंदिर (इंदौर नाका) से धरमकांटा चौराहा होते हुये खण्डवा डुल्हार मार्ग पर पुरानी अनाज मण्डी खण्डवा के सामने भारत पेट्रोलियम के पेट्रोल पम्प तक मान्य है। धरमकांटा चौराहे से लैण्ड मार्क वन मॉल होते हुये घासपुरा लिंक रोड (तापड़िया गार्डन मोड तक) पर खुदाई हेतु अनुमति नही दी जा रही है।

सहपत्र :– शून्य।

(हृदेश आर्य)
कार्यपालन यंत्री
लोक निर्माण विभाग
खण्डवा संभाग खण्डवा

पृ क्रमांक– /त.शा/मार्ग/भूमिगत् केबल/2024 खण्डवा, दिनांक

प्रतिलिपि :– अनुविभागीय अधिकारी लो.नि.वि. उपसंभाग खण्डवा/निमाड़ की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित।

सहपत्र :– शून्य।

(हृदेश आर्य)
कार्यपालन यंत्री
लोक निर्माण विभाग
खण्डवा संभाग खण्डवा

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Safe Drive, Long Life

Annexure V: NHAI Demand Letter

सत्यमेव जयते

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)

National Highways Authority of India

(Ministry of Road Transport and Highways, Government of India)

परियोजना कार्यान्वयन इकाई- खण्डवा /Project Implementation Unit –Khandwa

कार्यालयः प्लॉट नं. 66-67, सिद्धि विनायक कॉलोनी, दादाजी कॉलेज के पास, इन्दौर रोड़ खण्डवा (म.प्र.)

Office: Plot No. 66-67, Siddhi Vinayak Colony, Near Dadaji College, Indore Road, Khandwa (M.P.)-450001

Phone/दूरभाषः 0733-2990009; E-mail: nhaikhandwa@gmail.com & piukhandwa@nhai.org

No. NHAI/PIU-KNW/DH-BO/1118/2024-25/3718 Date:20.11.2024

To,

The Authorized Signatory,
Adani Total Gas Limited,
Crest 4, Inspire Business Park, Shantigram,
Nr. Vaishnodevi Circle, S.G. Highway,
Ahmedabad -382421, Gujrat

Sub: 4-lanning of Dhangoan - Boregaon section of NH-347BG & 753L (Indore to Boregaon- Pkg IV) Design Ch.81.000 to 139.000 (Length 58.000 Km) under Bharatmala Pariyojana Phase-I in the State of Madhya Pradesh on Hybrid Annuity Mode-**M/s Adani Proposal request for granting permission for laying 8" Dia steel pipeline to set up a Gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa-Pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa.**

Ref: (i) RO-Bhopal letter No. 52241 dated 19.11.2024.

Please refer above mentioned letter with regards to proposal for "permission for laying 8" Dia steel pipeline to set up a Gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa-Pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa.

2. In this regard, public comments were invited through Ministry/NHAI website vide RO Bhopal office letter dated 15.10.2024 till prescribed time i.e up to 14.11.2024 no comments/objections have been received by RO- office for the subject captioned proposal up to stipulated time.

3. In the view of the above, the approval for permission for laying 8" Dia steel pipeline to set up a gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa- pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa is hereby accorded by competent authority subjected to the following condition: -

(a) The License fee amounting to Rs. 11,15,904/- to be deposited by the applicant for use of NH land as per MoRTH circular dated 22.11.2016. As the policy for charges for utilization of NH land is under consideration for revision by NHAI, Thus, if license fee/charges applicable for such permission is increased by NHAI in future, the same shall be payable by the applicant and no objection of the applicant and no objection of the applicant in this regard will be considered.

(b) Further, BG amounting Rs. 9,02,800/- is also to be submitted by applicant as per the for against restoration, maintenance work after laying of Gas pipeline/utility. In case of receipt of directions of NHAI-HQ regarding increase in the amount of BG, the

20/11/24

मुख्यालयः जी 5 व, सेक्टर 10, द्वारका, नई दिल्ली 110075
Head Office: G-5 & 6, Sector 10, Dwarka, New Delhi-110075

same shall be submitted by the applicant. Further the BG should be suitably extended as per requirement at site by this office.

(c) Planning and execution of work shall be as per MoRTH & IRC norms so that proposed laying of gas pipeline should meet the specification and guideline issued by IRC, as well as Ministry of Road Transport &Highways, Govt. of India.

(d) The proposed site shall be open for inspection of NHAI officials of Highway Administration and the instruction imparted by officials of NHAI/ officials of Highway Administration has to be followed by the agency and the NHAI shall not be responsible for financial liability on this account.

(e) Top of the casing /conduit Gas pipelines shall be at least 1.20m below the top of subgrade or the existing ground level whichever is lower.

(f) The complete cost of Gas pipelines laying and cost of shifting of utility (if any) has to be borne by agency /applicant.

(g)Prior approval of the Highway Administration shall be obtained before undertaking any work of installation, shifting or repairs or alterations, to the Gas pipeline located in the National Highway.

(h) Expenditure, if any, incurred by the Highway Authority for repairing any damage caused to the National Highway by the laying, maintenance of shifting of the Gas pipelines will be borne by the agency owning the line.

(i) if Highway administration it necessary in future to move the Gas pipelines for any work of improvement or repairs to the road, it will carried out as desired by the Highway Authority at the cost of the agency owning the utility line within a reasonable time (not exceeding 60 days) of the intimation given. Also, the road land shall be restored to its original condition by agency when required to do so by the Govt. of India or any person authorized on its behalf and agency shall not be entitled to any compensation on account of such removal or restoration.

(j) The road shall be kept in traffic worthy condition during construction/laying period. The traffic should continuously move safely and without hindrance during laying of Gas pipeline.

(k) This permission would be valid for a maximum of 5 years at a time, which can thereafter be considered for renewal. On payment of additional fee at the time of renewal, rate prevailing at the time of renewal shall be charged. Delay in deposition of renewal fee shall attract interest @ 15% per annum compounded annually.

4. Undertaking to the various provisions mentioned in a para-3 above and applicable fee and BG have to be submitted by you to this office accordingly. The above work must be executed as per norms & latest guidelines issued in this regard by the ministry after entering in to agreement/license deed for crossing & laying of utility on National Highway land as per Ministry's Circular no. RW/NH-33044/29/2015/S&R (R) dated 22.11.2016 which is to be signed between the party/licensee and NHAI/Government of India.

5. In the view of the above, it is requested to submit the following:
   a) Undertakings to all condition as per para 3 above
   b) Submit the performance BG as indicated above
   c) Submit License fee as indicated above

It is requested to attend this office after submission of the above fee, BG and undertakings for signing the license deed as per the MoRTH guideline dated 22.11.2016.

(Ashutosh Soni)
Project Director

Copy to:
1. The Regional officer, NHAI RO-Bhopal for kind information.
2. Project Manager, Concessionaire for information and necessary action.
3. Team Leader, Independent Engineer for information and necessary action.

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)

NATIONAL HIGHWAYS AUTHORITY OF INDIA

(Ministry of Road Transport and Highways, Govt. of India)

क्षेत्रीय कार्यालय / REGIONAL OFFICE

सत्यमेव जयते

ई-6/47, स्मृति परिसर, साईबोर्ड के पास, अरेरा कॉलोनी, भोपाल (म.प्र.)-462016
E-6/47, Smriti Parisar, Near Sai Board, Arera Colony, Bhopal (M.P.)-462016
दूरभाष/Phone: 0755-2426638, फैक्स/Fax: 0755-2426698, ई-मेल/E-mail ID: robhopal@nhai.org

NHAI/RO-MP/Khandwa/Gas Pipeline/2024/E-262806/52241 Date: 19.11.2024

To,

The Project Director,
National Highways Authority of India,
Project Implementation Unit,
Khandwa (M.P.)

National Highway Authority of India, PIU Khandwa
Inward No. 6067
Date 20/11/24

Sub: 4-lanning of Dhangoan - Boregaon section of NH-347BG & 753L (Indore to Boregaon- Pkg IV) Design Ch.81.000 to 139.000 (Length 58.000 Km) under Bharatmala Pariyojana Phase-I in the State of Madhya Pradesh on Hybrid Annuity Mode-**M/s Adani Proposal request for granting permission for laying 8" Dia steel pipeline to set up a Gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa-Pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa.**

Ref: 1. This office letter no. NHAI/RO-MP/KNW/Pipeline/2024/E-262806/51926 dated 15.10.2024
2. PD, PIU-Khandwa e-office file (Computer No. 262806).

Sir,

Please refer above mentioned letters with regards to the proposal for "permission for laying 8" Dia steel pipeline to set up a Gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa-Pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa".

2. In this regard, public comments were invited through Ministry/NHAI website vide this office letter dated 15.10.2024 till the prescribed time i.e. upto 14.11.2024 no comments/objections have been received by this office for the subject captioned proposal upto stipulated time.

3. In view of the above, the approval for permission for laying 8" Dia steel pipeline to set up a Gas distribution Network from proposed LNG location to Naredi Goyal HPCL pump in District Khandwa-Pipeline laying along & across to National Highway -347B along the pipeline route in Khandwa is hereby accorded by Competent Authority subjected to the following:

(a) The license fee amounting to **Rs. 11,15,904/-** to be deposited by the applicant for use of NH land as per MoRT&H Circular dated 22.11.2016. As the policy for charges for utilization of NH land is under consideration for revision by NHAI. Thus, if the license fee/charges applicable for such permissions is increased by NHAI in future, the same shall be payable by the applicant and no objections of the applicant in this regards will be considered.

1/3

(b) Further, BG amounting **Rs. 9,02,800/-** is also to be submitted by applicant as per the circular for against restoration, maintenance work after laying of Gas Pipeline/utility. In case of receipt of directions of NHAI-HQ regarding increase in the amount of BG, the same shall be submitted by the applicant and no objections in this regard shall be considered from applicant. Further the BG may be suitably extended as per requirement at site by PD, PIU-Khandwa.

(c) Planning and execution of work shall be as per MoRT&H & IRC norms so that proposed laying of Gas pipeline should meet the specifications and guidelines issued by IRC, as well as Ministry of Road Transport & Highways, Govt. of India.

(d) The proposed site shall be open for inspection of NHAI officials of Highway Administration and the instruction imparted by officials of NHAI/Officials of Highway Administration has to be followed by the agency and the NHAI shall not be responsible for financial liability on this account.

(e) Top of the casing/conduit Gas Pipelines shall be at least 1.20m below the top of sub grade or the existing ground level whichever is lower.

(f) The complete cost of Gas Pipelines laying and cost of shifting of utility (if any) has to be borne by the agency/applicant.

(g) Prior approval of the Highway Administration shall be obtained before undertaking any work of installation, shifting or repairs, or alterations, to the Gas Pipeline located in the National Highway Right-Of-Ways (ROW).

(h) Expenditure, if any, incurred by the Highway Authority for repairing any damage caused to the National Highway by the laying, maintenance of shifting of the Gas Pipelines will be borne by the agency owning the line.

(i) If Highway Administration considers it necessary in future to move the Gas Pipelines for any work of improvement or repairs to the road, it will be carried out as desired by the Highway Authority at the cost of the agency owning the utility line within a reasonable time (not exceeding 60 days) of the intimation given. Also the road land shall be restored to its original condition by agency when required to do so by the Govt. of India or any person authorized on its behalf and agency shall not be entitled to any compensation on account of such removal or restoration.

(j) The road shall be kept in traffic worthy condition during construction/laying period. The traffic should continuously move safely and without hindrance during laying of Gas Pipeline.

(k) This permission would be valid for a maximum of 5 years at a time, which can thereafter be considered for renewal. On payment of additional fee at the time of renewal, rate prevailing at the time of renewal shall be charged. Delay in deposition of renewal fee shall attract interest @15% per annum compounded annually.

2/3

4. Undertakings to the various provisions mentioned in para-3 above and applicable fee and BG may be obtained and ensured by PD-Khandwa from the Competent Authority of the agency owning the Utility. The above works must be executed as per the norms & latest guidelines issued in this regard by the ministry after entering into the agreement/ license deed for crossing & laying of Utility on National Highway land as per Ministry's circular no. RW/NH-33044/29/2015/S&R (R) dated 22.11.2016 which is to be signed between the party/licensee and NHAI/Government of India. In view of the above, it is requested to please sign the license deed on behalf of Highway Administration and take further necessary action for the permission being accorded herewith. It is re-iterated that the requisite amount of License fee and Performance Bank Guarantee as indicated above please be ensured for submission (if not already submitted) before signing of the license deed and before according working permission at field.

This issues with the approval of Regional Officer cum Highway Administration.

19/11/2024

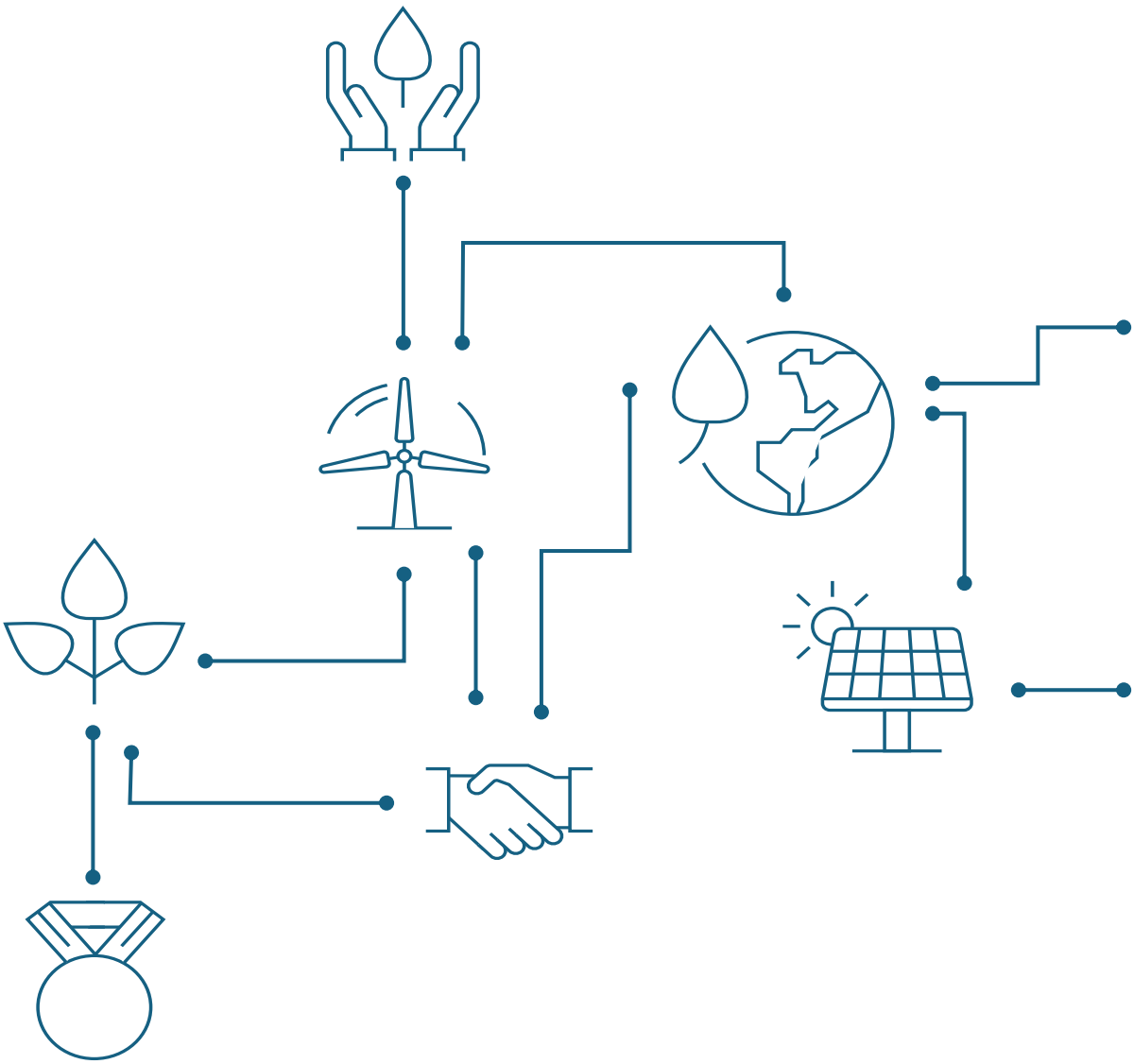
(Paras Bansal)
Manager (T)

Copy to:

(i) Adani Total Gas Limited, Crest 4, Inspire Business Park, Shantigram, Nr. Vaishnodevi Circle, S. G. Highway, Ahemdabad-382421, Gujarat for information.

3/3

Add value.
Inspire trust.



TÜV SÜD SOUTH ASIA PRIVATE LIMITED
374, Udyog Vihar Phase II, Sector -20, Gurugram, Haryana-122016, India
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